

VASCULAR FLORA OF SHADES
STATE PARK AND PINE
HILLS NATURAL AREA,
INDIANA

JACK MCCORMICK

BULLETIN
OF THE
AMERICAN MUSEUM OF NATURAL HISTORY
VOLUME 123 : ARTICLE 7 NEW YORK : 1962

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AREA, INDIANA

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BULLETIN

OF THE

AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME 123 : ARTICLE 7

NEW YORK : 1962

BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY

Volume 123, article 7, pages 353–422, text
figures 1–5, plates 41–47, tables 1–3

Issued May 21, 1962

Price: \$2.00 a copy

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INTRODUCTION

CENTRAL INDIANA IS SITUATED on a glacial plain which is noted for its undulating, monotonous topography and intensive agricultural development. Throughout the region, streams have become entrenched in the surface of the plain and contribute local variety to the landscape. The most spectacular development of stream entrenchment is found in the west-central portion of the state on the watershed of Sugar Creek, one of the larger tributaries of the Wabash River. The dissected lands bordering Sugar Creek present unusually diverse topography, characterized by narrow, deep canyons excavated through the till and into the underlying bedrock. Sections of the most outstanding portion of Sugar Creek Valley have been reserved in Shades State Park and the Pine Hills Natural Area (fig. 1). In the present paper, these tracts collectively are termed the Survey Area.

The region surrounding the Survey Area was occupied before white settlement by the Piankishaw subtribe of the Miami Indians (Sharpe, 1958). At least one large village was located in the southwestern portion of the present Shades State Park on a level tract above Sugar Creek (fig. 2). Agricultural tools found at this site suggest that the Indians had cleared the forests from around the village and cultivated maize and other crops. Most of the Indians left the region after a treaty was signed in 1818 by which the Miamis ceded the entire central portion of Indiana, the "New Purchase," to the Federal Government (Buley, 1950). The few Indians that remained in secluded sections of Sugar Creek Valley until the 1830's may have continued to cultivate some areas, but it is likely that most of the Indian fields were abandoned before white settlers arrived (Sharpe, 1958).

Sugar Creek Valley was surveyed by the United States Land Office in 1820, and the sale of government lands began in 1824 (Sharpe, 1958). The first settlers arrived in the area encompassed by the present study in 1827, but the tract was not completely patented until 1846. At first, small clearings were made for cabin sites and gardens, but after these immediate needs were met, the forests

gradually were stripped from larger areas of rich upland soil to prepare the land for agriculture. Logs from many trees were used to construct corduroy roads, houses, barns, and other buildings. Countless more were split to build miles of rail fences or ricked for fuel wood, but the majority were rolled together and burned during communal logging bees (Record, 1903; Buley, 1950).

The shallow soils and broken topography of the lands that border Sugar Creek provided little enticement to the farmer, and the forests on them escaped destruction. This region of wooded cliffs and shaded canyons was of special charm to Alexander Weir, who in 1828 obtained the original deed to land along Sugar Creek approximately 4.5 miles northeast of Pine Hills (section 21, township 18 north, range 5 west). The rugged terrain of the valley reminded Weir of his former home, which apparently was near Ballynahinch, County Galway, in western Ireland, and he affectionately transferred this name to the Sugar Creek lands (Mrs. Mabel Weir Grimes, personal communication). The term has since been corrupted to "Bal Hinch" by local residents and is sometimes used to refer only to the area near the old Weir tract, but more often is used in reference to the entire Sugar Creek Valley from Crawfordsville to Shades State Park.

Especially picturesque sections of Sugar Creek Valley were given individual names by the early settlers. One such area was called "Shades of Death," in allusion to the deep shadows beneath the nearly unbroken canopy of its forests, to the small, dark groves of hemlocks and white pines scattered about the tract, and to a crude murder which occurred on the tract a few years after its settlement (Russell, 1901). This place is now a part of Pine Hills Natural Area, and the adjacent tract, Shades State Park, has retained an abbreviated, less morbid form of the original name. One of the narrow canyons in the eastern portion of the State Park has been named "Shades of Death Ravine," although it is not part of the original area to which this name was assigned (fig. 3).

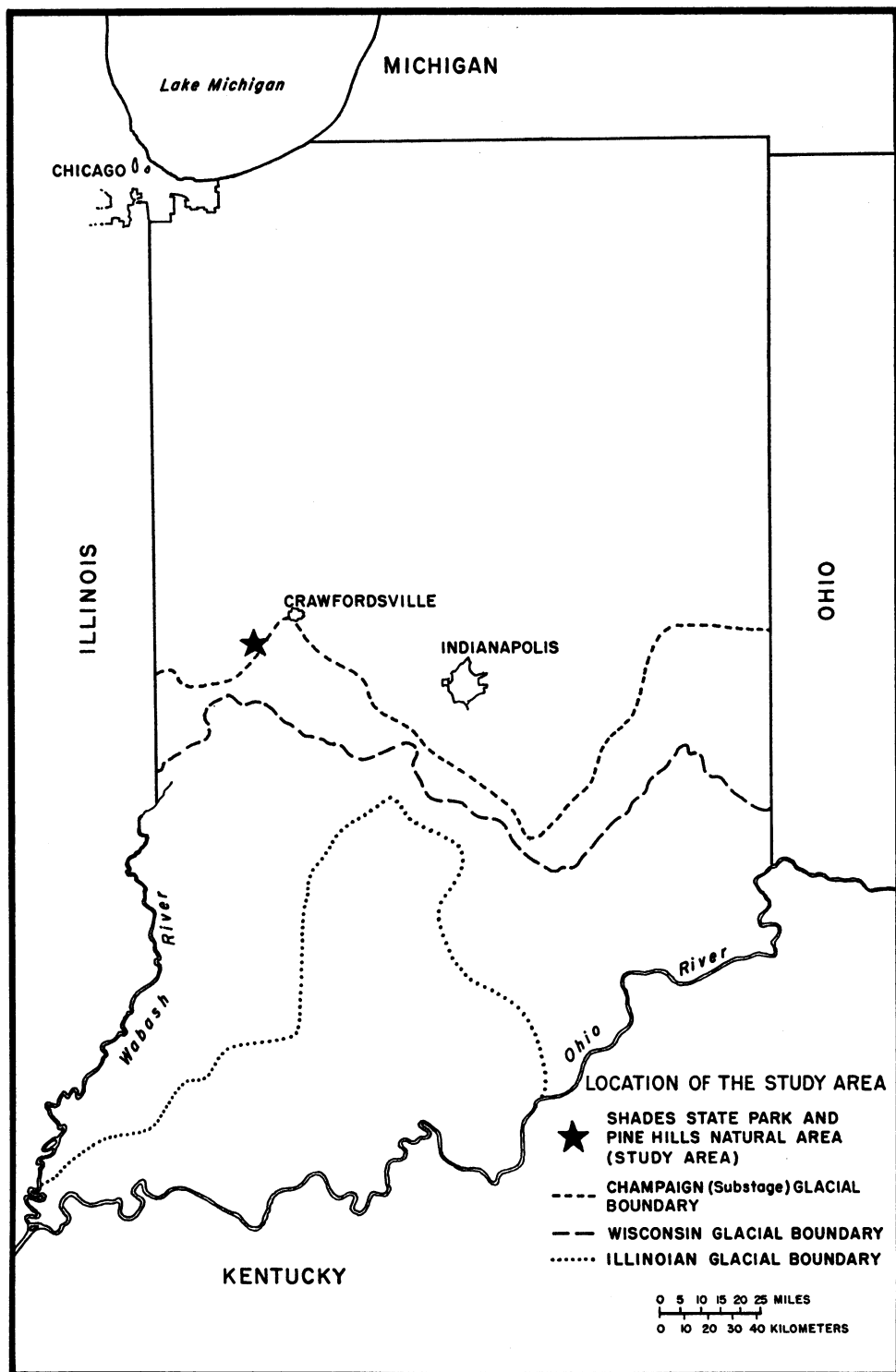


FIG. 1. Outline map of Indiana to show the location of the Survey Area (Shades State Park and Pine Hills Natural Area) and its relation to the glacial boundaries.

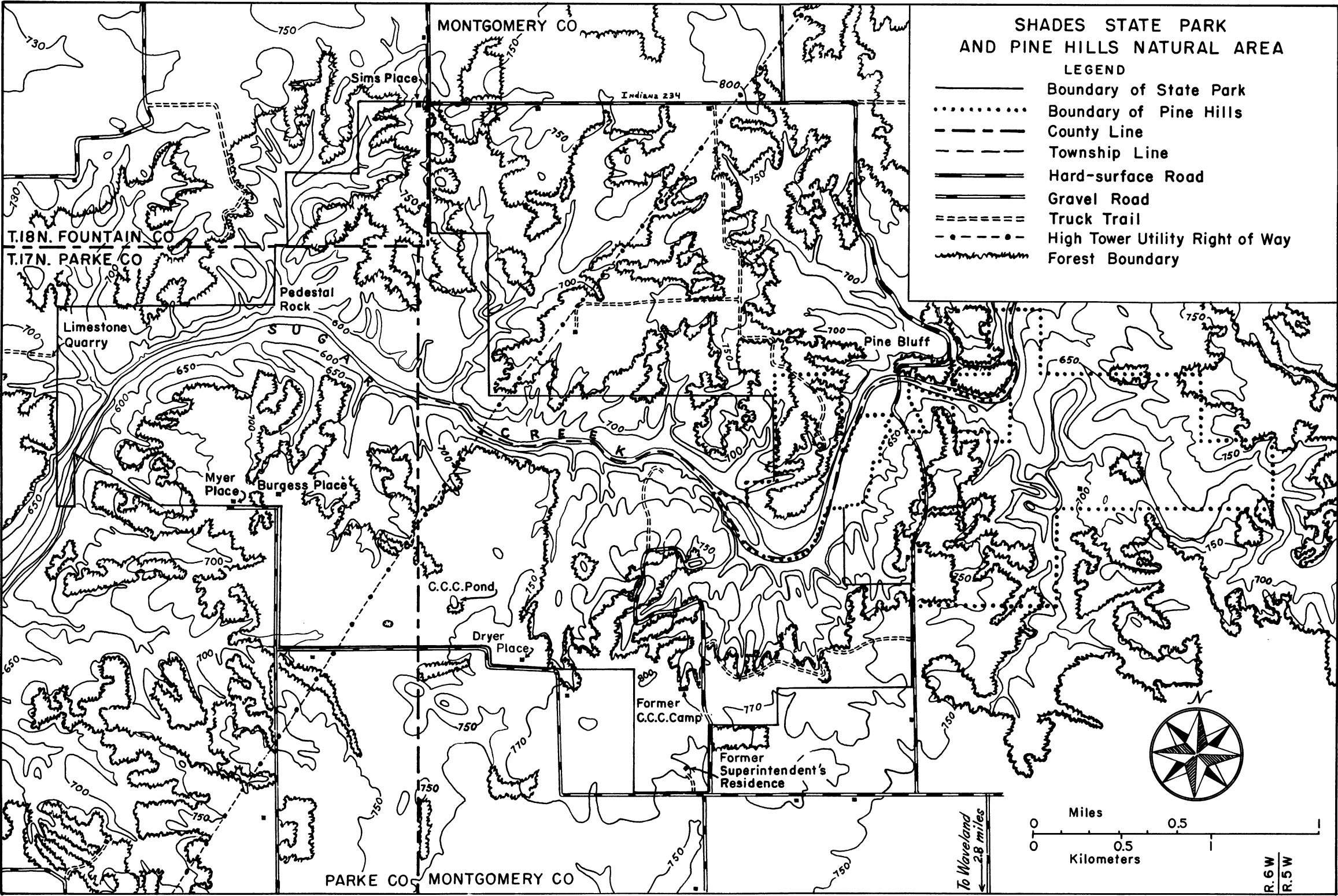


FIG. 2. Map of the Survey Area to show the relation of Pine Hills Natural Area to Shades State Park and general features of the topography of the tracts (from the Alamo Quadrangle, United States Geological Survey). The forest cover is interrupted by cultivated fields.

SIZE AND HISTORY OF SHADES STATE PARK

The Park encompasses approximately 800 hectares (1977 acres) in Brown and Ripley townships, Montgomery County; Howard Township, Parke County; and Jackson Township, Fountain County, Indiana (fig. 2). Early interest in the properties now included in the Park centered on the relatively large springs in the ravine north of the present Shades Inn, the waterfalls known as Silver Cascade and Hemlock Falls, and the high sandstone cliffs between Prospect Point and Inspiration Point (fig. 3).

The area was the site of an outing by Wabash College students as early as 1863 and by 1875 had become popular, at least locally, for picnicking and hiking (Beers and Company, 1878). Several efforts were made to commercialize the area, but none had adequate backing until 1886 when James M. Rice, Joel G. Deer, Perry Garland, John D. Vanuys, and George Seybold organized the Garland Dell Mineral Springs Association to buy, lease, and hold the springs and surrounding grounds and to improve the property for use as a health resort and recreation area (Garland Dell Mineral Springs Association, MS). In 1887, the Association built an inn, known as the Dell House and later as Shades Inn. Several additional properties were purchased or leased and by 1898 the corporation owned 60.7 hectares (150 acres; Hoffman, 1898). Boat rentals, swimming, a small amusement park, cabins, restaurant and hotel facilities, picnic areas, and marked hiking trails annually attracted a thousand or more visitors to Garland Dell or, as it was more familiarly known, "The Shades."

The first recorded attempt to establish the Shades as an officially recognized nature preserve was made in 1901. Henry Moore, president of the Board of Directors of the Garland Dell Mineral Springs Association, recommended the Shades, which then included 200 acres, to the Indiana State Board of Forestry as a "jungle or wild-wood park" (Anon., 1901, p. 32). However, this recommendation was not acted upon, and the Shades remained a privately owned resort.

In 1909, Joseph W. Frisz purchased capital stock in the Garland Dell Mineral Springs Association and soon was elected treasurer of

its Board of Directors. In 1914, he became president of the Board and through several large stock purchases, the Association passed completely into the control of the Frisz family by 1916. The park's popularity continued to grow as transportation facilities improved, and the property was visited by several thousands of people each season for picnicking, camping, hiking, vacations, camp meetings, and chautauquas.

Joseph W. Frisz continuously sought to purchase farms which included sections of Sugar Creek Valley or forested tracts adjoining the Shades. By the late 1930's the Shades Scenic Park occupied nearly 890 hectares (2200 acres) and the Association was "land poor," but Frisz, who was an avid naturalist and conservationist, steadfastly refused to sell or to use timber from park land to produce income or reduce building costs (Fabian Frisz, personal communication). However, the forests of the Shades had not always been so carefully protected. Following the initial period of land clearance, the forest remnants were the source of fuel wood, fence posts, and building material. Sections of the forest nearest to the homesteads doubtlessly were most heavily utilized, but widespread disturbance probably followed the establishment of a sawmill in association with the Deer and Canine grist mill on Sugar Creek at Pine Bluff (fig. 2; pl. 41). This sawmill was built before 1860 (United States Census Bureau, MS a) and operated until it was destroyed by a fire in 1887 (Anon., 1887). Joel G. Deer, a proprietor of the mill, owned most of the southeastern portion of the present Shades State Park and undoubtedly harvested oak and tulip trees from the area. Lumbering probably was terminated on this section in 1886 when the land was purchased by the Garland Dell Mineral Springs Association. The forests on parcels of the land which later were purchased by the Association vary greatly in the severity and recency of disturbance they have experienced.

When Joseph Frisz died in 1939, his corporation stock was divided among his heirs. The family later determined to sell the property because its continued operation, particularly during World War II, was a liability. Between September 3, 1941, and October 7, 1942, the Indiana State Conservation Com-

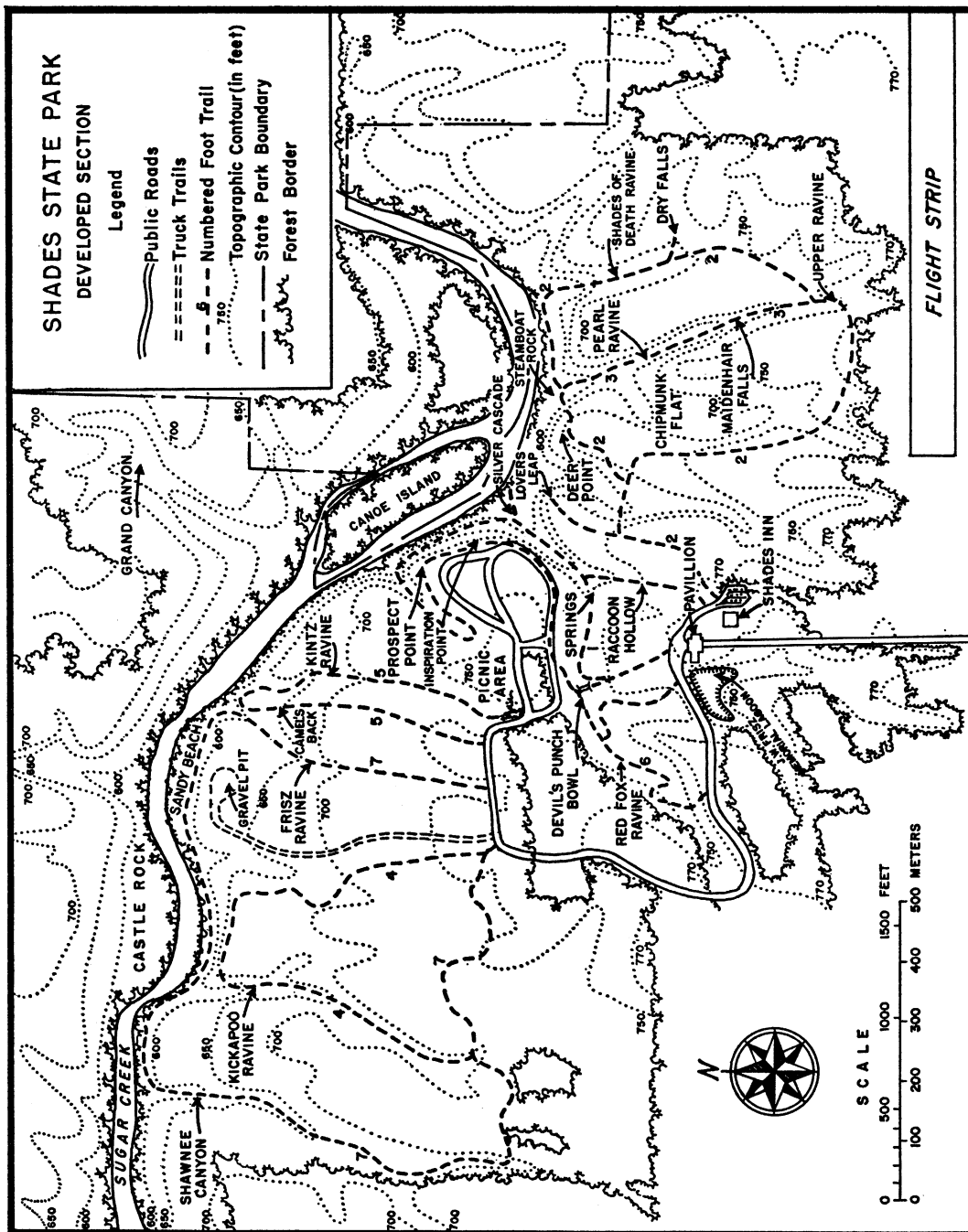


Fig. 3. Map of the developed portion of Shades State Park, showing topography and the locations of foot trails, roads, and points of interest (adapted from trail maps by the Indiana Department of Conservation).

mission considered acquisition of the private park, but the negotiations for its purchase were unsuccessful (State Conservation Commission, MS). Several small parcels of park land subsequently were sold to individuals, and private organizations expressed interest in the main property and its timber. On February 11, 1947, the Board of Directors of the Association resolved to, "offer for sale to the highest bidder the timber situate upon the real estate owned by the Corporation measuring 54 inches in circumference or larger . . ." (Garland Dell Mineral Springs Association, MS). This resolution resulted in the immediate resumption of the efforts by the state government to acquire and preserve the property. On February 18, the State Conservation Commission authorized the Director of the Department of Conservation to enter into an agreement, by means of an option, to purchase the Shades. During the following month, a short-term option was negotiated, but, because sufficient funds were not available to consummate the purchase, the Department of Conservation was instructed to raise money through public subscriptions to buy and develop the park. On May 29, 1947, Arthur R. Baxter and Associates, in behalf of the Baxter Foundation, intervened to purchase the main Shades tract of 587.6 hectares (1452 acres) and immediately leased the property to the State for operation as a State Park (State Conservation Commission, MS). On August 29, 1947, the public subscription campaign to "Save the Shades" was launched, and sufficient funds were raised to purchase the tract from the Baxter Foundation. The property was dedicated on July 18, 1948, as Shades State Park, the fifteenth such area reserved in Indiana. On November 19, 1948, an additional tract of 202.3 hectares (500 acres), known as Dryer Place, was purchased from the executors of the estate of Kate W. Dryer (fig. 2). Smaller parcels of land subsequently have been acquired and added to the Park. All farming has been discontinued, and approximately 100 hectares (250 acres) of formerly cultivated land are in early stages of natural revegetation. Public use of the Park is confined to the southeastern section where foot trails, picnic areas, roads, parking lots, and an airstrip are provided (fig. 3).

SIZE AND HISTORY OF PINE HILLS NATURAL AREA

The Natural Area, which contains approximately 242.8 hectares (600 acres), adjoins the eastern and northern boundaries of Shades State Park and is situated in Brown and Ripley townships, Montgomery County, Indiana (figs. 2, 4). The present Pine Hills tract originally was entered by several settlers whose holdings, in turn, were divided by land sales and inheritances. Most of the level upland areas, the wider portions of the flood plain of Sugar Creek, and Canoe Island (figs. 2-4) were cleared and farmed by 1850. Doubtless, most of the forested land was culled for firewood, and larger oaks, tulip trees, and maples were high-graded for lumber. Lumbering was probably intensified during the 1850's by the addition of a sawmill to the Deer and Canine grist mill at Pine Bluff (fig. 2; pl. 41).

The central portion of the tract, which contains the rock ridges known as "backbones," was not directly affected by farming, and its stands of hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) apparently were never seriously disturbed by lumbering (fig. 4). However, on December 4, 1868, Zenith Hellit, the contemporary landowner, signed a contract that permitted Enoch Matthewman to construct a dam on Clifty Creek for the purpose of supplying water power to machinery (Hellit and Matthewman, MS). Matthewman joined with William J. Canine, Joel G. Deer, Tyre L. Hanna, and [Simon C.?] Davis to form the Pine Hill Woolen Mill Company (Matthewman, Canine, Deer, Davis, and Hanna, MS). A U-shaped notch about 6 meters deep and 3 meters wide was cut through the upper portion of the ridge now known as Mill Cut Backbone, and an earth and log dam about 4.6 meters high was built across Clifty Creek on the south side of the backbone a few meters downstream from the opening. The impounded water flowed through the notch into a wooden flume that carried it about 50 meters to an overshot waterwheel in the mill which was located on a terrace of Clifty Creek at the south side of the base of Turkey Backbone (fig. 4). The flood plain below the flume probably was cleared for use as a drying yard and a place to tie

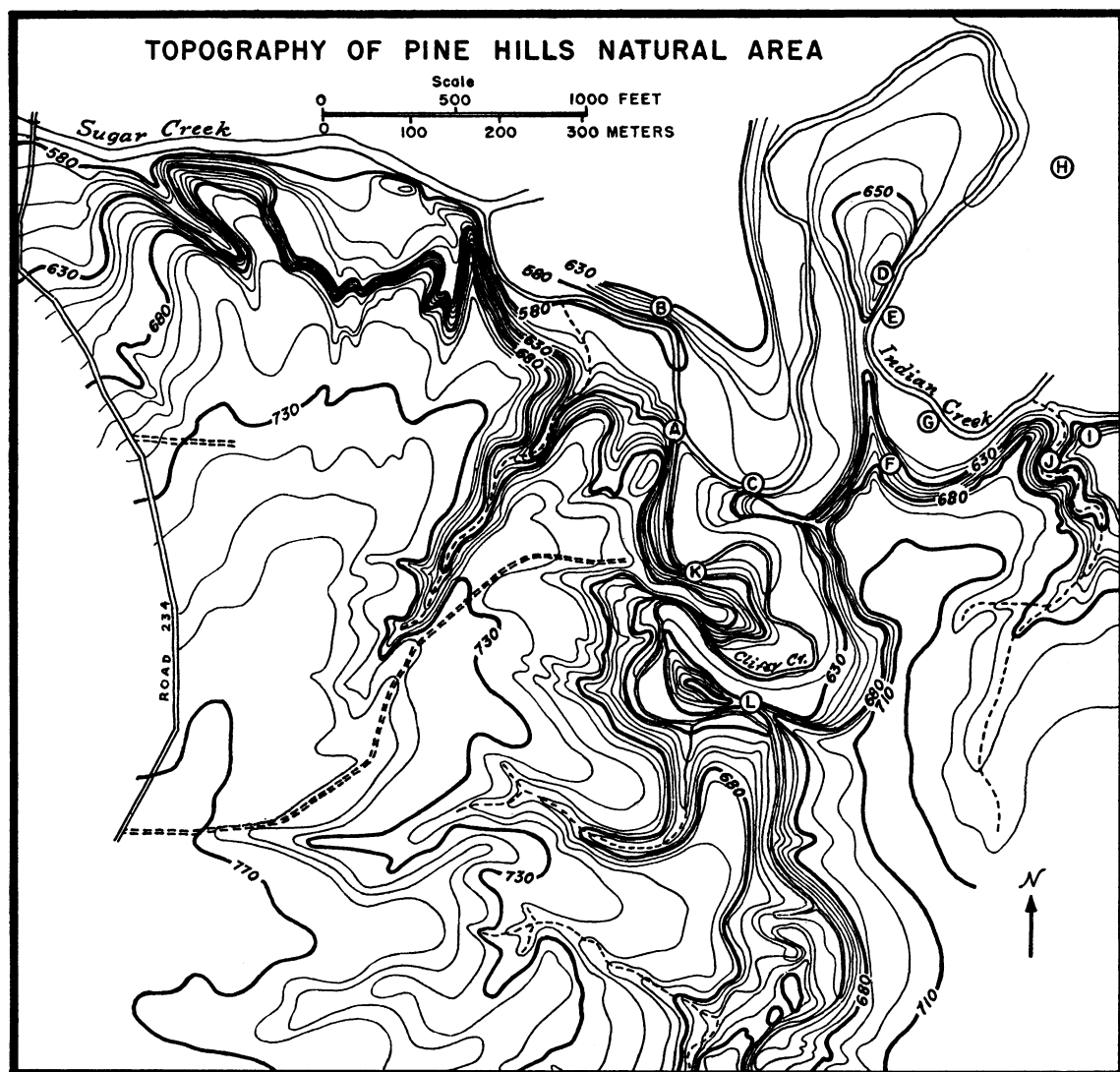


FIG. 4. Map of Pine Hills Natural Area to show topography and the location of principal features. Adapted from a map by Thomas B. Huestis and Lowell Osborn (*in* Smith, 1933). A. Honeycomb Rock and Honey Peak. B. Pine Bluff. C. Devil's Backbone. D. Pine Backbone. E. Pine Mountain Bluff. F. Pine Crag. G. Amphitheatre. H. Big Spring Glen. I. Pine Point. J. Little Spring Canyon. K. Turkey Backbone. L. Mill Cut Backbone.

wagons. A road led from the mill along the south bank of Clifty Creek to the end of Mill Cut Backbone, forded the stream, and then extended westward up a ravine to the present State Road 234. According to the 1870 census, the mill operated eight months of the year, employed eight persons, and was equipped with three narrow looms, one broadloom, and 208 spindles (United States Census Bureau, MS b). Perhaps as a result of dam-

age sustained during the annual spring floods that sweep Clifty Creek's narrow canyon, the mill was moved to Pine Bluff about 1873. Neither the mill nor the notch in the backbone was mentioned by John Collett, a geologist who visited Pine Hills in 1875 (Collett, 1876). Except for the notch, a few old footings, an overgrown sluiceway, and remnants of the dam, all evidence of the woolen mill operation have been obliterated.

The portion of the flood plain that may have been cleared for a drying yard supports a young forest, but the flooded area above the old dam site shows no obvious signs of disturbance.

The present Pine Hills tract was collected into two holdings by Frank Griggs Hasselman and Lawrence Sherman Hasselman between 1911 and 1923. The brothers continued to farm the lands and raised corn, alfalfa, red clover, timothy, potatoes, oats, and buckwheat. They also kept livestock and chickens, but the farms were well fenced, and it is unlikely that the scenic area around the backbones was disturbed by grazing. Cordwood was cut for fuel, and occasional large walnut trees from the flood plain of Sugar Creek were sold to lumbermen, but the forests were not intensively cut over.

Frank Hasselman also operated a concession known as the "Old Mill Camp" on Sugar Creek at Pine Bluff. This establishment included a general store and boat, cottage, and tent rentals. The building which had formerly housed the Deer and Canine mill was utilized as a dance hall, auditorium, and restaurant. Local residents recall that the locality was very popular and heavily patronized. Doubtlessly, many of the visitors hiked to the backbones and through the hemlock forests in Pine Hills.

In 1919, the Indiana State Conservation Commission leased Frank Hasselman's "Pine Hills Farm" and established the state's first Game Experiment Station, with Hasselman as superintendent. The monthly reports filed by Hasselman (MSS) indicate that the activities connected with the experiment station had little effect on the vegetation of the tract, although small areas in the forest were used for animal pens and white oak saplings were cut for the construction of several quail pens. The game farm was closed on November 1, 1921, but Hasselman continued to use the property to produce crops and to breed game animals experimentally. The tract soon was opened to picnickers and hikers as Pine Hills Nature Study Park.

In the spring of 1924, Lawrence Hasselman established a nursery business to sell both exotic and native perennial plants (L. S. Hasselman, MS). The plants were marketed through his parents' florist shop, the Indian-

apolis Flower and Plant Company. The stock of the nursery consisted of about 25 exotic species and a number of native species which were excavated from the property. The latter included:

Tsuga canadensis (hemlock)
Pinus strobus (white pine)
Juniperus virginiana (red cedar)
Rhus glabra, *R. typhina* (sumac)
Cornus florida (flowering dogwood)
Cercis canadensis (redbud)
Juglans nigra (black walnut)
Acer saccharum (sugar maple)
Ulmus americana (white elm)
Liriodendron tulipifera (tulip poplar)
Parthenocissus quinquefolia (Virginia creeper)
Celastrus scandens (bittersweet)

The nursery operation was continued at least until 1933. Many of the exotic species are persisting near the Pine Hills Natural Area entrance road and the site of Lawrence Hasselman's cabin in the northeast quarter of section 12 (fig. 4).

Frank Hasselman died in 1924, and the interest in his property was divided among several heirs. The tract continued to be operated as Pine Hills Nature Study Park, but a concerted effort was made to market the property. An option to buy the estate, together with Lawrence Hasselman's property, was granted to a private individual on June 21, 1926, but the option was permitted to expire. Soon thereafter, the heirs opened negotiations with the State of Indiana, and at the meeting of the Conservation Commission on March 19, 1927, Stanley Coulter, chairman of the commission, proposed the purchase of the entire Pine Hills tract as a state park [Coulter, MSS]. However, this proposal was nullified by legislation that prohibited the state from buying land for park purposes and vested local governments with the responsibility for acquisition. Subsequently, Coulter petitioned the Chamber of Commerce of Crawfordsville, Indiana, to promote the local acquisition of Pine Hills. That organization appointed a committee to determine the manner in which the County of Montgomery might effect the purchase, but their efforts were fruitless [Coulter, MSS]. Coulter next approached the Indiana Academy of Science in an effort to arrange for the purchase or

lease of the Pine Hills tract as a nature preserve and field study area [Coulter, MSS]. The Academy was not favorably inclined towards the proposal, and negotiations were abandoned.

Lawrence Hasselman continued to reside on the Pine Hills tract until 1938. During the later years of his residence, the operation of the area as a private park was terminated, and visitors were discouraged from entering upon the tract. Victor Mausur Hasselman, the administrator of the Frank Hasselman estate and guardian of Lawrence Hasselman's property, operated the tract *in absentia*. Land was rented for farming as recently as 1944, although several fields had been abandoned before 1930. Native evergreens, particularly saplings of *Pinus strobus*, and remnants of the nursery stock were sold as recently as 1941. However, thefts of small trees were frequent before and since that time, and timber was stolen from the southeastern portion of the tract as recently as 1958, but with the exception of firewood cutting and local disturbances by vandals and campers, the greater portion of the continuously forested area has suffered little damage since the Hasselmans acquired the property. Today, much of the formerly cultivated land is covered by young second-growth forests, and the high-graded sections of the older forests have been obscured by the rapid growth of saplings and seedlings.

Negotiations for the purchase of Pine Hills were initiated by the Nature Conservancy in 1954. These efforts were in marked contrast to those involved in the acquisition of the Shades. The owners of Pine Hills initially were indifferent to the attempts to arrange for sale of the property. However, as negotiations progressed (with exasperating slowness), the sincere interest of the Hasselmans in the preservation of the natural features of the area became apparent, and they jointly agreed to a sale price which was significantly lower than the appraised value of the land. However, a number of technical details concerning precise limitations of the future activities to be permitted in the area delayed acquisition of all rights to the tract until April, 1960.

The Nature Conservancy presented the Pine Hills Natural Area to the State of Indi-

ana as an addition to Shades State Park on October 16, 1961. Covenants attached to the deeds to the property by the Hasselman heirs and the Nature Conservancy, together with Indiana statutes governing the use of state park lands, guarantee that the Pine Hills Natural Area will be maintained as a wilderness in perpetuity.

LOCATION AND PHYSICAL DESCRIPTION OF THE SURVEY AREA

The Survey Area is located approximately 80 kilometers (50 miles) west-northwest of Indianapolis, Indiana, and 200 kilometers (125 miles) south-southeast of Chicago, Illinois (fig. 1). It lies approximately 1.5 kilometers north of the Champaign substage moraine (Pleistocene: Wisconsin), 16 kilometers north of the primary Wisconsin glacial boundary (McBeth, 1901; Patton, 1951; the present paper, fig. 1), and within the Tipton Till Plain (Malott, 1922) or the Till Plains Section of the Central Lowland Province (Fenneman, 1938), which was glaciated during the Illinoian and Wisconsin (Tazewell Substage) advances and possibly by earlier stages (Wier and Wayne, 1953). This physiographic region is a ground moraine plain that is gently rolling and relatively featureless throughout most of its extent. In the Survey Area and adjacent areas, however, Sugar Creek, the regional master stream, became entrenched in the glacial deposits and underlying bedrock during post-Wisconsin time, so that its narrow channel lies as much as 61 meters (200 feet) below the general surface of the till plain (Collett, 1876; Jones and Oran, 1914; Wier and Wayne, 1953). The immediate relief is similar to that of the Crawford or Norman Uplands of the unglaciated, southern portion of the state (Malott, 1922; Smith, 1933). For approximately 5 kilometers, the unusually deep channel of Sugar Creek passes through the long axis of the Survey Area. The many tributaries that originate or flow through the Survey Area are adjusting to the level of the master stream and have cut ravines of various widths and depths. The youthfulness of the topography is indicated by the nearly perpendicular walls of the narrow valleys, the frequent hanging valleys (Hemlock Falls, Silver Cascade, Grand Canyon, figs. 2, 3), abundant small

waterfalls, and the narrow backbones between the entrenched meanders of the streams in the Pine Hills tract (figs. 4; pls. 42, 43). These backbones, which are peninsular walls of bedrock as great as 33.6 meters high, 70 meters long, and as little as 1.5 meters wide at the narrowest points on their crests, are the most spectacular topographic features of the Survey Area and have been recognized as "the most remarkable examples of incised meanders in the eastern United States" (Smith, 1933). The local topography in the Survey Area is approximately 76 meters (250 feet), from a maximum elevation of 244 meters (800 feet) above mean sea level in the south-central section to a minimum elevation of 168 meters (550 feet) in the channel of Sugar Creek where it flows out of the Area (fig. 2).

The upland soils in the Survey Area are silt loams derived primarily from glacial deposits and post-Wisconsin loessial materials (Jones and Orahood, 1914; Bushnell, 1958). The thinner soils of the ridges and ravines have been derived from bedrock as well as from glacial debris and loess. The flood plains of Sugar Creek and the larger tributaries are veneered with recent alluvial deposits, and the soils derived from these materials are silt loams and silty clay loams (Bushnell, 1958).

Bedrock consists of massive and interbedded strata of Mississippian and Pennsylvanian age. In Shades State Park, the principal topographic features are developed in the massive beds of relatively resistant sandstone of the Mansfield formation, the basal member of the Pennsylvanian system in the state and the characteristic formation of the Crawford Upland of southern Indiana. Shales, siltstone, and limestone of the Borden group (Mississippian) lie unconformably below the Mansfield formation and have given rise to lower, more gradual slopes in the State Park. The contact between these two formations is especially striking on the cliff face below Inspiration and Prospect Points (fig. 3). Trail 1 is situated on a ledge formed along the contact, with approximately 15 meters (55 feet) of Mansfield sandstone exposed above, and 47 meters (155 feet) of Borden silt exposed below, the trail (Esary, Bieberman, and Bieberman, 1950). The Borden group is the only formation present in the portion of

the Pine Hills Natural Area located east of State Road 234 (fig. 4) and is the formation from which the spectacular topography of the latter area is developed (Smith, 1933; Wier and Wayne, 1953).

There are many types of habitats available in the Survey Area. Steep north- and south-facing slopes are frequent; many unstable rock walls provide open ground and talus deposits; portions of the forest are in various stages of recovery after high-grade lumbering, while others have never been cut; large tracts in various parts of the Area have been farmed and were retired from about five to 50 years ago; there are plantations of red pine, mixed conifers, and black locust; perennial springs and seeps are frequent in the ravines and provide areas of continuously saturated soil; Sugar Creek has a relatively narrow, but well-developed flood plain, one large island, and many gravel bars which are inundated by flood waters one or more times each year; Indian and Clifty creeks have narrow flood plains and two well-marked, abandoned terrace levels; waterfalls from a meter to more than 15 meters high are frequent and afford moist splash zones; exposed cliff faces are often pitted and crossed by narrow ledges which are frequented by xerophytic species; and a limestone quarry on the northwestern boundary of the Park and a small gravel pit near the center of the Park provide greatly disturbed areas denuded of soil. Roadsides, lawns, picnic and camping areas, and a flight strip with a turf runway, which was completed in 1960 (Cougill, 1960), are mowed frequently and maintain many weedy species that will disappear from formerly cultivated areas as they develop into forests. Three artificial ponds support a number of hydrophytes which are not found in the streams. Two of these ponds were impounded by a unit of the Civilian Conservation Corps (C.C.C.) which established a base on the Park in 1935. The pond at the site of the C.C.C. camp (fig. 2) has a maximum surface area of only about 0.1 hectare, but the pond on the former Dryer Place (fig. 2) has a surface area of approximately 0.8 hectare. The third pond, now known as the J. W. Frisz Memorial Lagoon (fig. 3), was impounded originally in 1914 by a dam about one-third of the height of the present structure. The dam was in-

creased to its present size in 1940 and reënf forced in 1946, so that the area of the Lagoon at overflow is approximately 1.2 hectares (Fabian Frisz, personal communication). None of these ponds supports a true aquatic vascular flora, which may be owing partly to their youthfulness, but probably can be attributed largely to significant seasonal fluctuations in their water levels. For example, in the J. W. Frisz Memorial Lagoon, the summer water level normally is a meter or more below that of overflow, the surface area of the lagoon is only about 0.2 hectare, and extensive mud flats are exposed along the banks and especially on the deltas of the small tributary streams. These flats are occupied rapidly by non-aquatic vegetation, particularly by *Eragrostis hypnoides*, which later is eliminated by the autumnal rise of the water level.

A steady influx of visiting motorists and aviators who originate from many geographic regions should assure a continuous supply of seeds and spores of adventive species which will appear temporarily or become naturalized in the Survey Area. However, the elimination of all agricultural activity from the Survey Area subsequent to the period during which most of the collections for this study were made will gradually lead to a reduction in the variety of sites, particularly of bare, disturbed soil, and should result in a considerable impoverishment of the flora. A similar impoverishment of the fauna also can be expected, particularly as the extent of forest border habitat is reduced by the natural reforestation of retired agricultural lands.

CLIMATE OF THE SURVEY AREA

The Survey Area is located in a region where rapid weather changes are initiated by the alternate passage of nearly a hundred cyclonic and anticyclonic air masses each year (Visser, 1944). The climate of the region is characterized by relatively mild temperatures and precipitation which is well distributed throughout the year.

Records of the United States Weather Bureau station at Crawfordsville, Indiana, approximately 15 miles northeast of the Survey Area, are the best available for the region (Lawrence A. Schaal, personal communication, 1961). These data indicate that

the average temperature for the coldest month, January, was -1.7°C . (29°F .) and for the warmest month, July, was 26.6°C . (80°F .) during 58 years of record (1900 to 1907, 1911 to 1960). The difference between these monthly averages, 51°F ., is typical of a continental climate.

The lowest temperature recorded during the 58 years of record was -30°C . (-22°F .) on January 5, 1927, and the highest temperature was 43.3°C . (110°F .) on July 14, 1936. Minimum temperatures of -17.7°C . (0°F .) are experienced nearly every winter, and cold snaps with a minimum temperature of at least -23.3°C . (-10°F .) occur every few years. Maximum temperatures of 37.7°C . (100°F .) or more occur during nearly every summer, sometimes on several successive days (Visser, 1944). The average freeze-free season (minimum temperature above 0°C .), based on 40 years of record (1921 to 1960), is 164 days, generally from about May 1 to October 12. However, the length of the freeze-free season is subject to great variation, from as short as 127 days to as long as 223 days (Martin, 1933).

The average annual precipitation during 58 years of record (1900 to 1907, 1911 to 1960) was 1008.4 mm. (39.7 inches). The minimum yearly precipitation was 647.7 mm. (25.5 inches) in 1930, and the maximum was 1450.3 mm. (57.1 inches) in 1950. Approximately 4 per cent of the precipitation falls as snow, and a snow cover of 0.5 inch or more is present during approximately 25 days of each year.

VEGETATION OF THE SURVEY AREA

The forests of the uplands are composed principally of *Fagus grandifolia*, *Acer saccharum*, *Liriodendron tulipifera*, and *Quercus alba* in combination with 20 or more other large tree species (pl. 44). *Cornus florida* and *Viburnum acerifolium* are predominant in the understory and shrub layers. Friesner and Potzger (1934) recognized sugar maple (*Acer saccharum*) to be the climax species in the upland forest, but considered the area to be representative of the transition between the eastern *Acer-Fagus* climax and the more western *Acer* climax. Gordon (1936), on his detailed map of the vegetation of Indiana, included the Survey Area in the upland oak

forest type. This is incorrect, and the vegetation is more properly referred to the beech-sugar maple association of his beech forest type.

The flood plain forests along Sugar, Indian, and Clifty creeks are composed of *Platanus occidentalis*, *Ulmus americana*, *Tilia americana*, *Acer saccharum*, and several other species, with dense clumps of *Salix nigra* and *S. interior* along the banks and sand bars (pls. 44, 45). *Lindera benzoin*, *Hamamelis virginiana*, and *Dirca palustris* form the bulk of the undergrowth in the lowland forests.

Hemlock (*Tsuga canadensis*) stands occupy north-facing slopes and terraces along Sugar, Indian, and Clifty creeks (fig. 5; pls. 43–47). White pines (*Pinus strobus*) generally occur in isolated positions along cliff edges and upper slopes in the Sugar Creek canyon, above Clifty and Indian creeks, and on the

walls of a few of the smaller tributary ravines (fig. 5; pls. 42–45). Bush honeysuckle (*Diervilla lonicera*) occurs in hemlock stands on the more exposed cliff faces, and yew (*Taxus canadensis*) forms the undergrowth in stands on shaded north-facing slopes.

Friesner and Potzger (1934), in their classic analysis of the vegetation complex of the Pine Hills Natural Area, made quadrat studies in, and mapped, modern flood plains, first and second stream terraces, upland plateaus, slopes covered by *Pinus strobus*-*Tsuga canadensis* forests, canyon walls occupied by *Tsuga* stands, *Tsuga*-*Pinus* groves, and *Taxus* associations on steep, north-facing canyon walls (fig. 5). They concluded that "this region exhibits a larger number of excellent and clear-cut forest ecological areas and associations than any other region in Indiana."

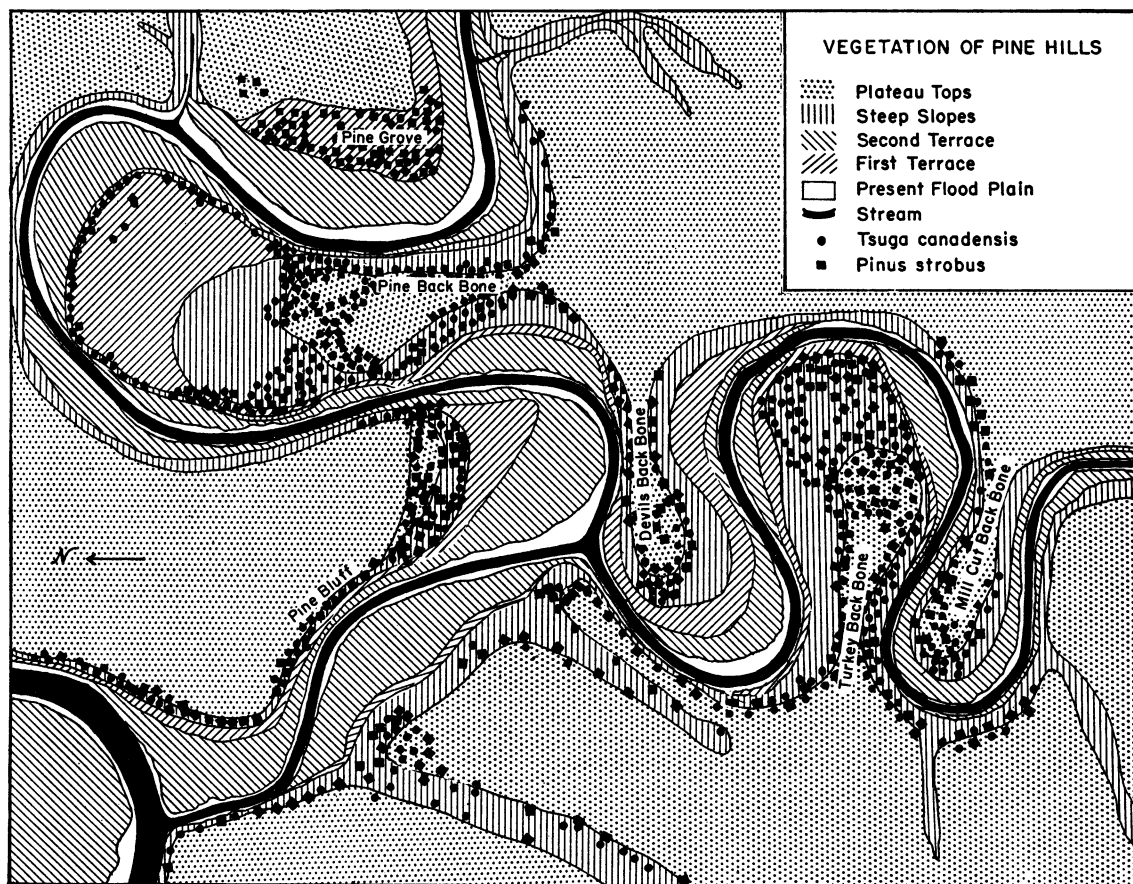


FIG. 5. Map of site types and the distribution of hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) in Pine Hills Natural Area. Redrawn from Friesner and Potzger (1934).

TABLE 1
COMPOSITION OF VEGETATION IN A FIELD ON THE
SIMS PLACE, SHADES STATE PARK,
16 MONTHS AFTER CULTIVATION

	Cover ^a	Fre- quency ^b
<i>Digitaria sanguinalis</i> and <i>D. ischaemum</i>	62%	100%
<i>Ambrosia artemisiifolia</i> var. <i>elatior</i> forma <i>villosa</i>	26	100
<i>Aster pilosus</i>	4	64
<i>Hedeoma pulegioides</i>	3	72
<i>Panicum huachucae</i>	3	90
<i>Agrostis alba</i>	3	54
<i>Aristida longespica</i>	2	45
<i>Agrostis hiemalis</i>	2	81
<i>Oenothera biennis</i> var. <i>pycnocarpa</i>	2	10
<i>Trifolium pratense</i>	1	10
+ <i>Sassafras albidum</i> ^c	1	10
<i>Solidago</i> spp.	1	45
+ <i>Rubus</i> sp.	1	30
<i>Setaria glauca</i>	1	63
<i>Polygala sanguinea</i>	1	54
<i>Poa pratensis</i>	* ^d	45
<i>Solanum carolinense</i>	*	18
<i>Panicum capillare</i>	*	45
<i>Danthonia spicata</i>	*	18
<i>Oxalis europaea</i>	*	36
<i>Achillea millefolium</i>	*	18
<i>Potentilla norvegica</i>	*	18
<i>Trifolium repens</i>	*	18
<i>Paspalum ciliatifolium</i> var. <i>muhlenbergii</i>	*	18
+ <i>Rhus typhina</i>	*	18
<i>Gnaphalium obtusifolium</i>	*	10
<i>Linum virginianum</i> var. <i>texanum</i>	*	10
<i>Solidago graminifolia</i>	*	10
<i>Antennaria neglecta</i>	*	10
<i>Euphorbia supina</i>	*	10
<i>Rumex acetosella</i>	*	10
<i>Aristida oligantha</i>	X ^e	
<i>Daucus carota</i>	X	
+ <i>Gleditsia triacanthos</i>	X	
<i>Lespedeza striata</i>	X	
<i>Panicum lindheimeri</i>	X	
+ <i>Robinia pseudo-acacia</i>	X	
<i>Verbascum blattaria</i>	X	
<i>Verbascum thapsus</i>	X	
<i>Verbena urticifolia</i>	X	
Total cover	118	
Bare ground	4	
Coverlap	22	

^a Cover is expressed as the average percentage of the ground in the field that is overspread by the foliage of

Trotter (1952) made a complete tally of trees on a 2-hectare tract in Chipmunk Flat on Trail 2 (fig. 3). The results of his study characterize the forest of this area as a *Fagus-Acer-Liriodendron* type in which 22 species contributed to the canopy. *Cornus florida*, *Carpinus caroliniana*, and *Asimina triloba* were outstanding in the understory, and *Lindera benzoin*, *Viburnum acerifolium*, *Cornus alternifolia*, and *Hamamelis virginiana* formed the bulk of the shrub layer.

Retired agricultural land is abundant in the Survey Area. A study was made of a field on the former Sims farm (fig. 2) on September 3, 1952, approximately 16 months after cultivation. Cornstalks from the last crop were still abundant, but the field had been mowed during June, 1952, and at the time of survey hogs from an adjacent farm were loose in the area. Regardless of these unfortunate disturbances, the data approximate the composition of the initial vegetation on retired agricultural land (table 1). In the absence of disturbance, the cover of vegetation probably would have been complete, which indicates that the practice of artificially seeding abandoned fields on the state park is unnecessary, as well as unnatural.

The same field was revisited on October 6, 1957, approximately six and a half years after cultivation. A general reconnaissance indicated that *Agrostis alba* formed the bulk of the vegetation, although several woody species were well established (table 2). These woody species on this 2-hectare field included about 50 scattered clumps of *Robinia pseudo-acacia*, which were 3 to 4.5 meters tall; widely scattered clumps of *Rhus typhina*, which were 1.2 to 1.8 meters tall; two *Ulmus fulva* saplings, 2 and 4.5 meters tall; and one *Platanus occidentalis* sapling, 1.5 meters tall. The vegetation on an adjacent field, retired

the species. In this survey, square-meter sample plots were utilized to measure cover.

^b Frequency represents the percentage of the sample plots in which the species appeared.

^c The names of woody species that had developed from relict roots are preceded by a cross (+).

^d An asterisk indicates that the species covered less than 1 per cent of the ground in the field.

^e Species that were observed on the field but did not occur in the sample plots are indicated by an X.

at the same time, was similar except that *Platanus occidentalis* saplings, 0.3 meter to 3 meters tall, were abundant.

On this former Meyer farm near the southwest boundary of Shades State Park (fig. 2), specimens of *Acer saccharum*, *Cornus florida*, *Fagus grandifolia*, *Juniperus virginiana*, *Platanus occidentalis*, *Quercus alba*, *Q. velutina*, *Rhus typhina*, and *Sassafras albidum*, most of which were less than 3 meters tall, were scattered over a field which had been retired approximately 15 years before. *Andropogon scoparius* and *Tridens flava* were the principal herbaceous species present and probably indicate that the area had been intensively pastured. Ultimately, the trees listed above and several other species, particularly *Fraxinus americana*, should form a large portion of the secondary forest. In some areas, the composition of secondary forests is very similar to that of old growth stands. At Pine Hills, however, a retired field had been seeded by exotic pines (*Pinus sylvestris*, *P. banksiana*) which should convert the tract to a mixed pine forest in another decade.

PREVIOUS LITERATURE ON THE FLORA OF THE SURVEY AREA

Although the Shades and Pine Hills were operated as private parks and were visited by thousands of persons each year, little was published about their flora before 1932. Collett (1876), in his description of some geologic features of the Survey Area, mentioned the occurrence of hemlock, cedar, and pine at Pine Hills and pine and *Camp-tosorus rhizophyllus* at the Shades. Coulter (1900) cited a station for *Gaultheria procumbens* in the Pine Hills tract, Blatchley (1903) observed that pine, yew, hemlock, and cedar grew in abundance at the Shades, and a station for *Vaccinium corymbosum* in Pine Hills was noted by Grimes (1912). Friesner and Potzger (1932a, 1932b) mentioned the occurrence of relict stands of *Tsuga canadensis* at Pine Hills, and Artist (1932) presented data obtained at Pine Hills in his investigation of the reliability of *Rumex acetosella* as an acidity indicator. Friesner and Pozger (1934) described and mapped the vegetation of the Pine Hills Natural Area and, in later papers, presented data on seasonal variations of soil moisture (Friesner and Potzger, 1936) and

TABLE 2

COMPOSITION OF VEGETATION IN A FIELD ON THE
SIMS FARM, SHADES STATE PARK, SIX AND A
HALF YEARS AFTER CULTIVATION

	Cover ^a
<i>Agrostis alba</i>	90%
<i>Solidago</i> spp.	15
<i>Robinia pseudo-acacia</i>	10
<i>Acalypha rhomboidea</i>	5
<i>Daucus carota</i>	5
<i>Rubus</i> sp.	5
<i>Agrostis hiemalis</i>	1
<i>Ambrosia artemisiifolia</i> var. <i>elatior</i> forma <i>villosa</i>	1
<i>Andropogon scoparius</i>	1
<i>Eupatorium purpureum</i>	1
<i>Achillea millefolium</i>	* ^b
<i>Aristida oligantha</i>	*
<i>Aster</i> sp.	*
<i>Lactuca canadensis</i> var. <i>latifolia</i>	*
<i>Oenothera biennis</i> var. <i>pyncocarpa</i>	*
<i>Paspalum ciliatofolium</i> var. <i>muhlenbergii</i>	*
<i>Platanus occidentalis</i>	*
<i>Rhus typhina</i>	*
<i>Sassafras albidum</i>	*
<i>Solanum carolinense</i>	*
<i>Ulmus fulva</i>	*

^a Cover is expressed as the percentage of the ground in the field that is overspread by the foliage of the species. In this survey, cover was ocularly estimated.

^b Species that covered less than 1 per cent of the field are indicated by an asterisk.

soil acidity under hemlock stands in the area (Potzger and Friesner, 1937).

In a discussion of "boreal and glacial disjuncts" in Indiana, Friesner (1937) made reference to stations in Pine Hills and the Shades for *Cornus rugosa*, *Taxus canadensis*, *Diervilla lonicera*, *Gaultheria procumbens*, and *Pinus strobus* and characterized the Survey Area as an ideal refugium in which relict species of extensive post-glacial vegetations have been able to maintain themselves against the succeeding waves of species of more temperate and mesophytic affinities. Deam (1940), in his "Flora of Indiana," cited *Fragaria vesca* from the Shades and *Vaccinium corymbosum* var. *pallidum* (V. c. var. *glabrum*) from Pine Hills. Trotter (1952) presented the results of a full tally of trees, shrubs, and lianas on a 2-hectare tract in Shades State Park.

The first Indiana station for the alga *Prophyrosiphon notarisii* was found at Pine Hills by Daily (1948), and several other algae were recorded from the J. W. Frisz Memorial Lagoon in Shades State Park by Daily and McCormick (1952). Martin and McCormick (1962) list several species of slime fungi, including four species new to the state, from Shades State Park and Pine Hills Natural Area. Several species of liverworts were recorded from Pine Hills by Parker (1937) and Wagner (1953).

McCormick (1952) discussed the flora of Shades State Park, but the list of species was omitted from the published paper. That list, to which 88 taxonomic entities, 34 genera, and two families have been added, has been annotated and forms the principal section of the present paper.

THE FLORISTIC STUDY

This study was conducted under the auspices of the Division of State Parks, Lands, and Waters, Indiana Department of Conservation, and the Department of Botany, Butler University. This is the first integrated floristic study of the Survey Area and the first complete vascular flora of an Indiana state park. The collections were made chiefly during 1949, 1950, and 1951 while the author was employed as resident naturalist at Shades State Park. Additional collections were made at various times between 1952 and 1954 while the author was in the Department of Botany, Rutgers University, and from 1954 through 1961 while the author was employed by the American Museum of Natural History.

NOMENCLATURE AND VOUCHERS

The sequence of families in this flora follows the system of Engler and Prantl. This sequence, as well as the nomenclature, is adapted from "Gray's manual of botany, eighth (centennial) edition" (Fernald, 1950). In those instances in which a scientific name used in this list differs from the name recognized in the "Flora of Indiana" (Deam, 1940), the latter name is given as a synonym. The common names listed are those used by local residents, mentioned by Deam (1940), or given by Lyon (1907).

Except when indicated otherwise, all the

entities listed in the flora have been collected by the author. Twenty-five taxa new to the flora of Indiana, including two species, eight varieties, and 15 forms, and 330 county records, including 72 entities new to the flora of Montgomery County, 74 new to Parke County, and 184 new to Fountain County, were discovered by this study and have been reported in the Proceedings of the Indiana Academy of Science (State Flora Committee, 1950, 1951, 1952, 1953; Buser, 1954). The record of one species new to Montgomery County, *Lycopodium complanatum* var. *flabelliforme*, collected during January, 1961, has not been published previously. Species reported as state or county records are vouchered by specimens in the Ray C. Friesner Memorial Herbarium, Butler University, Indianapolis, Indiana. Most of the other species are represented by specimens in the Chrysler Herbarium, Rutgers University, New Brunswick, New Jersey.

The symbols preceding the names of certain plants in the flora indicate the status of non-native entities. Unintentionally introduced plants that have become naturalized in the Survey Area are prefixed by an "I" (introduced). Plants persisting after cultivation and not reproducing or spreading extensively are prefixed by a "P" (planted). Plants that are persisting after cultivation but that are also reproducing themselves and spreading in the Survey Area are prefixed by the compound symbol "P-E" (planted-escaping). This last group of plants can be considered to be adventive in the local flora.

The relative abundance of each species was estimated from field notes and from the author's experience in the Survey Area and subjectively categorized as "rare," "infrequent," or "frequent." These qualitative designations refer to the comparative frequency of a species in the habitats in which it occurs. "Rare" indicates that the species was found only in one station or as a few individuals in less than 10 per cent of the available habitat. "Infrequent" means that a species was encountered at many stations, but that only a few individuals were present in any given station, or that the species was found to be abundant in only 10 to 25 per cent of the available habitat. "Frequent" indicates that the species was present in

nearly every locality in which a suitable habitat was developed, or that it was abundant in 25 per cent or more of the available habitat. The locations of stations mentioned in the annotations are shown on the detailed maps of the Survey Area (figs. 2-4).

ACKNOWLEDGMENTS

Many persons have contributed information utilized in this paper, and to each of them I wish to convey my sincere gratitude. Mr. Kenneth Cougill, Director of the Division of State Parks, Indiana Department of Conservation, and Mr. Max Forsyth, Chief Naturalist during 1949, 1950, and 1951, were generous in their allotment of time to make the majority of collections upon which this flora is based. Mr. Cougill and Mr. Louis Hasenstab, Division of State Parks, have also contributed many of the basic data for the maps of the Shades State Park and, together with Mr. Kenneth Marlin, Director of the Indiana Department of Conservation, made available to me the minutes of the State Conservation Commission. Mr. Fabian Frisz, Crawfordsville, Indiana, provided me with a wealth of data concerning the history of the Shades, as well as permitting me to copy all pertinent information from the ledgers of the Garland Dell Mineral Springs Association. Mr. Alonzo C. Deere, Mrs. Fay Welch, Mrs. Virginia Banta Sharpe, Mr. Charles Moore, and many other persons in and around Waveland, Indiana, and Mrs. Lawrence B. Armstrong, and Mrs. Mabel

Weir Grimes, Crawfordsville, Indiana, have contributed many facts about the history of the Survey Area and have verified portions of the manuscript. Mr. Victor M. Hasselman, in numerous discussions and through his thoughtfulness in preserving many family papers and old photographs, provided me with excellent documentation of the history of Pine Hills. Dr. John E. Potzger, Butler University, Mr. E. J. Alexander, New York Botanical Garden, Dr. Frederick J. Hermann, United States Department of Agriculture, and Dr. Elbert Little, Jr., each verified several botanical specimens. Mr. Gene C. Frazier, Park Naturalist, Shades State Park, has read the entire manuscript and made several suggestions which have been incorporated into the paper. The American Museum of Natural History permitted me considerable time to continue my collecting activities in the Survey Area while I was a member of the staff of the Museum and to negotiate and ultimately to consummate the purchase of Pine Hills Natural Area under the auspices of the Nature Conservancy.

Without doubt, however, my greatest single debt is to Dr. Ray C. Friesner, the late Chairman of the Department of Botany, Butler University. Dr. Friesner gave me great encouragement to become a state park naturalist and to undertake this study. He devoted considerable time to verifying identifications or determining specimens and counseled me on many of the botanical and phytogeographic aspects of this problem.

ANNOTATED CATALOGUE OF THE VASCULAR FLORA OF SHADES STATE PARK AND PINE HILLS NATURAL AREA

DIVISION PTERIDOPHYTA

FAMILY EQUISETACEAE

Equisetum arvense

FIELD HORSETAIL

Infrequent in moist soil at Indian Springs on Trail 1 below Inspiration Point and in a few other sites where perennial springs maintain moist conditions.

Equisetum hyemale var. *affine* (*E. prealtum*)

TALL SCOURING RUSH

Frequent in damp soil in ravine bottoms and on the flood plain of Sugar Creek.

FAMILY LYCOPODIACEAE

Lycopodium lucidulum

SHINING CLUB MOSS

Rare, known only from four isolated stations in the Survey Area. Specimens in the Wabash College Herbarium were collected by Gentry, "On ground just above waterfalls" (Silver Cascade), May 12, 1894, and by A. R. Bechtel "On narrow ledge, Frisz Ravine," Trail 7, October 18, 1942. Gentry's station apparently has disappeared, and the present author was unable to relocate Bechtel's station. During this study, a small colony was found on a shaded flat between Shades of Death Ravine and Upper Ravine on Trail 2, and a very luxuriant colony was found on and adjacent to a slab of sandstone in the ravine immediately east of Pedestal Rock. In 1951 a small cutting was transplanted from the latter station to a ledge in Red Fox Ravine, Trail 6, near the Devil's Punch-bowl.

Lycopodium complanatum var. *flabelliforme*

(*L. flabelliforme*)

GROUND PINE

Rare, known only from a station in the old field north of the Pine Hills Natural Area entrance road.

FAMILY OPHIOGLOSSACEAE

Botrychium dissectum

CUT-LEAF GRAPE FERN

Rare in the upland forest and on the upper portions of ravine banks.

Botrychium dissectum forma *obliquum*

(*B. dissectum* var. *obliquum*)

OBLIQUE GRAPE FERN

Infrequent in the upland forest and on shaded ravine banks.

Botrychium virginianum

RATTLESNAKE FERN

Frequent throughout the upland forest and on the upper portions of ravine banks.

FAMILY POLYPODIACEAE

Cystopteris fragilis var. *protrusa*

BRITTLE FERN

Frequent on moist ravine banks and infrequent in the upland forests.

Cystopteris bulbifera

BERRY BLADDER FERN

Rare in moist, shaded soil on ravine banks and on ledges of north-facing cliffs. The largest colony found is located in the perennially moist soil around Indian Springs on Trail 1 below Inspiration Point.

Pteritis pensylvanica (*Pteritis nodulosa*)

OSTRICH FERN

Rare on the flood plain of Sugar Creek. Plants from the area now included in Shades State Park have been planted on the northwest side of Shades Inn and around several homes in Waveland, Indiana.

Onoclea sensibilis

SENSITIVE FERN

Rare, found only in a swampy area in Kickapoo Ravine south of Trail 7.

Dryopteris noveboracensis

NEW YORK FERN

Rare in the upland forests.

Dryopteris hexagonoptera

BROAD BEECH FERN

Infrequent in the upland forests and forest borders.

Dryopteris spinulosa

TOOTHED WOOD FERN

Rare on shaded ravine banks and in the upland forests.

Dryopteris spinulosa var. *intermedia*

COMMON WOOD FERN

Rare on shaded ravine banks.

Dryopteris marginalis

LEATHER WOOD FERN

Frequent on shaded ravine banks, on ledges of north-facing cliffs, in the upland forests, and in hemlock stands.

Dryopteris marginalis* forma *elegans (not listed in Deam, 1940)

"Cliffs along Indian Creek, Pine Hills," August 1, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Polystichum acrostichoides

CHRISTMAS FERN

Frequent on the shaded banks and bottoms of ravines and in the upland forests.

Polystichum acrostichoides* forma *incisum

Rare on the shaded banks and bottoms of ravines and in the upland forests.

Dennstaedtia punctilobula

HAY-SCENTED FERN

Rare, found only at several stations in the ravine on the east side of Pedestal Rock. In 1951, a small specimen was transplanted to a ledge in Red Fox Ravine, Trail 6, near the Devil's Punchbowl.

Athyrium pycnocarpon

NARROW-LEAF SPLEENWORT

Rare on shaded ravine banks.

Athyrium thelypteroides

SILVERY SPLEENWORT

Infrequent in the upland forests and on shaded ravine banks.

Athyrium thelypteroides* forma *acrostichoides
(not listed in Deam, 1940)

"Wooded ravine, Pine Hills," July 11, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Athyrium filix-femina* var. *asplenioides
(*A. asplenioides*)

LADY FERN

Rare, found only in the ravine on the east side of Pedestal Rock.

Camptosorus rhizophyllus

WALKING FERN

Infrequent on moist limestone and tufa outcrops in ravine bottoms. Although Collett (1876) described a colony of the walking fern near Silver

Cascade in the Shades, the first catalogues of the flora of the state gave the range of the species only as southern Indiana (Editors of the Botanical Gazette and Barnes, 1881; Coulter, 1900).

Asplenium trichomanes

MAIDENHAIR SPLEENWORT

Rare, found only on moist ledges on Trail 1 at the Devil's Kitchen (below Prospect Point) and near Fat Man's Misery (below Inspiration Point).

Asplenium platyneuron

EBONY SPLEENWORT

Infrequent in upland forest borders and in open fields.

Pellaea glabella

SMOOTH PURPLE CLIFFBRAKE

Rare on ledges of vertical sandstone cliffs.

Adiantum pedatum

MAIDENHAIR FERN

Frequent on moist ravine banks and in the upland forests; infrequent on unmowed roadsides.

Pteridium aquilinum* var. *latiusculum
(*P. latiusculum*)

BRACKEN

"Dry open ridge, Mill Cut Backbone, Pine Hills," July 11, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Polypodium virginianum

COMMON POLYPODY

Frequent on ravine banks and shaded sandstone cliffs; infrequent in the upland forests.

DIVISION SPERMATOPHYTA

SUBDIVISION GYMNOSPERMAE

FAMILY TAXACEAE

Taxus canadensis

CANADA YEW

Frequent in hemlock stands; rare in beech-maple forests on narrow sandstone ridges. The most luxuriant stand was found under an open beech-maple stand on a flat ridge top about 200 meters north of Pedestal Rock (fig. 2).

Blatchley (1903) was the first to publish on the occurrence of *Taxus* in the Survey Area. The species was not listed in the first catalogue of the flora of the state (Editors of the Botanical Gazette and Barnes, 1881) and was not credited to the Survey Area in a later catalogue by Coulter (1900). Friesner and Potzger (1934) described the

distribution of *Taxus* in the Pine Hills Natural Area, and Friesner (1937) considered the species to be a glacial disjunct in its stations at Pine Hills and the Shades.

FAMILY PINACEAE

Tsuga canadensis

EASTERN HEMLOCK

Frequent on sandstone and shale cliffs above Sugar, Indian, and Clifty creeks and on the upper slopes of ravines throughout the Survey Area. The most dense stands are developed on terraces along the larger streams.

Tsuga was not listed in the first catalogue of the flora of the state (Editors of the Botanical Gazette and Barnes, 1881). This is difficult to understand, for John and Stanley Coulter, who edited the Botanical Gazette during its early years, attended the Waveland Presbyterial Academy, about 5 miles from the Survey Area, from 1862 to 1864, and were noted horsemen (Sharpe, 1958). In addition, Collett (1876) had mentioned the occurrence of hemlock in the "Shades of Death," the present Pine Hills Natural Area. In a later flora, Coulter (1900) cited a collection of *Gaultheria procumbens* by Blatchley from Pine Hills but did not credit *Tsuga* to the Survey Area, although Blatchley (1903) later described hemlock as growing in abundance on the Survey Area. The species was listed from Sugar Creek Valley by Deam (1912) and by subsequent authors.

Friesner and Potzger (1934) mapped the distribution of *Tsuga* in the Pine Hills Natural Area and analyzed communities in which it occurred (fig. 5). Later they measured various physical factors of its habitat, in an effort to determine the factors that permit it to survive in the area (Friesner and Potzger, 1936; Potzger and Friesner, 1937). No study has been made of stand histories or age groups of hemlocks in the Survey Area, but a count of growth rings in the stump of a tree cut by vandals near Turkey Backbone (fig. 4) indicated that the tree, which was 13.6 inches in diameter at 6 inches above the ground, was 115 years old.

(P) *Picea abies* (not listed in Deam, 1940)

NORWAY SPRUCE

A number of individuals are persisting in plantings made by Lawrence S. Hasselman in 1924 along the border of the field north of the Pine Hills Natural Area entrance road. A few seedlings were found in the vicinity of the parent trees, but the lack of saplings indicates that few, if any, seedlings survive.

Pinus strobus

NORTHERN WHITE PINE

Individual trees are frequent on cliff edges above Sugar Creek at Deer Point, Steamboat Rock, Lovers' Leap, and other places and on similar sites above Indian and Clifty creeks. They are infrequent to rare on the edges of the ravines of smaller tributaries.

Pinus strobus was not listed from the Survey Area in either of the two early catalogues of the flora of the state (Editors of the Botanical Gazette and Barnes, 1881; Coulter, 1900), although Collett (1876) had mentioned the occurrence of native "pine" in the "Shades of Death," which is now known as the Pine Hills Natural Area, and at Silver Cascade in the present Shades State Park. Blatchley (1903) also mentioned that "pine" grew in abundance in the Survey Area. The species was noted by Deam (1912) as growing "on a sandstone bluff on Sugar Creek in Montgomery County." All subsequent authors have listed the species from Sugar Creek Valley.

The distribution of *Pinus strobus* in the Pine Hills Natural Area was mapped, and stands in which it occurs were analyzed by Friesner and Potzger (1934). (See fig. 5 of the present paper.) Pine Hills was considered by Friesner (1937) to be the only Indiana station in which white pine exhibited an ability to maintain itself against invasion by broad-leaved trees.

(P) *Pinus resinosa*

RED PINE

Several individuals planted in 1924 are persisting along the border of the field north of the Pine Hills Natural Area entrance road. Two plantations established by the Civilian Conservation Corps (C.C.C.) are located on the Dryer Place, south of Trail 8 and west of Kickapoo Ravine.

(P-E) *Pinus sylvestris* (not listed in Deam, 1940)

SCOTCH PINE

A number of individuals planted in 1924 are persisting along the border of the field north of the Pine Hills Natural Area entrance road. A number of trees that have appeared as volunteers on the field are eight to 15 years old.

(P-E) *Pinus banksiana*

JACK PINE

Several individuals planted in 1924 are persisting along the border of the field north of the Pine Hills Natural Area entrance road and are seeding sparingly into the adjacent field. The cones on these trees apparently open during the year they mature but persist on the tree for several additional years.

(P) *Thuja occidentalis***ARBOR VITAE, NORTHERN WHITE CEDAR**

Several individuals planted in 1924 are persisting along the border of the field north of the Pine Hills Natural Area entrance road and along the abandoned road to Lawrence S. Hasselman's cabin near the southern boundary of the Natural Area. An ornamental planting also has been made at the northwest end of Shades Inn.

Juniperus virginiana* var. *crebra**EASTERN RED CEDAR**

Frequent on abandoned agricultural land, in fence rows, in upland forest borders, and on cliff edges. "Juniper" was mentioned to occur in the Survey Area by Collett (1876) and Blatchley (1903).

SUBDIVISION ANGIOSPERMAE**CLASS MONOCOTYLEDONEAE****FAMILY TYPHACEAE*****Typha latifolia*****COMMON CATTAIL**

Rare in saturated soil in unshaded sites. Only two stations were found in the Survey Area: in Kickapoo Ravine about 150 meters south of Trail 7 and at the head of an unnamed ravine 100 yards west-northwest of the Burgess farmhouse.

FAMILY ALISMATACEAE***Alisma subcordatum*****WATER PLANTAIN**

Rare in unshaded ravine bottoms and on the banks of Sugar Creek.

Sagittaria latifolia* var. *obtus**ARROWHEAD**

Rare on the banks of Sugar Creek.

FAMILY GRAMINEAE***Bromus purgans*****CANADA BROME**

Infrequent in forest borders in upland areas and on the flood plain and larger islands of Sugar Creek.

Bromus purgans* forma *laevivaginat

Frequent in fields and other open sites, in the upland forests, on rocky sites, in ravines, and on the flood plain of Sugar Creek.

(I) *Bromus inermis***SMOOTH BROME**

Frequent in fence rows, fields, and other open, disturbed areas.

(I) *Bromus secalinus***CHESS**

Frequent in fence rows, fields, and other disturbed areas.

(I) *Bromus commutatus***HAIRY CHESS**

Frequent in fence rows, fields, and other disturbed areas.

(I) *Bromus tectorum***DOWNY CHESS**

Frequent in fence rows, fields, and other disturbed areas.

(I) *Festuca ovina***SHEEP FESCUE**

Rare in the lawn of Shades Inn and in eroded fields.

(I) *Festuca elatior***MEADOW FESCUE**

Infrequent in fields and open forests.

Festuca obtusa**NODDING FESCUE**

Frequent in the upland forests; infrequent in hemlock stands.

Glyceria striata**FOWL MANNAGRASS**

Frequent in shaded and unshaded wet sites.

(I) *Poa annua***ANNUAL BLUEGRASS**

Infrequent in lawns, cultivated fields, and other disturbed areas.

(I) *Poa compressa***CANADA BLUEGRASS**

Frequent in fence rows, fields, and other disturbed areas.

Poa pratensis**KENTUCKY BLUEGRASS**

Frequent in fence rows, fields, and other disturbed areas.

Poa sylvestris**WOODLAND BLUEGRASS**

Infrequent in upland forests and on the flood plains of Sugar Creek and Indian Creek.

(I) *Dactylis glomerata***ORCHARD GRASS**

Frequent in fence rows, fields, and other disturbed areas.

Eragrostis hypnoides

CREEPING ERAGROSTIS

Rare, found only on mud flats around the J. W. Frisz Memorial Lagoon, where it forms a dense stand on mud flats exposed during periods of low water.

(I) **Eragrostis megastachya** (*E. cilianensis*)

STINKGRASS

Infrequent in fence rows, fields, and other disturbed areas.

Eragrostis pectinacea

Infrequent in fence rows, fields, and other disturbed areas.

Eragrostis frankii

FRANK'S LOVEGRASS

Rare, found only along dirt road 100 yards southeast of Shades Inn. This station was destroyed by the installation of an airstrip in 1960.

Eragrostis spectabilis

PURPLE LOVEGRASS

Frequent in fence rows, fields, and other disturbed areas.

Diarrhena americana

Rare, found only on tufa rock deposit known as the Devil's Fireplace on Trail 1 near Silver Cascade.

Uniola latifolia

WILD OATS

Frequent on the flood plain of Sugar Creek.

Triodia flava

PURPLETOP

Frequent in fence rows, fields, and other disturbed areas.

(I) **Agropyron repens**

QUACKGRASS

Infrequent in fields and roadsides.

(I) **Agropyron repens** forma **aristatum** (not listed in Deam, 1940)

Infrequent in fields and roadsides.

(I) **Lolium perenne**

PERENNIAL RYEGRASS

Infrequent in picnic areas, roadsides, lawns, and other mowed areas.

(I) **Hordeum jubatum**

FOXTAIL BARLEY

Frequent in fields, fence rows, and roadsides in southwestern section of Survey Area.

(P-E) **Triticum aestivum**

WHEAT

A few volunteer plants appeared along the dirt road 100 meters southeast of Shades Inn in 1950. Although wheat is no longer cultivated on park lands, it will probably appear occasionally along roads from seeds dropped from farm equipment, trucks, and horse feed.

Elymus virginicus

VIRGINIA WILD RYE

Frequent on moist soil in ravines and on the flood plains of the larger streams; infrequent in forest borders.

Elymus riparius

Infrequent in fields and open forests.

Elymus villosus

Infrequent in wet, shaded sites.

Elymus canadensis

CANADA WILD RYE

Infrequent in fields, roadsides, and wet ravine bottoms.

Hystrix patula

BOTTLE-BRUSH

Infrequent in moist ravine bottoms.

Hystrix patula var. **bigeloviana**

Frequent in moist ravines, forest borders, and on the flood plains of the larger streams.

Sphenopholis intermedia

SLENDER WEDGEGRASS

Infrequent in rocky, exposed sites.

(P-E) **Avena sativa**

OAT

Frequent escape on roadsides, field borders, and in the former Civilian Conservation Corps (C.C.C.) camp near the old garage which is used now as a temporary saddle barn.

Danthonia spicata

POVERTY GRASS

Frequent in fields, roadsides, parking lots, and other disturbed areas.

(I) *Agrostis alba***REDTOP**

Frequent in fence rows, fields, and open forests; infrequent in moist, shaded areas.

Agrostis hyemalis**TICKLEGRASS**

Frequent in fields and fence rows.

Agrostis perennans**AUTUMN BENT**

Infrequent in fields and forest openings.

Cinna arundinacea**WOODREED**

Frequent in moist, partially shaded areas along Sugar Creek and tributary streams; infrequent in field borders.

(I) *Phleum pratense***TIMOTHY**

Frequent in fields, roadsides, and other disturbed, unshaded areas.

(I) *Phleum pratense* forma *viviparum* (not listed in Deam, 1940)

Infrequent in fields, roadsides, and other disturbed, unshaded areas. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Muhlenbergia schreberi**NIMBLEWILL**

Frequent in fields, roadsides, and forest borders.

Muhlenbergia sobolifera

Rare, found only on a shaded stream bank 20 meters west of Pedestal Rock and on a dry ridge in the Pine Hills Natural Area.

Muhlenbergia tenuiflora

Rare in moist, shaded ravines.

Muhlenbergia frondosa* (*M. mexicana*)*WIRESTEM MUHLY**

Infrequent in fields and on sandy deposits in stream beds.

Brachyelytrum erectum

Rare on rocky ravine banks and stream terraces.

Aristida oligantha**PRAIRIE THREE-AWN**

Frequent in fence rows, fields, and other disturbed areas.

Aristida longespica

Frequent in fence rows, fields, and other disturbed areas.

(I) *Eleusine indica***GOOSEGRASS**

Frequent in fence rows, fields, and other disturbed areas.

(I) *Phalaris arundinacea***REED CANARY GRASS**

Found only at old C.C.C. camp site.

Leersia virginica**WHITEGRASS**

Frequent in open or partially shaded moist sites and open forests.

(I) *Digitaria ischaemum***SMOOTH CRABGRASS**

Frequent in fence rows, fields, and other disturbed areas.

(I) *Digitaria sanguinalis***CRABGRASS**

Frequent in fence rows, fields, and other disturbed areas.

***Paspalum ciliatifolium* var. *muhlenbergii* (*P. pubescens*)**

Rare, found only in fence rows and an old field on the former Sims farm.

Panicum dichotomiflorum**FALL PANICUM**

Infrequent in open forests, fields, and on the bank of the J. W. Frisz Memorial Lagoon.

***Panicum dichotomiflorum* var. *geniculatum* (not listed in Deam, 1940)**

Rare, found only on the east bank of the J. W. Frisz Memorial Lagoon. This variety was added to the state flora as a result of the present study (State Flora Committee, 1952).

Panicum capillare**WITCHGRASS**

Frequent in old fields, roadsides, and other disturbed areas, and on mud flats around the J. W. Frisz Memorial Lagoon.

Panicum philadelphicum

Infrequent on gravel bars in Sugar Creek and in upland fields.

Panicum gattingeri

Infrequent in fields and on the banks of the J. W. Frisz Memorial Lagoon.

Panicum linearifolium

"Pine Hills," June 20, 1927, collected by A. R. Bechtel and C. Klinger, determined by C. C. Deam; and "Grassy field, eastern end of Shades," June 9, 1942, collected by A. R. Bechtel and L. Lee. Specimens deposited in the Wabash College Herbarium.

Panicum dichotomum

Frequent in open forests.

Panicum huachucae

Frequent in fields, roadsides, and parking areas.

Panicum huachucae* var. *fasciculatum

Rare, found only on the east bank of the J. W. Frisz Memorial Lagoon.

Panicum lindheimeri

Rare, found only in fallow fields on the former Sims farm.

Panicum polyanthes

Rare, found only on the flood plains of the larger streams.

Panicum clandestinum

Frequent in moist, shaded sites and in fields, roadsides, and open forests.

Panicum latifolium

Infrequent in moist ravine bottoms and on the banks of the J. W. Frisz Memorial Lagoon.

Panicum boscii

Infrequent in the upland forests.

Echinochloa crusgalli**BARNYARD GRASS**

Frequent in fields, fence rows, roadsides, and other disturbed areas.

(I) *Setaria glauca* (*S. lutescens*)**YELLOW FOXTAIL**

Frequent in fields, fence rows, roadsides, and other disturbed areas; infrequent in forest borders.

(I) *Setaria viridis***GREEN FOXTAIL**

Frequent in fields, roadsides, and other disturbed areas.

Cenchrus longispinus* (*C. pauciflorus*)*FIELD SANDBUR**

Rare, found only in fields near the C.C.C. pond on the former Dryer farm.

Andropogon scoparius**LITTLE BLUESTEM, PRAIRIE BEARDGRASS**

Infrequent in old fields.

Andropogon gerardi* (*A. furcatus*)*BIG BLUESTEM**

Rare on the flood plain and islands of Sugar Creek.

(P-E) *Zea mays***CORN**

Infrequent as an escape along roads and in recently abandoned fields.

FAMILY CYPERACEAE***Cyperus strigosus***

Infrequent in partially shaded, moist soil.

Eleocharis obtusa**BLUNT SPIKERUSH**

Infrequent in poorly drained areas in fields near the southwest margin of the Survey Area.

Scirpus atrovirens

Infrequent in open and partially shaded wet areas, in ravines, and on pond margins.

Scirpus lineatus

Rare, found only in the field 100 meters northwest of the former C.C.C. camp.

Carex convoluta

Rare, found only on a shaded sandstone ledge 200 meters north of Shades Inn, in upland woods on Trail 7, and in an open woodland in the Pine Hills Natural Area.

Carex cephalophora

"Pine Hills," June 20, 1927, collected by A. R. Bechtel and C. Klinger. Specimen deposited in the Wabash College Herbarium.

Carex gravida

Rare, found only on the path to the cabin east of Shades Inn.

Carex vulpinoidea

Frequent on pond margins; infrequent in old fields.

Carex conjuncta

Frequent in fields, roadsides, and other disturbed, unshaded areas.

Carex tribuloides

Rare, found only on mud in the C.C.C. pond on the former Dryer farm.

Carex cristatella

"The Shades," June 23, 1928, collected by A. R. Bechtel, determined by F. J. Herman. Specimen deposited in the Wabash College Herbarium.

Carex normalis

"Open grassland, eastern end of Shades property," June 9, 1942, collected by A. R. Bechtel; and "Woods along Sugar Creek opposite the Shades," June 7, 1930, collected by A. R. Bechtel and J. Belmore, determined by L. Lee. Specimens deposited in the Wabash College Herbarium.

Carex festucacea

"Wooded ravine, Trail 8 [now Trail 7], the Shades," June 9, 1942, collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

Carex jamesii

"Wooded highland, Trail 8 [now Trail 7], the Shades," June 9, 1942, collected by A. R. Bechtel; and "Wooded bank of Sugar Creek below Pine Hills," May 24, 1930, collected by A. R. Bechtel and E. C. Stout, verified by F. J. Herman. Specimens deposited in the Wabash College Herbarium.

Carex picta

"On north-facing slope of Turkey Backbone at edge of hemlock stand," May 19, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Carex artitecta

"Wooded hilltop, Trail 8 [now Trail 7], Shades," collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

Carex hirtifolia

"Woods, the Shades," June 23, 1928, collected by A. R. Bechtel, determined by F. J. Herman. Specimen deposited in the Wabash College Herbarium.

Carex stricta

Infrequent in fields.

Carex hirsutella

Infrequent in fence rows and fields.

Carex umbellata

"Hasselman's Reserve [Pine Hills Natural Area], Deer's Mills," May 7, 1922, collected by H. B. Metcalf, verified by F. J. Herman. Specimen deposited in the Wabash College Herbarium.

Carex virescens

"Average type woods, the Shades," June 9, 1942; and "Steep wooded hill, Pine Hills," September 8, 1928, collected by A. R. Bechtel, verified by F. J. Herman. Specimens deposited in the Wabash College Herbarium.

Carex swanii

Infrequent in fields, fence rows, roadsides, and other disturbed areas, as well as on barren sandstone cliffs.

Carex prasina

"Wooded highland, Trail 8 [now Trail 7], the Shades," June 9, 1942, collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

Carex davisii

Infrequent in fields, roadsides, and other disturbed, unshaded areas.

Carex oligocarpa

"North bank of Sugar Creek, southwestern corner of [Montgomery] County," May 24, 1930, collected by A. R. Bechtel and E. C. Stout, determined by F. J. Herman. Specimen deposited in Wabash College Herbarium.

Carex amphibola var. *turgida* (*C. grisea*)

Rare, found only in a field 150 meters southeast of Shades Inn. This station was destroyed by the installation of an airstrip in 1960.

Carex hitchcockiana

"Woods, the Shades," June 23, 1928, collected by A. R. Bechtel, determined by F. J. Herman. Specimen deposited in the Wabash College Herbarium.

Carex plantaginea

Frequent in upland forests and on shaded ravine banks.

Carex albursina

Infrequent in fields.

Carex laxiflora

Rare, found only on the exposed sandstone cliff face below Inspiration Point and on the flood plain of Sugar Creek near the mouth of Frisz Ravine, Trail 7.

Carex frankii

Rare, found only on moist soil in the ravine below the dam of the J. W. Frisz Memorial Lagoon.

Carex squarrosa

Rare, found only on a stream bank in a shaded ravine near the northwest boundary of the Survey Area.

Carex lurida

Infrequent in fields and open woodlands.

FAMILY ARACEAE**Arisaema atrorubens** (*A. triphyllum*)**JACK-IN-THE-PULPIT**

Infrequent on terraces, flood plains, and shaded ravine banks; rare in the upland forests.

Arisaema atrorubens forma zebrinum
(*A. triphyllum*)

Frequent on terraces, flood plains, and shaded ravine banks; infrequent in protected sites in the upland forests.

Arisaema atrorubens forma viride
(*A. triphyllum*)

Infrequent to rare on terraces, flood plains, and shaded ravine banks; rare in protected sites in the upland forests.

Arisaema dracontium**DRAGONROOT**

Infrequent on the flood plains and terraces of Sugar Creek and Indian Creek.

Acorus calamus**SWEETFLAG**

Rare, found only in a wet area at head of a ravine 100 meters northwest of the house on the former Burgess farm.

FAMILY LEMNACEAE**Lemna minor****LESSER DUCKWEED**

Found only in a cattail marsh in Kickapoo Ravine, 150 meters south of Trail 7.

FAMILY COMMELINACEAE**(I) Commelina communis****COMMON DAYFLOWER**

Found only in the mowed lawn 30 meters south of Shades Inn and on the flood plain of Sugar Creek near the Parke County line.

Tradescantia subaspera**ZIGZAG SPIDERWORT**

Frequent on shaded ravine bottoms, on flood plains, on the east bank of the J. W. Frisz Memorial Lagoon, and on gravel bars in Indian Creek.

FAMILY JUNCACEAE**Juncus tenuis** (*J. macer*)**PATH RUSH**

Frequent in fields, roadsides, along paths, and in other disturbed areas.

Luzula echinata var. *mesochorea***WOOD RUSH**

Rare, found only on Trail 1 in the open hardwood forest at the south edge of the picnic area. (See *L. multiflora* under Excluded Species.)

FAMILY LILIACEAE**Uvularia grandiflora****BIG MERRYBELLS**

Infrequent on moist, shaded ravine banks.

Allium candense**MEADOW GARLIC**

Infrequent in fields, mowed areas, and roadsides.

(P-E) **Allium cepa** (not listed in Deam, 1940)

ONION

Rare, found only in the bed of an abandoned road on the former Sims farm.

Allium tricoccum**WOOD LEEK**

Infrequent on moist, shaded ravine banks.

(P) Hemerocallis flava**YELLOW DAY LILY**

Persisting in an old garden plot on the southwest side of Shades Inn.

(P) Lilium tigrinum**OUTHOUSE LILY**

Persisting in ornamental plantings at the site of the former superintendent's residence and on the southwest side of Shades Inn.

Erythronium americanum**DOGTUOTH VIOLET**

Frequent on moist, shaded ravine banks; infrequent in the upland forests.

Erythronium albidum

WHITE DOGTOOTH VIOLET

Infrequent on moist, shaded ravine banks; rare in the upland forests.

(P) **Yucca filamentosa**

COMMON YUCCA

Persisting in ornamental plantings beside the Pilot's Lounge at the Pavilion and on the former Dryer farm.

(I) **Asparagus officinalis**

GARDEN ASPARAGUS

Infrequent in fields and fence rows.

Smilacina racemosa

FALSE SOLOMON'S-SEAL

Infrequent on moist ravine banks and in the upland forests.

Smilacina racemosa var. *cylindrata*

Infrequent on moist ravine banks and in the upland forests.

Smilacina stellata

STARRY FALSE SOLOMON'S-SEAL

Infrequent on moist ravine banks and in the upland forests.

Polygonatum pubescens

HAIRY SOLOMON'S-SEAL

Infrequent in moist, shaded ravine bottoms and on stream terraces.

Polygonatum canaliculatum

Rare, found only along the bank of the tributaries of the J. W. Frisz Memorial Lagoon,

Medeola virginiana

INDIAN CUCUMBER

Frequent in hemlock stands; infrequent in the upland forests.

Trillium sessile

SESSILE-FLOWERED WAKE-ROBIN

Infrequent in the upland forests.

Trillium recurvatum

REFLEXED WAKE-ROBIN

Infrequent in the upland forests.

Trillium recurvatum forma *luteum*

Rare in the upland forests.

Trillium flexipes (*T. gleasoni*)

Infrequent in the upland forests, moist ravines, and on the flood plains of the larger streams.

Smilax herbacea

CARRION FLOWER

Rare on the flood plain of Sugar Creek and found once on an exposed face of a sandstone cliff, and at one station in a second-growth woods above the head of Shawnee Canyon on Trail 7.

Smilax tamnoides var. *hispida* (*S. hispida*)

HISPID GREENBRIER

Frequent in moist ravines, second-growth woodlands, small forest openings, and forest borders.

FAMILY **DIOSCOREACEAE****Dioscorea villosa**

WILD YAM-ROOT

Rare on the flood plain of Sugar Creek.

FAMILY **AMARYLLIDACEAE**(P) **Narcissus poeticus**

POET'S NARCISSUS

Persisting in a planting near the foundation of the Dryer house.

(P) **Narcissus pseudo-narcissus**

DAFFODIL

Persisting in a planting near the foundation of the Dryer house.

(P) **Narcissus incomparabilis** (not listed in Deam, 1940)

Persisting in a planting near the foundation of the Dryer house.

FAMILY **IRIDACEAE**(I) **Belamcandra chinensis**

BLACKBERRY-LILY

Rare, found only in Kickapoo Ravine, 200 meters south of Trail 7.

Sisyrinchium angustifolium (*S. graminoides*)

BLUE-EYED GRASS

Rare, found only in an eroded pasture on the former Sims farm and in the bed of Indian Creek just above its junction with Clifty Creek.

(P) **Iris** sp.

BLUE FLAG

Persisting in ornamental plantings along the drive to Shades Inn and along State Road 234 at Pine Hills Natural Area.

FAMILY ORCHIDACEAE

Orchis spectabilis

SHOWY ORCHIS

Rare in the upland forests and in hemlock stands.

Triphora trianthophora

NODDING POGONIA

Rare in the upland forests.

Spiranthes gracilis

SLENDER LADIES' TRESSES

Rare, found only beside Trail 1 in the open forest 75 meters north of the Shades pavilion and in an eroded pasture on the former Sims farm.

Spiranthes cernua

NODDING LADIES' TRESSES

Rare, found only on a cattle path in a field on the former Sims farm.

Goodyera pubescens

DOWNY RATTLESNAKE PLANTAIN

Rare in dense shade on moist ravine terraces and in the upland forests. The largest colony found covers about 0.8 square meter on the terrace immediately west of Pedestal Rock.

Corallorhiza wisteriana

CORAL ROOT

"Moist woods on first terrace, Pine Hills," June 2, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Liparis lilifolia (*L. liliifolia*)

LILY TWAYBLADE

Infrequent in the upland forests and on moist, shaded, ravine banks.

Aplectrum hyemale

PUTTYROOT

Rare in the upland forests.

CLASS DICOTYLEDONEAE

FAMILY SALICACEAE

Salix nigra

BLACK WILLOW

Infrequent on the flood plain of Sugar Creek and the banks of the J. W. Frisz Memorial Lagoon.

(I) *Salix alba*

Rare, found only in moist, low ground at the

head of a ravine 100 meters west-northwest of the house on the former Burgess farm.

Salix interior

SAND-BAR WILLOW

Frequent on the flood plain, sand bars, and islands of Sugar Creek, on the flood plains of Clifty and Indian creeks, and in moist, disturbed areas in the uplands.

Salix rigida (*Salix cordata*)

HEARTLEAF WILLOW

Infrequent on the flood plain of Sugar Creek. Also found in the gravel pit near Sandy Beach on Trail 7.

Salix discolor var. *latifolia*

Infrequent on the flood plain of Sugar Creek and in moist soil near the heads of ravines.

Populus tremuloides

QUAKING ASPEN

Infrequent on the flood plain of Sugar Creek; rare in old fields and fence rows in the uplands.

Populus grandidentata

LARGETOOTH ASPEN

Infrequent on ridge tops, in forest openings, old fields, and fence rows.

Populus deltoides

COTTONWOOD

Frequent on the flood plain of Sugar Creek; infrequent in ravine heads, fence rows, and old fields.

(P) *Populus nigra* var. *italica* (not listed in Deam, 1940)

LOMBARDY POPLAR

Planted as a windbreak along the east fence line at the site for the former superintendent's residence.

FAMILY JUGLANDACEAE

Juglans cinerea

BUTTERNUT

Infrequent on flood plains and terraces of the larger streams, in ravine bottoms, open woodlands, and forest borders.

Juglans nigra

BLACK WALNUT

Frequent on the flood plains and terraces of the larger streams; infrequent throughout the upland forests, and in ravines, old fields, and fence rows.

(P) *Carya illinoensis* (*Carya pecan*)

PECAN

Three planted trees are located in the parking area and lawn at the Shades Inn.

Carya cordiformis

BITTERNUT HICKORY

Frequent in the upland forests; infrequent on the flood plains and terraces of the larger streams and in ravines.

Carya ovata

SHAGBARK HICKORY

Frequent in the upland forests; infrequent on the flood plains and terraces of the larger streams and in ravines.

Carya laciniosa

SHELLBARK HICKORY

Infrequent in the upland forests.

Carya ovalis

SMALL-FRUITED HICKORY

Infrequent in the upland forests, old fields, and fence rows.

FAMILY CORYLACEAE

(P) *Corylus americana*

AMERICAN HAZELNUT

Rare, found only in a red pine plantation on the east side of the C.C.C. pond on the former Dryer farm. The plants are robust and bear abundant fruit, but no seedlings were observed.

Ostrya virginiana

HOP HORNBEAM, IRONWOOD

Frequent in ravines and upland forest borders; infrequent to frequent in the upland forests and on the flood plains and terraces of the larger streams. The largest individual found was 12.7 inches in diameter at breast height and was growing 200 meters southeast of the barn on the former Burgess farm.

Ostrya virginiana forma *glandulosa*

Frequent in ravines and upland forest borders; infrequent to frequent in the upland forests and on the flood plains and terraces of the larger streams. The form is often more common than the species.

Carpinus caroliniana var. *virginiana*

BLUE BEECH, IRONWOOD

Frequent in ravines and on the flood plains and terraces of Sugar, Indian, and Clifty creeks; infrequent to rare in the upland forests.

(P) *Betula pendula* (not listed in Deam, 1940)

Planted as an ornamental at the site of the former superintendent's residence.

FAMILY FAGACEAE

Fagus grandifolia

AMERICAN BEECH

Frequent in the upland forests, on ravine walls and stream terraces; infrequent on flood plains and old fields.

(P) *Castanea dentata*

AMERICAN CHESTNUT

A small specimen was planted on the south side of Shades Inn but recently has been destroyed by lawn improvements.

Quercus alba

WHITE OAK

Frequent in the upland forests, on ravine walls, and higher stream terraces; infrequent on flood plains and in ravine bottoms.

Quercus alba forma *latiloba*

Infrequent in the upland forests, on ravine walls, and higher stream terraces; rare on flood plains and in ravine bottoms.

Quercus macrocarpa

BUR OAK

Rare in moist ravine heads and on the flood plain of Sugar Creek. One tree is located on the southeast side of the J. W. Frisz Memorial Lagoon, near the Park entrance road.

Quercus bicolor

SWAMP WHITE OAK

Rare on the flood plain of Sugar Creek.

Quercus muehlenbergii

CHINQUAPIN OAK

Rare in the upland forests and on steep, north-facing slopes.

Quercus rubra (*Q. borealis* var. *maxima*)

RED OAK

Frequent in the upland forests; infrequent on the flood plains and terraces of the larger streams.

Quercus velutina

BLACK OAK

Frequent in the upland forests; rare in ravines and on stream terraces.

FAMILY **ULMACEAE****Ulmus rubra** (*U. fulva*)

SLIPPERY ELM

Infrequent to rare in the upland forests and in ravines; frequent on stream terraces and flood plains.

Ulmus americana forma pendula**Ulmus americana forma laevior****Ulmus americana forma alba**

AMERICAN ELM

Infrequent in the upland forests; frequent in ravines, on stream terraces, flood plains, and old fields. Of the three forms, forma *laevior* is the most frequent, forma *alba* is well distributed, but not abundant, and forma *pendula* is relatively rare.

Ulmus thomasi (*U. racemosa*)

ROCK ELM

"In a first terrace forest just north of Pine Grove, Pine Hills," October 3, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Celtis occidentalis var. canina

HACKBERRY

Frequent on the flood plains of Sugar, Indian, and Clifty creeks; infrequent in the upland forests, ravines, old fields, and fence rows.

FAMILY **MORACEAE****Morus rubra**

RED MULBERRY

Infrequent and sporadic in old fields, fence rows, forest borders, open woodlands, on stream terraces, and flood plains.

(P) **Morus alba var. tartarica**

RUSSIAN MULBERRY

One planted tree is located in the lawn about 30 meters east of Shades Inn.

(P-E) **Maclura pomifera**

OSAGE ORANGE

Rare on stream terraces in Pine Hills, where it is volunteer growth, and persisting in fence rows on the western side of the State Park, where it was probably planted.

FAMILY **URTICACEAE****Urtica procera**

TALL STINGING NETTLE

Frequent in moist soil on exposed ravine

bottoms and on the flood plains of the larger streams.

(I) **Urtica dioica**

STINGING NETTLE

Infrequent in moist, unshaded swales and roadside ditches.

Laportea canadensis

WOOD NETTLE

Infrequent in ravine bottoms; frequent on the flood plain of Sugar Creek.

Pilea pumila

CLEARWEED

Infrequent in moist, unshaded swales and ditches.

Boehmeria cylindrica

FALSE NETTLE

Infrequent on the banks of the J. W. Frisz Memorial Lagoon and in unshaded ravine bottoms.

FAMILY **ARISTOLOCHIACEAE****Asarum canadense**

WILD GINGER

Frequent in moist ravine bottoms and on stream terraces.

Asarum canadense var. acuminatum

Infrequent in moist ravine bottoms and on shaded slopes.

Asarum canadense var. reflexum (*A. reflexum*)

CURLY WILD GINGER

Infrequent in ravines, on terraces, and flood plains.

Aristolochia serpentaria

VIRGINIA SNAKEROOT

"Low woods, opposite and below Shades," June 7, 1930, collected by A. R. Bechtel and J. B. Elmore, II; and "Ravine, north bank of Sugar Creek, south of Pine Hills," May 24, 1950, collected by A. R. Bechtel and E. C. Stout. Specimens deposited in the Wabash College Herbarium.

FAMILY **POLYGONACEAE**(I) **Rumex crispus**

CURLY DOCK

Frequent in old fields, fence rows, and other unshaded, unmowed areas.

(I) *Rumex obtusifolius*

BLUNTLEAF DOCK

Frequent in old fields, parking areas, fence rows, and other unshaded, unmowed areas.

(I) *Rumex acetosella*

SHEEP SORREL

Frequent in old fields, lawns, picnic areas, and grassy recreation areas.

Tovara virginiana (*Polygonum virginianum*)

VIRGINIA KNOTWEED

Frequent in upland forest borders and roadsides; infrequent on stream terraces and flood plains.

(I) *Polygonum aviculare*

KNOTWEED

Frequent in lawns, old fields, and picnic areas; infrequent in upland forest borders.

Polygonum pensylvanicum var. *laevigatum*

Frequent in moist swales, fence rows, unshaded ravine bottoms, on stream sand bars, and flood plains.

Polygonum pensylvanicum var. *laevigatum* forma *albineum* (*P. p.* var. *laevigatum* forma *pallescens*)

Rare, found only in the field 150 meters south of Shades Inn. This station was destroyed by the installation of an airstrip in 1960.

Polygonum lapathifolium

Infrequent in moist areas on the banks and mud flats of the J. W. Frisz Memorial Lagoon and on sand bars in Sugar Creek.

(I) *Polygonum persicaria*

LADY'S THUMB

Frequent in old fields, fence rows, upland forest borders, and on the sandstone cliff below Inspiration Point on Trail 1.

Polygonum punctatum

WATER SMARTWEED

Frequent in moist areas around the J. W. Frisz Memorial Lagoon and on the flood plain of Sugar Creek; infrequent in open upland forests and forest borders.

Polygonum hydropiperoides

MILD WATER PEPPER

Infrequent on the banks of the J. W. Frisz Memorial Lagoon and on the flood plain and in shallow water of Sugar Creek.

Polygonum scandens

CLIMBING FALSE BUCKWHEAT

Frequent on the flood plain and sand bars of Sugar Creek; infrequent in old fields.

FAMILY CHENOPODIACEAE

(I) *Chenopodium album*

LAMB'S QUARTERS

Frequent in fence rows, barnyards, and old fields.

Atriplex patula

ORACH

Infrequent in old fields.

FAMILY AMARANTHACEAE

(I) *Amaranthus retroflexus*

ROUGH GREEN PIGWEED

Frequent in fence rows, farmyards, and abandoned fields.

(I) *Gomphrena globosa*

GLOBE AMARANTH

Rare, found only in a fence row south of the barn on the former Sims farm.

FAMILY PHYTOLACCACEAE

Phytolacca americana

COMMON POKEWEED

Frequent in fence rows, old fields, and thickets; infrequent on roadsides and in forest borders.

FAMILY AIZOACEAE

(I) *Mollugo verticillata*

CARPET-WEED

Frequent in cultivated fields and old fields; infrequent on exposed sand bars in Sugar Creek.

FAMILY PORTULACACEAE

Claytonia virginica

VIRGINIA SPRING BEAUTY

Frequent on ravine slopes; infrequent throughout the upland forests and in stream-terrace and flood-plain forests.

FAMILY CARYOPHYLLACEAE

(I) *Stellaria media*

COMMON CHICKWEED

Frequent in old fields, fence rows, and roadsides; infrequent in open woodlands.

Stellaria pubera

GREAT CHICKWEED

Infrequent in open woodlands and forest borders.

Stellaria longifolia

LONGLEAF STITCHWORT

Infrequent in fence rows, old fields, and open woodlands.

(I) **Cerastium vulgatum** (*C. v. var. hirsutum*)

COMMON MOUSE-EAR CHICKWEED

Infrequent in old fields, fence rows, and roadsides.

(I) **Cerastium vulgatum** forma **glandulosum**
(*C. v. var. hirsutum* forma *glandulosum*)

Frequent in old fields, fence rows, cultivated fields, parking areas, picnic areas, and forest borders.

(I) **Cerastium nutans**

NODDING CHICKWEED

Infrequent in old fields, fence rows, and roadsides.

(I) **Agrostemma githago**

CORN COCKLE

Infrequent in old fields, fence rows, and roadsides.

Silene antirrhina

SLEEPY CATCHFLY

Frequent along the banks of the J. W. Frisz Memorial Lagoon.

Silene virginica

FIREPINK

Infrequent on ravine slopes, in moist forests, and in protected sites in the upland forests.

(I) **Saponaria officinalis**

BOUNCING-BET, SOAPWORT

Infrequent on roadsides, in old fields, and on the flood plains of the larger streams.

FAMILY **RANUNCULACEAE****Ranunculus sceleratus**

CURSED CROWFOOT

Rare on the flood plain of Sugar Creek.

Ranunculus abortivus

SMALL-FLOWERED BUTTERCUP

Frequent in old fields, fence rows, roadsides, and open woodlands.

Ranunculus recurvatus

HOOKED BUTTERCUP

Rare in forest borders, forest openings, and on stream terraces.

Ranunculus hispidus

BRISTLY BUTTERCUP

Infrequent to rare in fence rows, forest borders, and open woodlands.

Ranunculus septentrionalis

SWAMP BUTTERCUP

Rare in moist ravine bottoms and on the flood plains of the larger streams.

(I) **Myosurus minimus**

MOUSETAIL

"The Shades" (without specific location), May 10, 1947, collected by E. Bower. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Thalictrum dioicum

EARLY MEADOW RUE

Infrequent in moist ravine bottoms and on the flood plain of Sugar Creek.

Thalictrum revolutum

WAXY MEADOW RUE

Infrequent to rare on the flood plains of the larger streams.

Anemonella thalictroides

RUE ANEMONE

Frequent on shaded ravine banks; infrequent in the upland forests.

Hepatica acutiloba

LIVER-LEAF

Frequent on shaded ravine banks; infrequent in the upland forests.

Anemone virginiana

THIMBLEWORT

Rare in ravine bottoms, fence rows, farmyards, and old fields.

Anemone canadensis

MEADOW ANEMONE

"Low woods, opposite creek from Shades," June 7, 1930, collected by A. R. Bechtel and J. B. Elmore, II; and "Low wet spot, Sugar Creek, Trail 8 [now Trail 7], the Shades," June 9, 1942, collected by A. R. Bechtel. Specimens deposited in the Wabash College Herbarium.

Clematis virginiana

VIRGIN'S-BOWER

Rare on the flood plain and sand bars of Sugar Creek and on the wooded terraces of Clifty and Indian creeks.

Isopyrum biternatum

FALSE RUE ANEMONE

Infrequent in moist forests along ravines, stream terraces, and flood plains.

Caltha palustris

MARSH MARIGOLD

Infrequent in partially shaded ravine bottoms, usually growing in the streams.

Aquilegia canadensis

AMERICAN COLUMBINE

Rare on rocky outcrops along Sugar Creek and on the backbones in the Pine Hills Natural Area.

(P-E) **Delphinium ajacis**

ROCKET LARKSPUR

Rare. One large colony was found on the roadside about 100 meters south of the old Burgess farm house.

Actaea pachypoda (*A. alba*)

WHITE BANEERRY

Frequent on ravine banks; infrequent in the upland forests.

FAMILY **BERBERIDACEAE****Podophyllum peltatum**

COMMON MAYAPPLE

Frequent in large colonies in upland and lowland forests and forest borders.

Caulophyllum thalictroides

BLUE COHOSH

Infrequent in ravines, on stream terraces, and flood plains; rare in upland forest borders.

(P-E) **Berberis thunbergii**

JAPANESE BARBERRY

Infrequent as an escape in old fields, fence rows, and open woodlands, and also represented by persistent ornamental plantings in the lawn of Shades Inn and around house sites in the Pine Hills Natural Area.

FAMILY **MENISPERMACEAE****Menispermum canadense**

COMMON MOONSEED

Rare, found only in a small forest opening near the northwest boundary of the Survey Area.

FAMILY **MAGNOLIACEAE****Liriodendron tulipifera**

TULIP TREE

Frequent in the upland forests, ravine bottoms, on stream terraces, flood plains, and old fields.

FAMILY **ANNONACEAE****Asimina triloba**

PAPAW

Frequent in forest borders and open woodlands; infrequent in the upland and lowland forests.

FAMILY **LAURACEAE****Sassafras albidum**

SASSAFRAS

Frequent in fence rows, old fields, and forest borders; infrequent in the upland forests, on stream terraces, and flood plains.

Sassafras albidum var. *molle*

Infrequent in fence rows, old fields, and forest borders; rare in the upland forests, on stream terraces, and flood plains.

Lindera benzoin (*Benzoin aestivale*)

SPICEBUSH

Frequent on the flood plains of the larger streams; infrequent to rare in moist sites in the upland forests, on slopes, old fields, and in fence rows.

FAMILY **PAPAVERACEAE****Sanguinaria canadensis**

BLOODROOT

Frequent on moist, shaded ravine banks; infrequent in the upland forests.

Stylophorum diphyllum

CELANDINE-POPPY

Infrequent on moist, shaded ravine banks, stream terraces, and flood plains.

Dicentra cucullaria

DUTCHMAN'S-BREECHES

Frequent on moist, shaded ravine banks and stream terraces; infrequent in protected sites in the upland forests.

Dicentra canadensis

SQUIRREL CORN

Infrequent on moist, shaded ravine banks; rare in protected sites in the upland forests.

FAMILY CRUCIFERAE

Lepidium virginicum

PEPPERGRASS

Frequent in old fields, fence rows, and unmowed roadsides.

(I) *Lepidium densiflorum*

Rare, found only in a hog pen 10 meters north of the house on the former Meyer farm.

(I) *Capsella bursa-pastoris*

SHEPHERD PURSE

Frequent in old fields, fence rows, pathways, roadsides, unshaded picnic areas, and other disturbed, unshaded areas.

(I) *Sisymbrium officinale* var. *leiocarpum*

SMOOTH-POD HEDGE MUSTARD

Frequent in old fields, fence rows, and other open, unmowed sites.

Descurainia pinnata var. *brachycarpa*(D. *brachycarpa*)

"In alfalfa field, edge of woodland, Shades," April 28, 1945, collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

Rorippa islandica var. *fernaldiana*(R. *palustris* var. *glabrata*)

YELLOW WATERCRESS

Infrequent to frequent in cultivated fields, old fields, fence rows, and unmowed roadsides; rare in low ground around the artificial ponds.

(I) *Nasturtium officinale*

WATERCRESS

Rare in moist, unshaded soil adjacent to streams in ravine heads. The largest colony was found in Kickapoo Ravine, 200 meters south of Trail 7.

Iodanthus pinnatifidus

PURPLE ROCKET

Rare in ravine bottoms, on stream terraces, and flood plains. The most luxuriant colony was found on Trail 1 along Little Ranty Run near the mouth of Raccoon Hollow.

Dentaria laciniata

CUT-LEAVED TOOTHWORT

Infrequent on shaded ravine banks; rare in the upland forests.

Cardamine bulbosa

BULB BITTERCRESS

Infrequent on shaded ravine banks; rare in the upland forests.

Cardamine douglassii

NORTHERN BITTERCRESS

Infrequent on shaded ravine banks and in the upland forests.

Arabis laevigata

SMOOTH ROCKCRESS

Infrequent on shaded ravine banks and cliff ledges.

FAMILY CRASSULACEAE

Sedum ternatum

MOUNTAIN STONECROP

Rare in hemlock stands and broad-leaved forests near cliff edges and on rocky slopes.

FAMILY SAXIFRAGACEAE

Penthorum sedoides

DITCH STONECROP

Rare on moist soil in ravine bottoms and on the flood plain of Sugar Creek.

Heuchera americana var. *interior*

ALUM ROOT

Frequent on cliff ledges and rocky slopes.

Heuchera richardsonii var. *affinis*

ALUM ROOT

"Pine Hills," June 20, 1927, collected by A. R. Bechtel and C. Klinger. Specimen deposited in the Wabash College Herbarium.

Mitella diphylla

BISHOP'S-CAP

Frequent on shaded ravine banks, rocky slopes, and cliff ledges; infrequent to rare on protected sites in the upland forests.

Mitella diphylla forma *oppositifolia* (not listed in Deam, 1940)

Rare on shaded ravine banks, rocky slopes, cliff ledges, and in the upland forests.

Parnassia glauca

GRASS-OF-PARNASSUS

"Limestone ledge along Indian Creek, first dirt road west of Shades," September 30, 1959, collected by E. Davidson. Specimen deposited in the Wabash College Herbarium. (The locality description is confused. Indian Creek is east of the

Shades. The collection was probably made on Rass Clore Branch in the southwestern section of the Survey Area.)

(P) *Philadelphus* sp.

MOCK ORANGE

Planted on the south side of the Shades pavilion.

Hydrangea arborescens

SMOOTH HYDRANGEA

Frequent in ravines; infrequent on exposed cliff edges, in forest borders, on stream terraces, and flood plains; rare in the upland forests.

Hydrangea arborescens var. *deamii*

Rare, found only on the cliff edge at Lovers' Leap near Trail 2.

Ribes cynosbati (*Grossularia cynosbati*)

PRICKLY GOOSEBERRY

Infrequent on cliff edges, ravine banks, flood plains, stream terraces, and in open woodlands.

Ribes cynosbati forma *inermis* (not listed in Deam, 1940)

SPINELESS GOOSEBERRY

Rare, found only on a shale bank above Sugar Creek 30 meters east of Shawnee Ravine on Trail 7. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

FAMILY HAMAMELIDACEAE

Hamamelis virginiana

AMERICAN WITCH-HAZEL

Infrequent on cliff edges, flood plains, stream terraces, in hemlock stands, and upland forests.

FAMILY PLATANACEAE

Platanus occidentalis

AMERICAN SYCAMORE

Frequent on the flood plains and sand bars of Sugar, Indian, and Clifty creeks, in ravine mouths, and on old fields in uplands and lowlands; infrequent to rare in ravine bottoms. The interior portions of Canoe Island, the largest island in Sugar Creek, were cultivated until about 1920 and now support a dense sycamore forest.

FAMILY ROSACEAE

Physocarpus opulifolius

COMMON NINEBARK

Infrequent on stream terraces and flood plains; rare on cliff edges above Sugar Creek.

(P) *Spiraea tomentosa*

HARDHACK

A single planted specimen is located in the lawn of Shades Inn opposite Raccoon Hollow.

(P) *Spiraea japonica*

JAPANESE SPIRAEA

Several specimens are planted in the lawn of Shades Inn and along the roadway south of the Inn.

(I) *Pyrus malus* (*Malus pumila*)

APPLE

Rare, a volunteer tree was found in Kickapoo Ravine, 200 meters south of Trail 7.

Pyrus coronaria (*Malus coronaria*)

WILD CRAB

Rare in upland forest borders.

Amelanchier canadensis

DOWNY SHADBUSH

Reported from a slope forest in the Pine Hills Natural Area by Friesner and Potzger (1934), but not vouchered by a herbarium specimen.

Fragaria virginiana

VIRGINIA STRAWBERRY

Infrequent in old fields, pastures, roadsides, and forest openings.

Fragaria virginiana var. *illinoensis*

LARGE VIRGINIA STRAWBERRY

Rare, found only along the entrance road to Shades State Park, opposite the former C.C.C. camp.

(I) *Fragaria vesca*

ALPINE STRAWBERRY

Deam (1940, p. 564) reported that this species grew "on a wooded sandstone bluff of Sugar Creek in the 'Shades.' "

(I) *Potentilla recta*

Frequent in old fields and fence rows.

Potentilla norvegica (*P. monspeliensis*)

ROUGH CINQUEFOIL

Frequent in old fields and fence rows.

Potentilla simplex

COMMON CINQUEFOIL

Frequent in old fields, fence rows, and open woodlands.

Geum canadense

WHITE AVENS

Infrequent on shaded ravine banks; rare in moist sites in the upland forests.

Geum virginianum

ROUGH AVENS

Infrequent in open woodlands.

Geum laciniatum

NORTHERN ROUGH AVENS

Frequent in open woodlands and forest borders.

Geum vernum

SPRING AVENS

Rare on shaded ravine banks.

Rubus occidentalis

COMMON BLACKCAP RASPBERRY

Frequent in old fields, fence rows, and forest borders; infrequent on stream terraces and flood plains.

Rubus flagellaris

NORTHERN DEWBERRY

Rare, found only in the gravel pit near Trail 7 at Sandy Beach.

Rubus allegheniensis

ALLEGHENY BLACKBERRY

Frequent in old fields, fence rows, and forest borders; infrequent on stream terraces and flood plains.

Rubus frondosus

Rare in forest borders.

Agrimonia rostellata

"Dry wooded plateau, Pine Hills," July 11, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Agrimonia parviflora

SMALL-FLOWERED AGRIMONY

Rare, found only in Kickapoo Ravine, 200 meters south of Trail 7.

Agrimonia pubescens

HAIRY AGRIMONY

Infrequent in shaded, unmowed roadsides and forest borders.

Rosa setigera var. **tomentosa**

PRAIRIE ROSE

Frequent in fence rows, roadside thickets, and forest borders.

Rosa palustris

SWAMP ROSE

Infrequent in old fields, fence rows, and unshaded, moist sites in ravine heads.

Rosa carolina

PASTURE ROSE

Rare on cliff edges above Sugar Creek.

(P) **Rosa multiflora** (not listed in Deam, 1940)

MULTIFLORA ROSE

Planted in field borders and roadsides at various places around the State Park.

Prunus americana

AMERICAN PLUM

Reported by Friesner and Potzger (1934) in a flood-plain forest in the Pine Hills Natural Area, but not vouchered by a herbarium specimen.

(I) **Prunus persica**

PEACH

A volunteer tree was found along the truck trail adjacent to the site of the present airstrip.

Prunus serotina

BLACK CHERRY

Frequent in fence rows, forest borders, old fields, and second-growth woodlands; infrequent in the upland forests and on stream terraces.

FAMILY LEGUMINOSAE

Gymnocladus dioica

KENTUCKY COFFEE TREE

Infrequent on flood plains and in ravine bottoms. The largest single group of trees was found on Trail 6.

Gleditsia triacanthos

HONEY LOCUST

Frequent on flood plains; infrequent in old fields, fence rows, and forest borders.

Cassia hebecarpa

WILD SENNA

Rare in old fields and forest borders.

Cercis canadensis

REDBUD

Frequent in forest borders and openings; infrequent in the upland forest, on stream terraces, flood plains, and old fields.

(I) *Crotalaria sagittalis***RATTLEBOX**

Rare, found only in a red pine plantation on the former Dryer farm where it may have been planted by the C.C.C.

(P-E) *Trifolium pratense***RED CLOVER**

Frequent in fence rows and old fields.

**(P-E) *Trifolium pratense* forma *leucochraceum*
(not listed in Deam, 1940)**

Rare in fence rows and old fields. This form was added to the state flora as a result of the present study (State Flora Committee, 1951).

(I) *Trifolium repens***WHITE CLOVER**

Frequent in old fields, lawns, fence rows, and roadsides.

(I) *Trifolium hybridum* var. *elegans* (*T. hybridum*)**ALSIKE CLOVER**

Frequent in old fields, fence rows, and roadsides.

(I) *Trifolium procumbens***LOW HOP CLOVER**

Frequent in old fields, lawns, and roadsides.

(P-E) *Melilotus officinalis***YELLOW SWEET CLOVER**

Frequent in old fields, fence rows, and roadsides; rare on the flood plains of Sugar, Indian, and Clifty creeks.

(P-E) *Melilotus alba***WHITE SWEET CLOVER**

Frequent in old fields, fence rows, and roadsides; rare on the flood plains of Sugar, Indian, and Clifty creeks.

(P-E) *Medicago sativa***ALFALFA**

Frequent in fence rows and unmowed roadsides.

(I) *Medicago lupulina***BLACK MEDIC**

Infrequent in old fields, lawns, eroded soil on roadsides, and around building foundations.

Robinia pseudo-acacia**BLACK LOCUST**

Frequent in old fields, forest borders, and fence rows. Plantations have also been made at several sites in the Survey Area.

Desmodium nudiflorum**NAKED-FLOWERED TICKCLOVER**

Frequent in open forests and forest borders.

Desmodium nudiflorum* forma *foliolatum

Rare, found only on the dry clay flat above Steamboat Rock on Trail 2. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Desmodium nudiflorum* forma *personatum

Rare in forest borders and field edges. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Desmodium glutinosum* (*D. acuminatum*)*POINTED-LEAF TICKCLOVER**

Frequent in open woodlands, forest borders, and fence rows.

***Desmodium glutinosum* forma *chandonnetii*
(*D. acuminatum* forma *chandonnetii*)**

Infrequent to rare in ravine bottoms and open woodlands. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Desmodium pauciflorum**FEW-FLOWERED TICKCLOVER**

Rare, only one large colony was found in the ravine on the west side of Pedestal Rock, about 0.6 kilometer north of the Fountain County line.

Desmodium rotundifolium**FEW-FLOWERED TICKCLOVER**

Rare, found only in an eroded pasture 200 meters south-southwest of the Sims house site.

Desmodium canescens**HOARY TICKCLOVER**

Rare in open woodlands and shaded roadsides.

Desmodium canadense**CANADA TICKCLOVER**

Rare in old fields and fence rows.

***Desmodium cuspidatum* var. *longifolium*
(*D. bracteosum* var. *longifolium*)****LARGE-BRACT TICKCLOVER**

Infrequent in open woodlands and forest borders.

***Desmodium perplexum* (*D. dillenii*)**

Infrequent in open woodlands, forest borders, and old fields.

Lespedeza violacea

"Dry clay banks of Turkey Backbone, Pine Hills," September 5, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Lespedeza intermedia**WAND-LIKE BUSH CLOVER**

"Wooded bluff, north side of Shades," October 3, 1941, collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

(I) Lespedeza cuneata (not listed in Deam, 1940)

Rare, found only in an old field about 100 meters east of the C.C.C. pond on the former Dryer farm. This species has been introduced to the state within the past 15 years, probably as a soil-improving cover crop. However, its immediate source is unknown to local residents (McCormick, 1952). The species was added to the state flora as a result of the present study (State Flora Committee, 1952).

(I) Lespedeza stipulacea**KOREAN LESPEDEZA**

Frequent in abandoned fields.

Amphicarpa bracteata**HOG PEANUT**

Rare in shaded ravine bottoms.

Amphicarpa bracteata var. *comosa*

Infrequent in open woodland, forest borders, shaded roadsides, and fence rows.

FAMILY LINACEAE**Linum medium** var. *texanum*

Infrequent in old fields and fence rows.

Linum virginianum

Infrequent in open woodland, old fields, fence rows, and eroded road cuts.

FAMILY OXALIDACEAE**Oxalis violacea****VIOLET WOOD SORREL**

Infrequent in moist forests.

Oxalis violacea var. *trichophora*

Infrequent on the flood plains of Sugar, Indian, and Clifty creeks.

Oxalis stricta**YELLOW WOOD SORREL**

Frequent in barnyards, old fields, fence rows, roadsides, and forest borders.

Oxalis europaea**LADY'S SORREL**

Frequent in fence rows, old fields, roadsides, and forest borders.

Oxalis europaea forma *cymosa*

Infrequent in old fields, fence rows, roadsides, and forest borders.

Oxalis europaea forma *villicaulis*

Infrequent in old fields, fence rows, and forest borders.

Oxalis europaea var. *bushii* forma *subglabrata*

Infrequent in old fields, roadsides, fence rows, and disturbed areas around buildings.

FAMILY GERANIACEAE**Geranium maculatum****CRANES BILL**

Frequent on moist ravine banks and in protected sites in the upland and lowland forests.

FAMILY RUTACEAE**Xanthoxylum americanum** (*Zanthoxylum americanum*)**NORTHERN PRICKLY ASH**

Rare in open second-growth woodlands and forest borders.

Ptelea trifoliata**COMMON HOPTREE, WAFER ASH**

Infrequent in ravine bottoms, on flood plains, and on north-facing slopes.

FAMILY POLYGALACEAE**Polygala senega** var. *latifolia***WHITE SENEGA SNAKEROOT**

"Wooded first terrace near Pine Grove, Pine Hills," June 13, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Polygala sanguinea**MILKWORT**

Infrequent in old fields and fence rows.

FAMILY EUPHORBIACEAE**Acalypha rhomboidea****THREE-SEEDED MERCURY**

Infrequent in old fields and fence rows.

Euphorbia dentata

Infrequent in old fields and roadsides.

Euphorbia commutata

"Low first terrace woods, Pine Hills," June 2, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

(I) Euphorbia marginata**SNOW-ON-THE-MOUNTAIN**

Rare, but usually in large colonies, in roadside ditches, fence rows, waste places, and neglected garden plots.

Euphorbia corollata**FLOWERING SPURGE**

Infrequent to rare on dry clay or shale ridges and banks in partial shade or full sunlight.

Euphorbia supina

Frequent in farmyards and old fields.

Euphorbia maculata**BLACK SPURGE**

Infrequent to rare in moist areas around the ponds and larger streams.

FAMILY LIMNANTHACEAE**Floerkea proserpinacoides****FALSE MERMAID**

Rare on shaded ravine slopes and in protected places throughout the upland forests.

FAMILY ANACARDIACEAE**Rhus typhina****STAGHORN SUMAC**

Frequent, in large colonies, in fence rows, old fields, and forest borders.

Rhus glabra**SMOOTH SUMAC**

Infrequent in old fields and fence rows.

Rhus radicans**POISON IVY**

Frequent on flood plains, stream terraces, in forest borders, fence rows, and old fields; infrequent in the upland forests.

FAMILY CELASTRACEAE**Euonymus atropurpureus** (*Evonymus atropurpureus*)**WAHOO**

Rare on the flood plains of the larger streams.

Euonymus obovatus (*Evonymus obovatus*)**RUNNING WAHOO**

Frequent on the flood plains and terraces of Sugar, Indian, and Clifty creeks; infrequent in the upland forests.

Celastrus scandens**BITTERSWEET**

Infrequent on exposed cliff edges, flood plains, in forest borders, and old fields; rare in the upland forests.

FAMILY STAPHYLEACEAE**Staphylea trifolia****AMERICAN BLADDERNUT**

Infrequent in ravines and on the flood plain of Sugar Creek.

FAMILY ACERACEAE**Acer saccharum****SUGAR MAPLE**

Frequent in the upland forests, on stream terraces, flood plains, and old fields.

Acer nigrum**BLACK MAPLE**

Infrequent on stream terraces, flood plains, and in the upland forests.

Acer rubrum**RED MAPLE**

Frequent on stream terraces and flood plains; infrequent to rare in the upland forests.

Acer rubrum forma tomentosum (not listed in Deam, 1940)

Rare on ridges between ravines and in second-growth woodlands. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Acer saccharinum**SILVER MAPLE**

Frequent on stream terraces and flood plains.

Acer negundo**BOX ELDER**

Frequent on the flood plains of the larger streams; infrequent in moist upland sites and old fields.

FAMILY HIPPOCASTANACEAE**Aesculus glabra****OHIO BUCKEYE**

Infrequent on stream terraces and flood plains; rare in the upland forests.

FAMILY BALSAMINACEA

Impatiens pallida

PALE TOUCH-ME-NOT, SNAPWEED

Frequent in ravine bottoms and on flood plains; rare in moist areas in the uplands.

Impatiens capensis (*I. biflora*)

SPOTTED TOUCH-ME-NOT

Frequent to infrequent in moist areas in the uplands; rare in ravines and on flood plains.

FAMILY VITACEAE

Parthenocissus quinquefolia

VIRGINIA CREEPER

Frequent throughout the upland and lowland forests, in forest borders, and open second-growth woodlands; infrequent in fence rows.

Vitis aestivalis

SUMMER GRAPE

Frequent in forest borders and forest openings; infrequent in upland and lowland forests.

Vitis vulpina

FROST GRAPE

Infrequent in lowland forests and on moist sites in the upland forests.

FAMILY TILIACEAE

Tilia americana

AMERICAN LINDEN, BASSWOOD

Frequent on stream terraces and flood plains; infrequent in the upland forests and ravines.

FAMILY MALVACEAE

(I) *Malva neglecta*

Infrequent in old fields, fence rows, and farmyards.

Sida spinosa

PRICKLY SIDA

Infrequent in old fields.

(I) *Abutilon theophrasti*

VELVET-LEAF

Frequent in cultivated fields and old fields.

(P) *Hibiscus syriacus*

ROSE OF SHARON

Persisting in ornamental plantings in the lawns south and northeast of Shades Inn.

(I) *Hibiscus trionum*

FLOWER-OF-AN-HOUR

Frequent in cultivated fields; infrequent in fence rows and old fields.

FAMILY GUTTIFERAE

(I) *Hypericum perforatum*

COMMON ST. JOHN'S-WORT

Infrequent in fence rows and old fields.

Hypericum punctatum

Infrequent in fence rows, old fields, forest borders, and on exposed sites on flood plains.

Hypericum mutilum

Infrequent in fence rows, fields, and open woodlands.

FAMILY VIOLACEAE

Hybanthus concolor

GREEN VIOLET

Infrequent on flood plains and stream terraces.

Viola cucullata

MARSH BLUE VIOLET

"In mossy bank, Shawnee Canyon [Trail 7], Shades," May 14, 1952, A. R. Bechtel and W. M. Laetsch. Specimen deposited in the Wabash College Herbarium.

Viola papilionacea

BUTTERFLY VIOLET

Infrequent in old fields and open woodlands.

Viola sororia

DOWNY BLUE VIOLET

Infrequent in ravines and old fields.

Viola triloba

THREE-LOBED VIOLET

Infrequent on shaded ravine banks.

Viola pensylvanica (*V. eriocarpa*)

STEMMED YELLOW VIOLET

Infrequent on ravine banks, stream terraces, and in the upland forests.

Viola pensylvanica var. *leiocarpa* (*V. eriocarpa* forma *leiocarpa*)

Infrequent in the upland forests and in ravines.

Viola striata

CREAM VIOLET

Infrequent on ravine banks, stream terraces, and in the upland forests.

Viola kitaibeliana var. *rafinesquii*

FIELD PANSY

"Dry open weedy pasture, 100 meters northeast of [the C.C.C.] pond [on the former Dryer farm],

near [the Montgomery-Parke] county line, north of gravel road running west from Shades," May 2, 1949, collected by D. B. Ward. Specimen deposited in the Wabash College Herbarium.

FAMILY THYMELAEACEAE

Dirca palustris

LEATHERWOOD

Infrequent on the flood plains and terraces of the larger streams and in ravine bottoms.

FAMILY NYSSACEAE

Nyssa sylvatica* var. *caroliniana

BLACK GUM, TUPELO

Infrequent in the upland forests, forest borders, and on stream terraces and flood plains.

FAMILY ONAGRACEAE

Epilobium coloratum

WILLOW-HERB

Infrequent to rare on the flood plain of Sugar Creek and in moist soil in upland areas.

Oenothera biennis* var. *pycnocarpa

(*O. pycnocarpa*)

EVENING PRIMROSE

Frequent in fence rows and old fields.

Oenothera perennis

"Woodsy field, east of the balanced [Pedestal] rock, north side of Shades," June 9, 1947, collected by A. R. Bechtel and determined by D. B. Wood. Specimen deposited in the Wabash College Herbarium.

Circaea quadrisulcata* var. *canadensis

(*C. latifolia*)

ENCHANTERS' NIGHTSHADE

Frequent in forest borders, forest openings, and in open woodlands.

FAMILY ARALIACEAE

(P) *Aralia spinosa*

HERCULES' CLUB, PRICKLY ASH

A small colony, apparently planted, is located in the fence row west of Shades Inn.

Aralia racemosa

AMERICAN SPIKENARD

Infrequent on ravine banks and moist cliffs.

Panax quinquefolius

AMERICAN GINSENG

Rare in open woodlands and forest borders.

FAMILY UMBELLIFERAE

Sanicula canadensis

BLACK SNAKEROOT

Frequent on stream terraces and flood plains, in shaded sites on the banks of the J. W. Frisz Memorial Lagoon, and in forest borders.

Chaerophyllum procumbens

CHERVIL

Infrequent on stream terraces, flood plains, and in ravines.

Osmorhiza claytoni

SWEET CICELY

Frequent, in large colonies, in the upland forests, in ravines, on stream terraces, and flood plains.

Erigenia bulbosa

HARBINGER-OF-SPRING

Infrequent, but in large colonies, in the upland forest and on ravine banks.

Circuta maculata

WATER HEMLOCK

Infrequent on the flood plain of Sugar Creek.

Cryptotaenia canadensis

HONEWORT

Infrequent in open woodlands and ravines.

Taenida integerrima

YELLOW PIMPERNEL

Rare, found only on the eroded crest of Turkey Backbone, Pine Hills Natural Area.

Thaspium barbinode

Infrequent on ravine banks, cliff edges, stream terraces, flood plains, and in forest borders.

(I) *Pastinaca sativa*

PARSNIP

Infrequent in fence rows, old fields, and forest borders.

(I) *Daucus carota*

QUEEN ANNE'S LACE

Frequent in fence rows and old fields.

(I) *Daucus carota* forma *roseus* (*D. c.* forma *rosea*)

Rare in fence rows and old fields. This form was added to the state flora as a result of the present study (State Flora Committee, 1951).

FAMILY CORNACEAE

Cornus florida

FLOWERING DOGWOOD

Frequent in the upland forest, forest borders, on stream terraces and old fields.

Cornus rugosa

ROUNDLEAF DOGWOOD

"Wooded slope, Pine Hills," June 2, 1931; "Wooded ravine, Pine Hills," June 27, 1931; and "Dry clay bank, Mill Cut Backbone, Pine Hills," May 14, 1932, collected by R. C. Friesner. Specimens deposited in the Friesner Memorial Herbarium, Butler University. This species, in its station at Pine Hills, was cited by Friesner (1937) as a boreal disjunct.

Cornus drummondii (*C. asperifolia*)

ROUGHLEAF DOGWOOD

Infrequent on stream terraces, flood plains, open woodlands, and forest borders.

Cornus obliqua

PALE DOGWOOD

Infrequent in open woodlands, near forest borders, and on the flood plain of Sugar Creek.

Cornus racemosa

GRAY DOGWOOD

Infrequent in forest borders and on exposed cliffs.

Cornus alternifolia

GREEN OSIER

Infrequent on stream terraces, flood plains, in ravines, open woodlands, and forest borders.

FAMILY PYROLACEAE

Chimaphila maculata

STRIPED PIPSISSEWA

Infrequent to rare in the upland forests and on stream terraces.

Monotropa uniflora

INDIAN PIPE

Infrequent in the upland forests, hemlock stands, and on ravine banks.

FAMILY ERICACEAE

Gaultheria procumbens

WINTERGREEN, TEABERRY

Rare, known only in a single colony on the south-facing slope of Mill Cut Backbone in the Pine Hills Natural Area. Coulter (1900, p. 869) notes that W. S. Blatchley had collected the

species "on the 'Devil's Back-Bone' at Pine Hills." This is apparently the first record of the plant in the area and, if the location cited is correct, represents an extinct station. The species was considered to be a glacial disjunct at its Pine Hills station by Friesner (1937).

Gaylussacia baccata

BLACK HUCKLEBERRY

Rare on exposed cliff edges above Sugar Creek.

Vaccinium vacillans

LOWBUSH BLUEBERRY

Reported by Friesner and Potzger (1934) as infrequent in a second terrace beech-maple forest in the Pine Hills Natural Area, but not vouchered by herbarium specimens.

Vaccinium corymbosum var. *glabrum*

This species was collected in fruit on July 23, 1911, from the Devil's Backbone in the Pine Hills Natural Area by E. J. Grimes, who identified it as *V. c.* var. *amoenum* (*V. c.* var. *albiflorum*). Grimes (1911) reported that only a single plant, about 1 meter tall, was found on a dry ledge where it grew in association with *Tsuga canadensis*. Deam (1940, p. 743) examined Grimes's specimen in the DePauw University Herbarium and referred it to *Vaccinium corymbosum* var. *pallidum* (*V. c.* var. *glabrum*). The species apparently is extinct at this station.

FAMILY PRIMULACEAE

Dodecatheon meadia

SHOOTING-STAR

Infrequent on the backbones and near cliff edges in the Pine Hills Natural Area.

(1) *Lysimachia nummularia*

MONEYWORT

Infrequent along stream margins.

Lysimachia ciliata

FRINGED LOOSESTRIFE

Infrequent in moist soil along streams and on the banks of the J. W. Frisz Memorial Lagoon.

Lysimachia lanceolata

Infrequent in forest borders and open woodlands.

Samolus parviflorus (*S. pauciflorus*)

WATER PIMPERNEL

Infrequent along stream margins.

FAMILY EBENACEAE

Diospyros virginiana var. *pubescens* (not listed in Deam, 1940)

PERSIMMON

Rare in forest borders and fence rows. This variety was added to the state flora as a result of the present study (State Flora Committee, 1952).

FAMILY OLEACEAE

Fraxinus americana

WHITE ASH

Frequent on flood plains and islands; infrequent in the upland forests, forest borders, fence rows, and old fields.

Fraxinus pennsylvanica var. *subintegerrima* (*F. lanceolata*)

GREEN ASH

Reported by Friesner and Potzger (1934) as infrequent in the upland forests, on stream terraces, and flood plains in the Pine Hills Natural Area, but not vouchered by herbarium specimens.

Fraxinus quadrangulata

BLUE ASH

Infrequent on stream terraces and flood plains; rare in the upland forests.

Fraxinus nigra

BLACK ASH

Infrequent to rare in the upland forests, in ravines, and on flood plains.

(P) *Syringa vulgaris*

LILAC

Specimen plantings are persisting near old house sites at several locations in the Survey Area.

FAMILY GENTIANACEAE

Gentiana quinquefolia var. *occidentalis*

AGUE-WEED

"North approach to Devil's Backbone, Pine Hills," October 15, 1930; and "Pine Tree Backbone, Pine Hills," September 21, 1928, collected by A. R. Bechtel. Specimens deposited in the Wabash College Herbarium.

Gentiana andrewsii

CLOSED GENTIAN

Infrequent on stream terraces and flood plains.

FAMILY APOCYNACEAE

(I) *Vinca minor*

COMMON PERIWINKLE

Rare, found only on a ravine bank near the northwest boundary of the Survey Area.

Apocynum cannabinum

HEMP DOGBANE

Infrequent in old fields, fence rows, roadsides, and on stream gravel bars.

Apocynum cannabinum var. *glaberrimum*

Rare in old fields, fence rows, and open lowland forests.

FAMILY ASCLEPIADACEAE

Asclepias tuberosa

BUTTERFLY WEED

Infrequent to rare in old fields, roadsides, and on exposed shale banks.

Asclepias incarnata

SWAMP MILKWEED

Infrequent in moist soil on the banks of the J. W. Frisz Memorial Lagoon and on stream banks.

Asclepias exaltata (*A. phytolaccoides*)

POKE MILKWEED

Rare in moist ravine bottoms.

Asclepias syriaca

COMMON MILKWEED

Frequent in fence rows, old fields, and roadsides.

Asclepias syriaca forma *leucantha* (not listed in Deam, 1940)

Rare in fence rows, old fields, and roadsides. This form was added to the state flora as a result of the present study (State Flora Committee, 1951).

Asclepias verticillata

HORSETAIL MILKWEED

Infrequent in fence rows and old fields.

FAMILY CONVULVULACEAE

(I) *Ipomoea hederacea*

IVY-LEAF MORNING-GLORY

Infrequent in cultivated fields, fence rows, and old fields.

(I) *Ipomoea purpurea*

COMMON MORNING-GLORY

Infrequent in fence rows and old fields.

Convolvulus spithameus**DWARF MORNING-GLORY**

"Dry clay ridge top, upper limits of Turkey Backbone, Pine Hills," June 2, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Convolvulus sepium var. **fraternifolius**

Rare, found only on a fence near the former C.C.C. camp.

Cuscuta cephalanthi**DODDER**

Infrequent on various herbaceous plants on the flood plain of Sugar Creek.

Cuscuta pentagona**DODDER**

Rare on *Boehmeria cylindrica* along stream margins.

Cuscuta gronovii**DODDER**

Infrequent on *Justicia americana* along the margins of Sugar Creek.

FAMILY POLEMONIACEAE**Polemonium reptans****JACOB'S LADDER**

Infrequent on flood plains.

Phlox divaricata**BLUE PHLOX**

Infrequent on ravine banks, stream terraces, and flood plains.

Phlox divaricata forma **albiflora** (not listed in Deam, 1940)

"West bank of Indian Creek, Pine Hills," May 1, 1953, collected by W. M. Laetsch; and "Thick level woods along south bank of Sugar Creek west of Shades, Montgomery County," May 2, 1949, collected by D. B. Ward. Specimens deposited in the Wabash College Herbarium.

Phlox paniculata**GARDEN PHLOX**

Infrequent in old fields, fence rows, and roadsides.

FAMILY HYDROPHYLLACEAE**Hydrophyllum canadense****BROADLEAF WATERLEAF**

Infrequent on stream terraces, flood plains, and in ravines.

Hydrophyllum appendiculatum**APPENDAGED WATERLEAF**

Infrequent on stream terraces, flood plains, and ravine banks; rare in protected sites in the upland forests.

Phacelia bipinnatifida

Rare on ravine banks and stream terraces in the Pine Hills Natural Area.

FAMILY BORAGINACEAE**Mertensia virginica****VIRGINIA BLUEBELL**

Infrequent in the lowland forests, on stream terraces, and flood plains in the Pine Hills Natural Area.

Hackelia virginiana**STICKSEED**

Infrequent in open woodlands, forest borders, and on flood plains.

FAMILY VERBENACEAE**Verbena urticifolia****WHITE VERVAIN**

Infrequent in old fields, fence rows, and in exposed sites on flood plains.

Verbena hastata**BLUE VERVAIN**

Infrequent in cultivated fields, fence rows, and old fields.

Verbena stricta**HOARY VERVAIN**

Infrequent in old fields and fence rows.

Lippia lanceolata var. **recognita** (*Phyla lanceolata*)

Infrequent on flood plains and gravel bars of Sugar, Indian, and Clifty creeks.

FAMILY LABIATAE**Teucrium canadense****AMERICAN GERMANDER**

Infrequent to rare in fence rows, old fields, and on flood plains.

Teucrium canadense var. **virginicum**

Infrequent in fence rows, old fields, on exposed cliff faces, on the banks of the J. W. Frisz Memorial Lagoon, and the flood plains of the larger streams.

Scutellaria ovata var. **versicolor** (*S. ovata*)

SKULLCAP

Rare in open woodland.

Scutellaria incana

SKULLCAP

Infrequent in fence rows, roadsides, open woodlands, and on the banks of the J. W. Frisz Memorial Lagoon.

Scutellaria lateriflora

MAD-DOG SKULLCAP

Infrequent on ravine slopes, in moist sites in the upland forests, and on the banks of the J. W. Frisz Memorial Lagoon.

Agastache nepetoides

GIANT HYSSOP

Rare in forest borders and open woodlands.

(I) **Nepeta cataria**

CATNIP

Infrequent in fence rows, old fields, and lawns.

(I) **Glechoma hederacea** var. **micrantha**
(*G. h.* var. *parviflora*)

SMALL-FLOWERED GROUND-IVY

Infrequent on stream terraces, flood plains, and in lawns.

Prunella vulgaris var. **lanceolata**

AMERICAN SELF-HEAL

Frequent in fence rows, around building foundations, on roadsides, in lawns, old fields, picnic areas, and similar habitats.

Prunella vulgaris var. **lanceolata** forma
candida (not listed in Deam, 1940)

Rare, found only in the lawn south of the Shades Inn. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Physostegia virginiana

VIRGINIA FALSE-DRAGONHEAD

Rare in fence rows and on exposed cliff edges.

(I) **Leonurus cardiaca**

MOTHERWORT

Rare, but in large colonies, in fence rows and around building foundations.

(I) **Lamium purpureum**

PURPLE DEADNETTLE

"On low bank of Sugar Creek, the Shades," April 28, 1945, collected by A. R. Bechtel. Speci-

men deposited in the Wabash College Herbarium.

Stachys tenuifolia

HEDGE NETTLE

Rare, found only near the base of a chinquapin oak 20 meters east of Shades Inn. This station was destroyed when the area was paved for parking.

(P) **Monarda didyma**

OSWEGO BEEBALM

Persisting in an old garden plot southwest of Shades Inn.

Monarda fistulosa

WILD BERGAMOT

Rare, but in large colonies, in moist, unshaded sites and on exposed cliff faces.

Monarda fistulosa var. **mollis**

Rare, found only on an exposed shale bank above Steamboat Rock, Trail 2.

Blephilia hirsuta

Infrequent on stream terraces, flood plains, and in moist ravine bottoms.

Hedeoma pulegioides

AMERICAN PENNYROYAL

Frequent in fence rows, old fields, forest borders, and open woodlands.

Lycopus virginicus

BUGLEWEED

Rare, found only on the bank at the southeast side of the J. W. Frisz Memorial Lagoon.

Lycopus americanus

AMERICAN BUGLEWEED

Infrequent in open woodlands and forest borders.

Lycopus rubellus

Rare, found only on the bank at the southwest side of the J. W. Frisz Memorial Lagoon.

Mentha arvensis var. **villosa** (not listed
in Deam, 1940)

"Gravel bar in Indian Creek, Pine Hills," August 1, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Mentha arvensis var. **villosa** forma **glabrata**
(not listed in Deam, 1940)

Rare, found only in Kickapoo Ravine, about 200 meters south of Trail 7.

Collinsonia canadensis**HORSEBALM**

Infrequent, but in large colonies, in moist ravine bottoms, open upland and lowland forests, and forest borders.

(P-E) Perilla frutescens var. crispa**KOLI**

Rare, found only in fields near the site of the house on the former Sims farm, but there it is common. The species apparently was planted around the foundation of the house and has become established as a weed.

FAMILY SOLANACEAE**Solanum dulcamara****BITTER NIGHTSHADE**

Infrequent in openings in the upland forests, forest borders, and fence rows.

Solanum nigrum**COMMON NIGHTSHADE**

Infrequent in fence rows and old fields.

Solanum carolinense**HORSE NETTLE**

Infrequent in cultivated fields, old fields, and roadsides.

Solanum carolinense forma albiflorum (not listed in Deam, 1940)

Infrequent to rare in cultivated fields, old fields, and roadsides. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Physalis subglabrata**SMOOTH GROUNDCHERRY**

Infrequent in cultivated fields, old fields, roadsides, and upland forest borders.

Physalis heterophylla

Infrequent in cultivated fields, old fields, and roadsides.

(I) Nicandra physalodes**APPLE-OF-PERU**

A common weed in cultivated fields and fence rows on the former Sims farm, but rare elsewhere in the Survey Area.

(I) Datura stramonium**JIMSONWEED**

Frequent in cultivated fields, old fields, and fence rows.

(I) Datura stramonium var. tatula (not listed in Deam, 1940)

Infrequent to rare in cultivated fields, old fields, and fence rows.

FAMILY SCROPHULARIACEAE**(I) Verbascum thapsus****GREAT MULLEIN**

Frequent in old fields, pastures, roadsides, refuse dumps, and shale talus.

(I) Verbascum blattaria**MOTH MULLEIN**

Infrequent in old fields, pastures, roadsides, and open woodlands.

(I) Verbascum blattaria forma albiflora

Rare in old fields, pastures, roadsides, and open woodlands.

Scrophularia marilandica**FIGWORT**

Infrequent in upland forest borders, open woodlands, and forest openings.

Penstemon digitalis**FOXGLOVE PENSTEMON**

Infrequent, but in large colonies, in old fields.

Penstemon hirsutus**BEARD-TONGUE**

Frequent on cliff edges.

Mimulus alatus**MONKEY-FLOWER**

Infrequent on moist soil around the artificial ponds and in forest openings.

Gratiola neglecta

Rare, found only on a mud bank in the artificial pond at the former C.C.C. camp.

Gratiola virginiana

Rare, found only in the south end of the C.C.C. pond on the former Dryer farm.

Lindernia dubia

Rare, found only on exposed mud flats in the J. W. Frisz Memorial Lagoon and in a fence row on the former Sims farm.

Lindernia anagallidea

Rare, found only on exposed mud flats in the J. W. Frisz Memorial Lagoon.

(I) *Veronica serpyllifolia*

THYME-LEAVED SPEEDWELL

Frequent in old fields and pastures.

(I) *Veronica officinalis*

COMMON SPEEDWELL

Rare, found only in a red pine plantation of the former Dryer farm.

Seymeria macrophylla (*Dasistoma macrophylla*)

FALSE FOXGLOVE

Infrequent to rare on exposed shale banks and in forest openings.

Gerardia tenuifolia

Infrequent to rare in moist ground in ravine heads and on cliff edges.

Gerardia flava var. *macrantha* (*Aureolaria flava* var. *macrantha*)

SMOOTH FALSE FOXGLOVE

Rare, found only on a sandstone outcrop 50 meters east of Pedestal Rock.

Pedicularis canadensis

EARLY WOOD-BETONY, LOUSEWORT

Infrequent in open woodland and near cliff edges; rare in upland and terrace forests.

FAMILY BIGNONIACEAE

(I) *Campsis radicans*

TRUMPET-CREEPER

Infrequent in fence rows, forest borders, and old fields.

(P) *Catalpa speciosa*

HARDY CATALPA

Several trees are persisting around the house site on the former Sims farm.

FAMILY OROBANCHACEAE

Epifagus virginiana

BEECHDROPS

Frequent in association with *Fagus grandifolia*, upon which it is parasitic.*Conopholis americana*

CANCER-ROOT

Infrequent in association with *Fagus grandifolia*, *Tsuga canadensis*, and *Quercus rubra*, upon which it is parasitic.

FAMILY ACANTHACEAE

Justicia americana (*Dianthera americana*)

WATER WILLOW

Frequent in shallow water along the banks and islands of Sugar Creek.

Ruellia strepens

SMOOTH RUELLIA

Infrequent on stream terraces, flood plains, and the banks of the J. W. Frisz Memorial Lagoon.

FAMILY PHRYMACEAE

Phryma leptostachya

LOPSEED

Frequent in open woodlands, forest openings, and forest borders; infrequent to rare throughout the upland forests.

FAMILY PLANTAGINACEAE

Plantago rugelii

RUGEL PLANTAIN

Frequent in old fields, pastures, fence rows, lawns, roadsides, and similar areas.

(I) *Plantago lanceolata*

ENGLISH PLANTAIN

Frequent in old fields, pastures, fence rows, lawns, roadsides, and similar areas.

Plantago aristata

BRACTED PLANTAIN

Frequent in old fields, pastures, fence rows, and roadsides.

Plantago virginica

Frequent in old fields, pastures, and fence rows.

FAMILY RUBIACEAE

Galium aparine

CLEAVERS

Infrequent throughout the upland forests.

Galium triflorum

SWEET-SCENTED BEDSTRAW

Infrequent in open woodlands, forest borders, and fence rows.

Galium circaezans

"Wooded plateau, Pine Hills," June 13, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Galium circaezans var. **hypomalacum**

WILD LICORICE

Infrequent in moderately moist sites in the upland forests and on stream terraces.

Galium concinnum

PRETTY BEDSTRAW

Frequent throughout the upland forests, in forest borders, and on stream terraces.

Mitchella repens

PARTRIDGE BERRY

Frequent in large colonies, usually on the crest of a ridge, upper ravine bank, or cliff edge under hardwoods or hemlocks.

Houstonia minima (not listed in Deam, 1940)

BLUETS

Rare, found only in an intensively grazed pasture on the former Sims farm.

Houstonia minima was listed from Starke County, Indiana, by Thompson (1889), but his report is not vouchered and was ignored by Deam (1940). The species was added to the state flora as a result of the present study (State Flora Committee, 1953). The possible origin of the plants at this station, including the chance of their direct importation from the nearest known station in western Illinois, was discussed in an earlier paper (McCormick, 1952). Searches made in the spring of 1953 and 1955, after the Sims farm had been retired from cultivation and pasturage, failed to relocate the species, and it now may be extinct.

Houstonia purpurea

MOUNTAIN HOUSTONIA

Infrequent in old fields, roadsides, and on cliff edges.

FAMILY **CAPRIFOLIACEAE****Diervilla lonicera**

BUSH HONEYSUCKLE

Infrequent to rare on cliff edges and in hemlock stands. Friesner (1937) cited the bush honeysuckle as a glacial disjunct and mentioned a colony on Turkey Backbone in the Pine Hills Natural Area.

(P-E) **Symphoricarpos orbiculatus**

CORAL BERRY

Planted under the conifer plantation on the border of the field north of the Pine Hills Natural Area entrance road and sparingly seeding into adjacent areas.

Triosteum aurantiacum

WILD COFFEE

"At bottom of steep wooded slope, Pine Hills," May 9, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Viburnum prunifolium

BLACK HAW

Infrequent to rare in forest borders and fence rows.

Viburnum rafinesquianum var. **affine**(V. *affine*)

ARROW-WOOD

"Devil's Backbone," Pine Hills Natural Area, June 13, 1931; and "Wooded bank on east and south sides of Indian Creek, about 300 yards north of Devil's Backbone, Pine Hills," May 11, 1946, collected by R. C. Friesner. Specimens deposited in the Friesner Memorial Herbarium, Butler University. "Top of ridge leading to Pine Backbone, Pine Hills," June 8, 1951, collected by A. R. Bechtel and D. B. Ward. Specimen deposited in the Wabash College Herbarium.

Viburnum molle

"Steep, dry wooded slope just north of Devil's Backbone," Pine Hills Natural Area, June 2, 1931; and "On wooded terrace of Indian Creek opposite Pine Grove, Pine Hills," May 13, 1951, collected by R. C. Friesner. Specimens deposited in the Friesner Memorial Herbarium, Butler University.

Viburnum acerifolium

MAPLE-LEAVED VIBURNUM

Frequent throughout the upland forests, in hemlock stands, on steep wooded slopes, and higher stream terraces.

Sambucus canadensis

AMERICAN ELDER

Frequent in old fields and roadside thickets; infrequent in forest borders, open woodlands, and forest openings.

FAMILY **VALERIANACEAE****Valeriana pauciflora**

LARGE-FLOWERED VALERIAN

Infrequent in moist ground on stream terraces and flood plains.

FAMILY **DIPSACACEAE**(I) **Dipsacus sylvestris**

COMMON TEASEL

Frequent in old fields, pastures, fence rows, and roadsides; infrequent to rare in open forests, ravine bottoms, and on flood plains.

FAMILY **CUCURBITACEAE****Sicyos angulatus**

BUR CUCUMBER

Infrequent in open woodlands, forest borders, and forest openings.

Echinocystis lobata

WILD BALSAM APPLE

"Along Sugar Creek, Pine Hills," August 26, 1932, collected by A. R. Bechtel. Specimen deposited in the Wabash College Herbarium.

FAMILY **CAMPANULACEAE****Specularia perfoliata**

VENUS' LOOKING-GLASS

Frequent in old fields, pastures, fence rows, roadsides, and on the banks of the J. W. Frisz Memorial Lagoon.

Campanula americana

TALL BELLFLOWER

Infrequent to rare, but in large colonies, in ravine bottoms, on stream terraces, flood plains, and in forest borders.

Campanula americana var. **illinoensis** (not listed in Deam, 1940)

Rare, found only in open second-growth woodland on Trail 2 opposite the present airstrip. This variety was added to the state flora as a result of the present study (State Flora Committee, 1952).

(P) **Platycodon grandiflorum**

CHINESE BELLFLOWER

Persisting in the garden plot at the southwest side of Shades Inn.

Lobelia siphilitica

LARGE BLUE LOBELIA

Infrequent in ravine bottoms, on stream terraces, and flood plains.

Lobelia inflata

INDIAN TOBACCO

Frequent in cultivated fields, old fields, pastures, fence rows, roadsides, and forest borders.

FAMILY **COMPOSITAE****Vernonia fasciculata**

IRONWEED

Infrequent in old fields and pastures.

Vernonia altissima

TALL IRONWEED

Infrequent in old fields, pastures, and forest borders.

Eupatorium purpureum

GREEN-STEMMED JOE-PYE WEED

Infrequent in old fields, fence rows, open woodlands, and forest borders.

Eupatorium perfoliatum

BONESET

Infrequent in open woodlands and forest borders.

Eupatorium serotinum

LATE EUPATORIUM

Infrequent in old fields, open woodlands, and exposed areas along streams.

Eupatorium rugosum

WHITE SNAKEROOT

Infrequent in open woodlands, forest borders, and on exposed areas along streams.

Eupatorium rugosum forma **villicaule** (not listed in Deam, 1940)

Rare in open woodlands and forest borders.

Eupatorium rugosum forma **tomentellum** (not listed in Deam, 1940)

Rare, found only in a fence row along the Shades State Park entrance road. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

(P-E) **Eupatorium coelestinum**

MIST FLOWER

Rare, persisting in a roadside planting opposite the east entrance of Shades Inn and growing as a volunteer on the flood plain of the eastern tributary of the J. W. Frisz Memorial Lagoon.

Kuhnia eupatorioides var. **corymbulosa**

FALSE BONESET

Infrequent in old fields, roadsides, and forest borders.

Solidago caesia

WREATH GOLDENROD

Frequent in old fields, pastures, roadsides, and fence rows; infrequent in open woodlands.

Solidago caesia forma **axillaris** (not listed
in Deam, 1940)

Rare, found only on the bank of the J. W. Frisz
Memorial Lagoon.

XSolidago ulmicaesia (not listed in Deam, 1940)

Rare, found only in a clearing northwest of the
Shades Pavilion.

Solidago flexicaulis (*S. latifolia*)

Infrequent on cliff edges, in ravine bottoms, and
on stream terraces and flood plains.

Solidago juncea

EARLY GOLDENROD

Frequent in old fields, roadsides, open wood-
lands, on cliff edges, and shale talus.

Solidago nemoralis

OLD-FIELD GOLDENROD

Frequent in old fields, pastures, roadsides,
forest borders, open woodland, and on cliff edges.

XSolidago ulmifolia

Rare, found only on moist soil in an abandoned
roadbed on the former Sims farm.

Solidago rugosa

Infrequent in old fields, fence rows, and road-
sides.

Solidago canadensis var. **gilvocanescens**

Infrequent in old fields, fence rows, and open
woodlands.

Solidago altissima

TALL GOLDENROD

Infrequent in open woodlands, forest borders,
and exposed ravine bottoms.

Solidago gigantea var. **leiophylla**

"Moist wooded stream bank, Pine Hills,"
September 5, 1931, collected by R. C. Friesner.
Specimen deposited in the Friesner Memorial
Herbarium, Butler University.

Solidago graminifolia var. **nuttallii**

Infrequent in old fields, fence rows, and open
woodland.

Aster shortii

"Steep wooded bluff along Indian Creek, Pine
Hills," September 19, 1931, collected by R. C.
Friesner. The specimen was not located in the
Friesner Memorial Herbarium, Butler University,
but the identification doubtlessly is correct.

Aster cordifolius

BLUE WOOD ASTER

Frequent in fence rows, roadsides, old fields,
open woodlands, and on cliff edges.

Aster sagittifolius

ARROW ASTER

Infrequent in open woodlands and forest
borders.

Aster novae-angliae

NEW ENGLAND ASTER

Frequent in fence rows; infrequent in old
fields, forest borders, and on cliff edges.

Aster pilosus

HEATH ASTER

Frequent in old fields, fence rows, roadsides,
open woodlands, and forest borders.

Aster simplex (*A. paniculatus* var. *simplex*)

Infrequent in fence rows, roadsides, open wood-
lands, and forest borders.

Aster simplex var. **ramosissimus** (*A. paniculatus*)

"Edge of wooded bluff along Clifty Creek, Pine
Hills," September 19, 1931, collected by R. C.
Friesner. The specimen was not located in the
Friesner Memorial Herbarium, Butler University,
but the identification doubtlessly is correct.

Erigeron pulchellus

ROBIN'S FLEABANE

Infrequent in open woodlands, forest borders,
and on cliff edges.

Erigeron philadelphicus

PHILADELPHIA FLEABANE

Frequent in old fields, fence rows, and road-
sides; infrequent on exposed sites on flood plains.

Erigeron annuus

WHITE-TOP

Frequent in old fields, pastures, fence rows, and
roadsides.

Erigeron strigosus (*E. ramosus*)

DAISY FLEABANE

Frequent in old fields, fence rows, roadsides, and
open woodlands.

Erigeron canadensis

HORSEWEED

Frequent in old fields and fence rows.

Antennaria neglecta

PUSSYTOES

Infrequent in moist, unshaded soil in ravines and around the C.C.C. pond on the former Dryer farm.

Antennaria plantaginifolia

PLANTAIN-LEAVED PUSSYTOES

Infrequent in old fields, pastures, and in open hardwood and hemlock stands.

Gnaphalium obtusifolium

OLD-FIELD BALSAM

Frequent in old fields, pastures, fence rows, and roadsides.

Gnaphalium purpureum

PURPLISH CUDWEED

Infrequent in old fields and pastures.

(I) ***Inula helenium***

ELF DOCK

"Low place in old field $\frac{1}{4}$ mile east of Devil's Backbone, Pine Hills," September 19, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Ambrosia trifida

GREAT RAGWEED

Frequent in moist soil on flood plains and exposed upland areas.

***Ambrosia artemisiifolia* var. *elatior* forma *villosa* (*A. elatior*)**

COMMON RAGWEED

Frequent in cultivated fields, old fields, fence rows, pastures, roadsides, and forest borders.

Xanthium chinense

COCKLEBUR

Rare, found only on the banks of the J. W. Frisz Memorial Lagoon.

Xanthium pensylvanicum

SMOOTH COCKLEBUR

Rare, found only on the banks of the J. W. Frisz Memorial Lagoon.

Polymnia canadensis

WHITE-FLOWERED LEAF-CUP

Infrequent on flood plains and stream terraces.

Silphium perfoliatum

CUP ROSINWEED

Frequent on flood plains and stream terraces.

Silphium integrifolium

ENTIRE-LEAVED ROSINWEED

Rare, found only on the ledge of a cliff above Steamboat Rock, Trail 2.

Heliopsis helianthoides

FALSE SUNFLOWER

Frequent on the flood plain and bars of Sugar Creek; infrequent in open woodlands, forest borders, and fence rows, especially in moist sites.

***Heliopsis helianthoides* var. *scabra* (*H. scabra*)**

"Base of cliff along stream, Pine Hills," July 11, 1931; "First terrace woods, Pine Hills," July 24, 1931; and "Rocky bed of Clifty Creek, Pine Hills," September 19, 1931, collected by R. C. Friesner. Specimens deposited in the Friesner Memorial Herbarium, Butler University.

Eclipta alba

YERBA DE TAJO

Rare, found only in a fence row on the former Sims farm.

Rudbeckia laciniata

CUT-LEAVED CONEFLOWER

Infrequent on the flood plain of Sugar Creek.

Rudbeckia triloba

BROWN-EYED SUSAN

Frequent on the flood plains of the larger streams.

Rudbeckia hirta

BLACK-EYED SUSAN

Infrequent in old fields, pastures, and fence rows.

(I) ***Rudbeckia serotina***

BLACK-EYED SUSAN

Rare, found only on a roadside in the former C.C.C. camp.

(I) ***Helianthus petiolaris***

Rare, found only in fields and fence rows on the former Sims farm.

Helianthus microcephalus

SMALL WOOD-SUNFLOWER

Rare, in open woodlands, on cliff edges, and in open hemlock stands.

Helianthus decapetalus

THIN-LEAVED SUNFLOWER

Rare, found only on Trail 2 above Steamboat Rock in an open hemlock stand.

Helianthus tuberosus**JERUSALEM ARTICHOKE**

Rare, found only on the banks of the J. W. Frisz Memorial Lagoon.

Actinomeris alternifolia**YELLOW IRONWEED**

Frequent on the flood plains and bars of the larger streams.

(P-E) Coreopsis palmata**FINGER COREOPSIS**

Persisting in the old garden plot southwest of Shades Inn and volunteering in a fence row east of the former superintendent's residence.

Bidens comosa**BEGGAR-TICKS**

Frequent in old fields, fence rows, around artificial ponds, and on flood plains.

Bidens frondosa**BEGGAR-TICKS**

Infrequent on banks and exposed flats of the J. W. Frisz Memorial Lagoon and on the flood plains of the larger streams.

Bidens bipinnata**SPANISH NEEDLES**

Frequent in old fields, fence rows, open woodlands, and forest borders.

(I) Achillea millefolium**YARROW**

Frequent in old fields, fence rows, roadsides, parking areas, picnic grounds, and grassy recreation areas.

(I) Achillea millefolium forma rosea (not listed in Deam, 1940)

Rare in old fields, fence rows, and roadsides. This form was added to the state flora as a result of the present study (State Flora Committee, 1951).

(I) Anthemis cotula**DOG FENNEL**

Infrequent, but in large colonies, in barnyards, old fields, and roadsides.

(I) Matricaria matricarioides**PINEAPPLE WEED**

Infrequent, but in large colonies, in barnyards, old fields, and roadsides.

(I) Chrysanthemum leucanthemum var. pinnatifidum**OXEYE DAISY**

Frequent in old fields, fence rows, and roadsides.

(I) Artemisia annua**SWEET WORMWOOD**

Rare, in open woodland, forest borders, and fence rows.

Erechtites hieracifolia var. prealta (not listed in Deam, 1940)**FIREWEED**

Infrequent in old fields, fence rows, and on the banks of the J. W. Frisz Memorial Lagoon. This variety was added to the state flora as a result of the present study (State Flora Committee, 1951).

Cacalia atriplicifolia**INDIAN PLANTAIN**

Infrequent on the flood plains of the larger streams and in old fields.

Senecio glabellus

"In bed of Indian Creek just above junction with Clifty Creek, Pine Hills," June 3, 1931, collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Senecio plattensis

Rare in old fields.

Senecio aureus var. intercurus (*S. aurea*)**GOLDEN RAGWORT**

"Pine Hills, low wooded terrace above Indian Creek, opposite Pine Grove," collected by R. C. Friesner. Specimen deposited in the Friesner Memorial Herbarium, Butler University.

Senecio obovatus**ROUND-LEAVED GROUNDSEL**

Frequent in open woodlands and on cliff edges; infrequent in old fields.

(I) Arctium minus**BURDOCK**

Frequent in barnyards, old fields, fence rows, and forest borders.

(I) Arctium minus forma pallidum (not listed in Deam, 1940)

Rare in fence rows and barnyards. This form was added to the state flora as a result of the present study (State Flora Committee, 1951).

(I) *Cirsium vulgare*

BULL THISTLE

Infrequent in old fields and fence rows.

Cirsium discolor

FIELD THISTLE

Frequent in old fields, fence rows, roadsides, open woodland, and forest borders.

Cirsium discolor forma *albiflorum* (not listed in Deam, 1940)

Rare in old fields and forest borders. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Cirsium altissimum

TALL THISTLE

Infrequent in open woodlands, forest borders, and on the flood plains of the larger streams.

(I) *Cichorium intybus*

CHICORY

Frequent in old fields, fence rows, and roadsides.

(I) *Cichorium intybus* forma *roseum*

Rare in roadsides. This form was added to the state flora as a result of the present study (State Flora Committee, 1952).

Krigia biflora

DWARF DANDELION

"Woods, north bank Sugar Creek, southwest corner of [Montgomery] County," May 24, 1930, collected by A. R. Bechtel and E. C. Stout. Specimen deposited in the Wabash College Herbarium.

(I) *Tragopogon pratensis*

GOAT'S-BEARD

Infrequent in old fields, fence rows, and roadsides.

(I) *Tragopogon major* (not listed in Deam, 1940)

GOAT'S-BEARD

Infrequent in old fields, fence rows, and roadsides.

(I) *Taraxacum erythrospermum* (*T. laevigatum*)

RED-SEEDED DANDELION

Infrequent to rare in lawns, roadsides, and on a terrace of Indian Creek.

(I) *Taraxacum officinale* (*T. palustre* var. *vulgare*)

COMMON DANDELION

Frequent in old fields, lawns, roadsides, and on

exposed areas on the flood plains of the larger streams.

(I) *Sonchus oleraceus*

SOW THISTLE

Infrequent in barnyards, old fields, and fence rows.

(I) *Lactuca scariola*

PRICKLY LETTUCE

Infrequent in old fields and fence rows.

Lactuca canadensis

WILD LETTUCE

Infrequent in old fields and fence rows.

Lactuca canadensis var. *latifolia*

Frequent in old fields, fence rows, open woodlands, forest borders, and on the banks of the J. W. Frisz Memorial Lagoon.

Lactuca floridana

WILD BLUE LETTUCE

Infrequent in open woodland and forest borders.

Lactuca floridana var. *villosa* (not listed in Deam, 1940)

Rare, found only in the ravine west of Pedestal Rock, at a point 0.6 meter north of the Fountain County line.

Prenanthes altissima

Infrequent in open woodlands, forest borders, on the banks of the J. W. Frisz Memorial Lagoon, and on the flood plains of the larger streams.

Prenanthes altissima var. *cinnamomea* (not listed in Deam, 1940)

Rare in open woodlands, forest borders, on the banks of the J. W. Frisz Memorial Lagoon, and on the flood plains of the larger streams. This variety was added to the state flora as a result of the present study (State Flora Committee, 1952).

Hieracium paniculatum

Infrequent in the upland forests, on ravine banks, and cliff edges.

Hieracium gronovii

HAWKWEED

Frequent in old fields, pastures, and open woodlands.

EXCLUDED SPECIES

The field notebooks of Ray Clarence Friesner, on deposit in the Friesner Memorial

Herbarium, Butler University, and the accession list of the Wabash College Herbarium were examined for records of collections from the present Shades State Park or Pine Hills Natural Area. Reports for which vouchers were found in the respective herbaria are listed above in the flora of the Survey Area. In addition, a few species mentioned in the Friesner notebooks or the Wabash accession list for which no vouchers were found, but which the present author is confident occur within the area, also were entered in the flora. All other species mentioned in the Friesner collection records, in the Wabash accession list, or in other sources are excluded from the flora. Some of the entities included in this list of excluded species were based on erroneous determinations, but others actually may occur in the Survey Area, even though insufficient evidence now exists for their admission to the flora.

Selaginella rupestris

Plants growing in Turkey Run Hollow, Turkey Run State Park, near Rockville, Indiana, are alleged to have been transplanted from the sandstone cliffs near Silver Cascade (fig. 3). A careful search of the area around Silver Cascade, however, failed to reveal a station for the species. Test (1930), who studied the pteridophytes of Turkey Run State Park, did not report the Turkey Run Hollow station. He did mention a station along Sugar Creek where the species is relatively abundant on sandstone cliffs. The species will probably be found in similar sites in the Survey Area.

Ophioglossum vulgatum

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

Dryopteris goldiana

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Pellaea atropurpurea

A specimen in the Wabash College Herbarium, collected on the "Cliff under Lookout [Prospect] Point, Shades," July 20, 1936, by Fred Hall, is *Pellaea glabella*.

Milium effusum

Listed from the Survey Area in the Wabash

College Herbarium accession list, but not vouchered by a specimen.

Carex granularis

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

Carex digitalis

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

Carex gracilescens

According to Ray C. Friesner's notebooks, he collected this species on Turkey Backbone in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen, but the species probably occurs in the Survey Area.

Luzula multiflora

According to Ray C. Friesner's notebooks, he collected this species on Turkey Backbone in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen, and the collection was doubtlessly *Luzula echinata* var. *mesochorea*.

Polygonatum biflorum

According to Ray C. Friesner's notebooks, he collected this species on a wooded slope in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen, and the collection probably was *Polygonatum pubescens*.

Trillium nivale

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

***Epipactis helleborine* (*E. latifolia*)**

According to Ray C. Friesner's notebooks, he collected this species on a stream terrace in the Pine Hills Natural Area. This report is not vouchered by a herbarium specimen and doubtless was in error.

Carya glabra

PIGNUT HICKORY

Eleven trees of this species were recorded by Trotter (1952) on a 5-acre plot in Chipmunk Flat on Trail 2, but his report is not vouchered by herbarium specimens. The species was not found by the present study, and the report is dubious.

Carya tomentosa**MOCKERNUT**

Three trees of this species were recorded by Trotter (1912) on a 5-acre plot in Chipmunk Flat on Trail 2, but his report is not vouchered by herbarium specimens. The species was not found by the present study, and the report is dubious.

Stellaria longipes

A specimen listed in Ray C. Friesner's notebooks from the flood plain of Indian Creek in the Pine Hills Natural Area is *Stellaria longifolia*.

Anemone quinquefolia

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Anemone patens var. **wolfgangiana**

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Hydrastis canadensis**GOLDENSEAL**

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

Corydalis flavula**PALE YELLOW CORYDALIS**

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen. The species probably occurs in the Survey Area.

Lepidium campestre**FIELD PEPPERGRASS**

According to Ray C. Friesner's notebooks, he collected this species on the flood plain of Indian Creek in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen, but may be correct.

Arabidopsis thaliana (*Sisymbrium thalianum*)**THALE CRESS**

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Cassia marilandica

A specimen in the Wabash College Herbarium that was collected in the Survey Area is *Cassia hebecarpa*.

Trifolium agarium

A specimen in the Wabash College Herbarium that was collected in the Survey Area is *Trifolium procumbens*.

Vitis labrusca

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Viola pallens

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Viola hastata

A specimen in the Wabash College Herbarium that was collected in Shades State Park probably is *Viola pennsylvanica*.

Oenothera tetragona var. **longistipitata**

A specimen in the Wabash College Herbarium that was collected in Shades State Park is *Oenothera perennis*.

Aralia nudicaulis

A specimen in the Wabash College Herbarium that was collected in Shades State Park is *Aralia racemosa*.

Lysimachia quadrifolia

A specimen in the Wabash College Herbarium that was collected in Shades State Park is *Lysimachia lanceolata*. The report of *L. quadrifolia* from Montgomery County (State Flora Committee, 1943) based on this specimen is recanted.

Gentiana saponaria

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Pycnanthemum clinopodioides

Listed from the Survey Area in the Wabash College Herbarium accession list, but not vouchered by a specimen.

Penstemon canescens

A specimen listed in Ray C. Friesner's notebooks from the Pine Hills Natural Area is *Penstemon hirsutus*.

Houstonia canadensis

A specimen listed in Ray C. Friesner's notebooks from the Pine Hills Natural Area is *Houstonia purpurea*.

Viburnum dentatum

A specimen listed in Ray C. Friesner's notebooks from the Pine Hills Natural Area is *Viburnum molle*.

Aster laevis

According to Ray C. Friesner's notebooks, he collected this species in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen, and the identification probably was in error.

Hieracium canadensis

A specimen in the Wabash College Herbarium that was collected in the Survey Area is *Hieracium paniculatum*.

Hieracium longipilum

According to Ray C. Friesner's notebooks, he collected this species in an upland beech-maple-oak woods in the Pine Hills Natural Area. The report is not vouchered by a herbarium specimen and probably represents *Hieracium gronovii*.

DISCUSSION

THE VASCULAR FLORA of Shades State Park and Pine Hills Natural Area is composed of at least 715 taxonomic entities. Of this number 623 species, 25 varieties, 39 forms, and two named hybrids, which belong to 345 genera in 99 families, are native, naturalized, or adventive, and 26 species, including representatives of 15 additional genera and one additional family, are known to be persisting after cultivation but are not reproducing spontaneously.

The Division Pteridophyta (the ferns and "fern allies") and the Division Spermatophyta (the seed plants), the major classificatory units of vascular plants, are represented, respectively, by 31 and 684 native, naturalized, adventive, and persisting entities. Within the Division Spermatophyta, the Subdivision Gymnospermae is represented by nine species, of which four are native, two are adventive, and three are persisting in plantings. The Subdivision Angiospermae has 675 representatives, 160 of which are members of the Class Monocotyledoneae

and 515 are members of the Class Dicotyledoneae (table 3). In the former class, 113 entities are grass-like plants (grasses, sedges, rushes), and in the latter class, 76 entities are trees (see list below), 47 are shrubs, nine are woody lianas, and five are semi-woody subshrubs with creeping subterranean or trailing aerial shoots (see list below).

An alphabetical check list of the trees of Shades State Park and Pine Hills Natural Area follows. The 76 taxa include representatives of 23 families and 39 genera. Sixty entities are native to the Survey Area, three are adventive (I), three are naturalized (P-E), and 10 are persisting in ornamental plantings or plantations (P). Eight species, marked with asterisks (*), are conifers.

Acer negundo (box elder)
Acer nigrum (black maple)
Acer rubrum (red maple)
Acer rubrum forma *tomentosum*
Acer saccharinum (silver maple)
Acer saccharum (sugar maple)
Aesculus glabra (Ohio buckeye)

TABLE 3
 RÉSUMÉ OF THE COMPOSITION OF THE VASCULAR FLORA OF SHADES STATE PARK AND
 PINE HILLS NATURAL AREA, INDIANA

	Native				Naturalized				Adventive		Total Entities
	Species	Varieties	Forms	Hybrids	Species	Varieties	Forms	Persistent Species	Species	Forms	
Division Pteridophyta											
Equisetaceae	2	—	—	—	—	—	—	—	—	—	2
Lycopodiaceae	2	—	—	—	—	—	—	—	—	—	2
Ferns	22	1	4	—	—	—	—	—	—	—	27
Subtotal	26	1	4	—	—	—	—	—	—	—	31
Division Spermatophyta											
Gymnospermae	4	—	—	—	—	—	—	3	2	—	9
Angiospermae											
Monocotyledoneae	115	4	4	—	24	—	2	7	4	—	160
Dicotyledoneae	370	19	22	2	67	1	6	16	11	1	515
Subtotal	489	23	26	2	91	1	8	26	17	1	684
Total	515	24	30	2	91	1	8	26	17	1	715

- (P) *Aralia spinosa* (Hercules' club)
Asimina triloba (papaw)
- (P) *Betula pendula*
Carpinus caroliniana var. *virginiana* (ironwood, blue beech)
Carya cordiformis (bitternut hickory)
- (P) *Carya illinoensis* (pecan)
Carya laciniosa (shellbark hickory)
Carya ovalis (small-fruited hickory)
Carya ovata (shagbark hickory)
- (P) *Castanea dentata* (chestnut)
- (P) *Catalpa speciosa* (hardy catalpa)
Celtis occidentalis var. *canina* (hackberry)
Cercis canadensis (redbud)
Cornus florida (flowering dogwood)
Diospyros virginiana var. *pubescens* (persimmon)
Fagus grandifolia (beech)
Fraxinus americana (white ash)
Fraxinus pennsylvanica var. *subintegririma* (green ash)
Fraxinus nigra (black ash)
Fraxinus quadrangulata (blue ash)
Gleditsia triacanthos (honey locust)
Gymnocladus dioica (Kentucky coffee tree)
Juglans cinerea (butternut, white walnut)
Juglans nigra (black walnut)
**Juniperus virginiana* var. *crebra* (eastern red cedar)
Liriodendron tulipifera (tulip tree)
- (P-E) *Maclura pomifera* (Osage orange)
- (P) *Morus alba* var. *tartarica* (Russian mulberry)
Morus rubra (red mulberry)
Nyssa sylvatica var. *caroliniana* (black gum)
Ostrya virginiana (hop hornbeam)
Ostrya virginiana forma *glandulosa*
- (P) **Picea abies* (Norway spruce)
- (P-E) **Pinus banksiana* (jack pine)
- (P) **Pinus resinosa* (red pine)
**Pinus strobus* (northern white pine)
- (P-E) **Pinus sylvestris* (Scotch pine)
Platanus occidentalis (American sycamore)
Populus deltoides (cottonwood)
Populus grandidentata (largetooth aspen)
- (P) **Populus nigra* var. *italica* (Lombardy poplar)
Populus tremuloides (quaking aspen)
Prunus americana (American plum)
- (I) *Prunus persica* (peach)
Prunus serotina (black cherry)
Ptelea trifoliata (common hoptree, wafer ash)
Pyrus coronaria (wild crab)
- (I) *Pyrus malus* (apple)
Quercus alba (white oak)
- Quercus alba* forma *latiloba*
Quercus bicolor (swamp white oak)
Quercus macrocarpa (bur oak)
Quercus muehlenbergii (chinquapin oak)
Quercus rubra (red oak)
Quercus velutina (black oak)
Robinia pseudo-acacia (black locust)
- (I) *Salix alba*
Salix interior (sand-bar willow)
Salix nigra (black willow)
Sassafras albidum (sassafras)
Sassafras albidum var. *molle*
- (P) **Thuja occidentalis* (arbor vitae, northern white cedar)
Tilia americana (American linden, basswood)
**Tsuga canadensis* (eastern hemlock)
Ulmus americana forma *alba* (American elm)
Ulmus americana forma *laevior*
Ulmus americana forma *pendula*
Ulmus rubra (slippery elm)
Ulmus thomasi (rock elm)

Following is an alphabetical check list of the shrubs, sub-shrubs, and woody lianas of Shades State Park and Pine Hills Natural Area. The 60 taxa include representatives of 25 families and 38 genera. Forty-nine entities are native to the Survey Area, two are adventive (I), two are naturalized (P-E), and seven are persisting in ornamental plantings (P). One species, marked with an asterisk (*), is a conifer.

SHRUBS

- Amelanchier canadensis* (downy shadbush)
- (P-E) *Berberis thunbergii* (Japanese barberry)
Cornus alternifolia (green osier)
Cornus drummondii (roughleaf dogwood)
Cornus obliqua (pale dogwood)
Cornus racemosa (gray dogwood)
Cornus rugosa (roundleaf dogwood)
- (P) *Corylus americana* (American hazelnut)
Diervilla lonicera (bush honeysuckle)
Dirca palustris (leatherwood)
Euonymus atropurpureus (wahoo)
Gaylussacia baccata (black huckleberry)
Hamamelis virginiana (American witch-hazel)
- (P) *Hibiscus syriacus* (Rose of Sharon)
Hydrangea arborescens (smooth hydrangea)
Hydrangea arborescens var. *deamii*
Lindera benzoin (spicebush)
- (P) *Philadelphus* sp. (mock orange)
Physocarpus opulifolius (common nine-bark)

- Rhus glabra* (smooth sumac)
Rhus typhina (staghorn sumac)
Ribes cynosbati (prickly gooseberry)
Ribes cynosbati forma *inermis* (spineless gooseberry)
(P) *Rosa carolina* (pasture rose)
(P) *Rosa multiflora* (multiflora rose)
Rosa palustris (swamp rose)
Rosa setigera var. *tomentosa* (prairie rose)
Rubus allegheniensis (Allegheny blackberry)
Rubus flagellaris (northern dewberry)
Rubus frondosus
Rubus occidentalis (common blackcap raspberry)
Salix rigida (heartleaf willow)
Salix discolor var. *latifolia*
Sambucus canadensis (American elder)
(P) *Spiraea japonica* (Japanese spiraea)
(P) *Spiraea tomentosa* (hardhack)
Staphylea trifolia (American bladdernut)
(P-E) *Symphoricarpos orbiculatus* (coral berry)
(P) *Syringa vulgaris* (lilac)
**Taxus canadensis* (Canada yew)
Vaccinium corymbosum var. *glabrum*
Vaccinium vacillans (lowbush blueberry)
Viburnum acerifolium (maple-leaved viburnum)
Viburnum molle
Viburnum prunifolium (black haw)
Viburnum rafinesquianum var. *affine* (arrow-wood)
Xanthoxylum americanum (northern prickly ash)

SUB-SHRUBS

- Chimaphila maculata* (striped pipsissewa)
Euonymus obovatus (running wahoo)
Gaultheria procumbens (wintergreen, tea-berry)
(I) *Vinca minor* (common periwinkle)

WOODY LIANAS

- (I) *Campsis radicans* (trumpet-creeper)
Celastrus scandens (bittersweet)
Clematis virginiana (virgin's bower)
Menispermum canadense (common moonseed)
Parthenocissus quinquefolia (Virginia creeper)
Rhus radicans (poison ivy)
Smilax tamnoides var. *hispida* (hispid greenbrier)
Vitis aestivalis (summer grape)
Vitis vulpina (frost grape)

Eighteen entities have escaped from cultivation (E), and several of these are becoming naturalized on the Survey Area. Coniferous species are indicated by an asterisk (*).

- (E) *Allium cepa* (onion)
Aralia spinosa (Hercules' club)
(E) *Avena sativa* (oat)
(E) *Berberis thunbergii* (Japanese barberry)
Betula pendula
Carya illinoensis (pecan)
Castanea dentata (American chestnut)
Catalpa speciosa (hardy catalpa)
(E) *Coreopsis palmata* (finger coreopsis)
Corylus americana (American hazelnut)
(E) *Delphinium ajacis* (rocket larkspur)
(E) *Eupatorium coelestinum* (mist flower)
Hemerocallis flava (yellow day lily)
Hibiscus syriacus (Rose of Sharon)
Iris sp. (blue flag)
Lilium tigrinum (outhouse lily)
(E) *Maclura pomifera* (Osage orange)
(E) *Medicago sativa* (alfalfa)
(E) *Melilotus alba* (white sweet clover)
(E) *Melilotus officinalis* (yellow sweet clover)
Monarda didyma (Oswego beebalm)
Morus alba var. *tartarica* (Russian mulberry)
Narcissus incomparabilis
Narcissus poeticus (poet's narcissus)
Narcissus pseudo-narcissus (daffodil)
(E) *Perilla frutescens* var. *crispa* (koli)
Philadelphus sp. (mock orange)
**Picea abies* (Norway spruce)
(E) **Pinus banksiana* (jack pine)
**Pinus resinosa* (red pine)
(E) **Pinus sylvestris* (Scotch pine)
Platycodon grandiflorum (Chinese bellflower)
Populus italica var. *nigra* (Lombardy poplar)
Rosa multiflora (multiflora rose)
Spiraea japonica (Japanese spiraea)
Spiraea tomentosa (hardhack)
(E) *Symphoricarpos orbiculatus* (coral berry)
Syringa vulgaris (lilac)
**Thuja occidentalis* (arbor vitae, northern white cedar)
(E) *Trifolium pratense* (red clover)
(E) *Trifolium pratense* forma *leucochraceum*
(E) *Triticum aestivum* (wheat)
Yucca filamentosa (common yucca)
(E) *Zea mays* (corn)

The sunflower family (Compositae), with 97 taxa, has the greatest number of local representatives. The grass family (Gramineae), with 77 representatives, ranks second in importance. The sedge family (Cyperaceae), with 33 entities, the pea family (Legu-

An alphabetical check list of 44 taxa planted on the Survey Area is given below.

minosae), with 32 entities, and the rose family (Rosaceae), with 30 entities, are each well represented in the local flora. Other families with 20 or more representatives are: Labiatae, 26 entities; Polypodiaceae, 24 entities; and Liliaceae, 22 representatives.

In the uncultivated flora, 571 entities, or approximately 82 per cent of the total, are considered to be native to Indiana, and 118, or about 18 per cent, have been introduced in various ways from Europe, Asia, South America, or from other sections of North America.

McCormick (1952) ascertained that 45 per cent of the native entities in the flora of Shades State Park are common to all six of the floral areas recognized by Deam (1940) in Indiana. Approximately 93 per cent of these entities occurred in the Illinois Drift Plain, 92 per cent in the Unglaciaded Region, 88 per cent in the Lakes Region, 64 per cent in the Lower Wabash Valley, and 61 per cent in the Prairie Region. By plotting the ranges of each species in North America, as described by Fernald (1950) and Deam (1940), it was found that 68 per cent of the species in the local flora are intraneous, or found in all directions from the state, 18 per cent are found in all but one of the major compass directions, and 14 per cent definitely are extraneous and reach the limit of their range in Indiana. More than half of these extraneous species reach their northern limit and 32 per cent reach their southern limit in the state (McCormick, 1952). Friesner (1937) and Deam (1924) estimated that extraneous species compose from 40 to 45 per cent of the total flora of Indiana, and other authors have found that extraneous species form 40 to 62 per cent of certain taxonomic or physiognomic groupings of species (Clevenger, 1951; Cook, 1946; Lindsey, 1932; Trefz, 1935). The extraneous element in the flora of the Survey Area, however, is consistently smaller than that in the total state flora and the various subgroups of the state flora, a fact that may be explained by several circumstances: 1. More than 60 per cent of the extraneous species in the state flora do not occur in the Tipton Till Plain, the floral region in which the Survey Area is situated (Friesner, 1937). 2. Most of the previous analyses of extraneous elements were made from 10 to 35 years ago, and range

extensions for many species have been published during the intervening period. 3. The known flora of the Survey Area comprises only about 25 per cent of the total number of species known to occur in the state (Deam, 1940) and contains many species of such habitats as forests and lowlands in which there is a paucity of extraneous entities.

The fact that approximately 17 per cent of the flora of an area preserved as "a part of original Indiana . . ." (Cougill, 1947) is composed of species which are not native to Indiana, and, in a majority of cases, are not native to North America, is striking evidence of the thoroughness with which such weeds have invaded the region in the 130 years since settlement began. The proportion of naturalized and adventive species in the flora of the Survey Area actually is slightly greater than the 14 per cent estimated for the flora of the state (Deam, 1940). Nearly all the introduced species in the Survey Area are found in disturbed areas such as cultivated or pastured fields, fence rows, roadsides, parking areas, picnic grounds, and around buildings. A few of these species may have been brought to the area by the thousands of persons who visit it each year, but most were introduced in conjunction with agricultural activities.

The many visitors who come to the Survey Area from all parts of Indiana and from many other states guarantee that the present floristic catalogue is not final. Doubtless new species will be introduced from time to time, and some may become established permanently. In addition, a more thorough examination of certain portions of Shades State Park, particularly its southwestern section, of the upland portions of the Pine Hills Natural Area, and of the exposed cliff faces along Sugar Creek, as well as more intensive studies of the vernal and autumnal flora may disclose several species overlooked during the present investigation. Also, the closer consideration of certain taxonomic groups, notably the Cyperaceae, doubtless will reveal more local representatives than are listed here.

The present study was initiated for several reasons. A reserved public area, such as a state park, should have a published flora for the convenience of the scientists who engage in research on the tract and for the enlight-

enment of laymen who visit it. Rare species should be recognized so that necessary measures may be instigated for their protection. And, in addition, a knowledge of the flora of an area is prerequisite to a study of its vegetation. It is hoped that the publication of this

annotated catalogue of the flora of Shades State Park and Pine Hills Natural Area will encourage the thorough study of the vegetation of the tracts and investigations of the many other intriguing ecological and floristic problems which exist there.

SUMMARY

THE VASCULAR FLORA of Shades State Park and Pine Hills Natural Area, west-central Indiana, was studied during the period from 1949 to 1961 and was found to be composed of 715 taxonomic entities, including 571 native entities, 118 naturalized and adventive entities, and 26 species that are persisting after cultivation. A total of 649 species, 25 varieties, 39 forms, and two named hybrids are listed phylogenetically and are accompanied by annotations that describe their

abundance in the area. In addition, 28 species previously reported from the Survey Area are excluded because the original determinations were erroneous, or the reports are questionable in light of the known distribution of the species and are not verified by herbarium specimens.

Twenty-five entities new to the state flora and 330 new records for the floras of Montgomery, Parke, and Fountain counties were discovered by this investigation.

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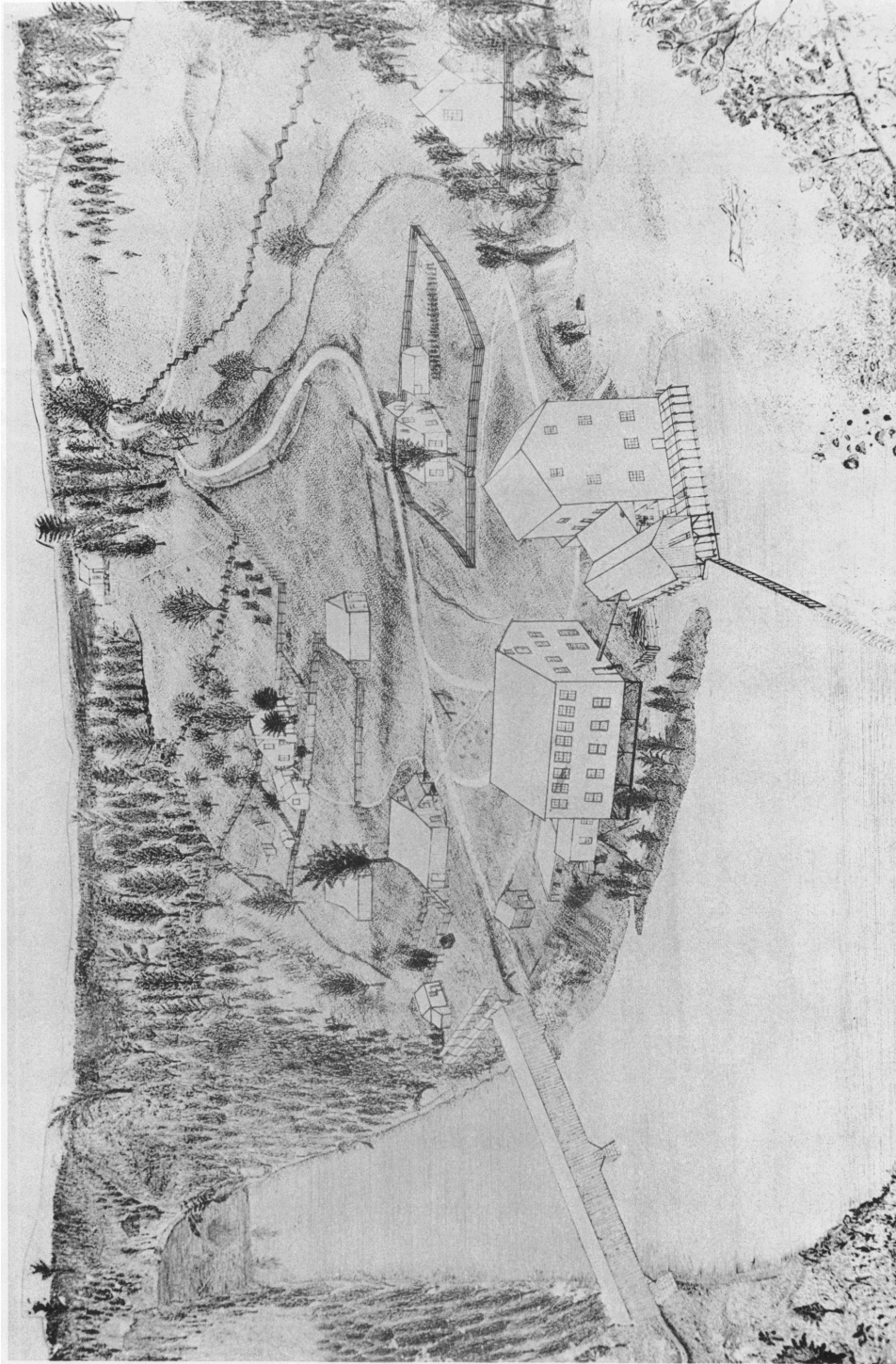
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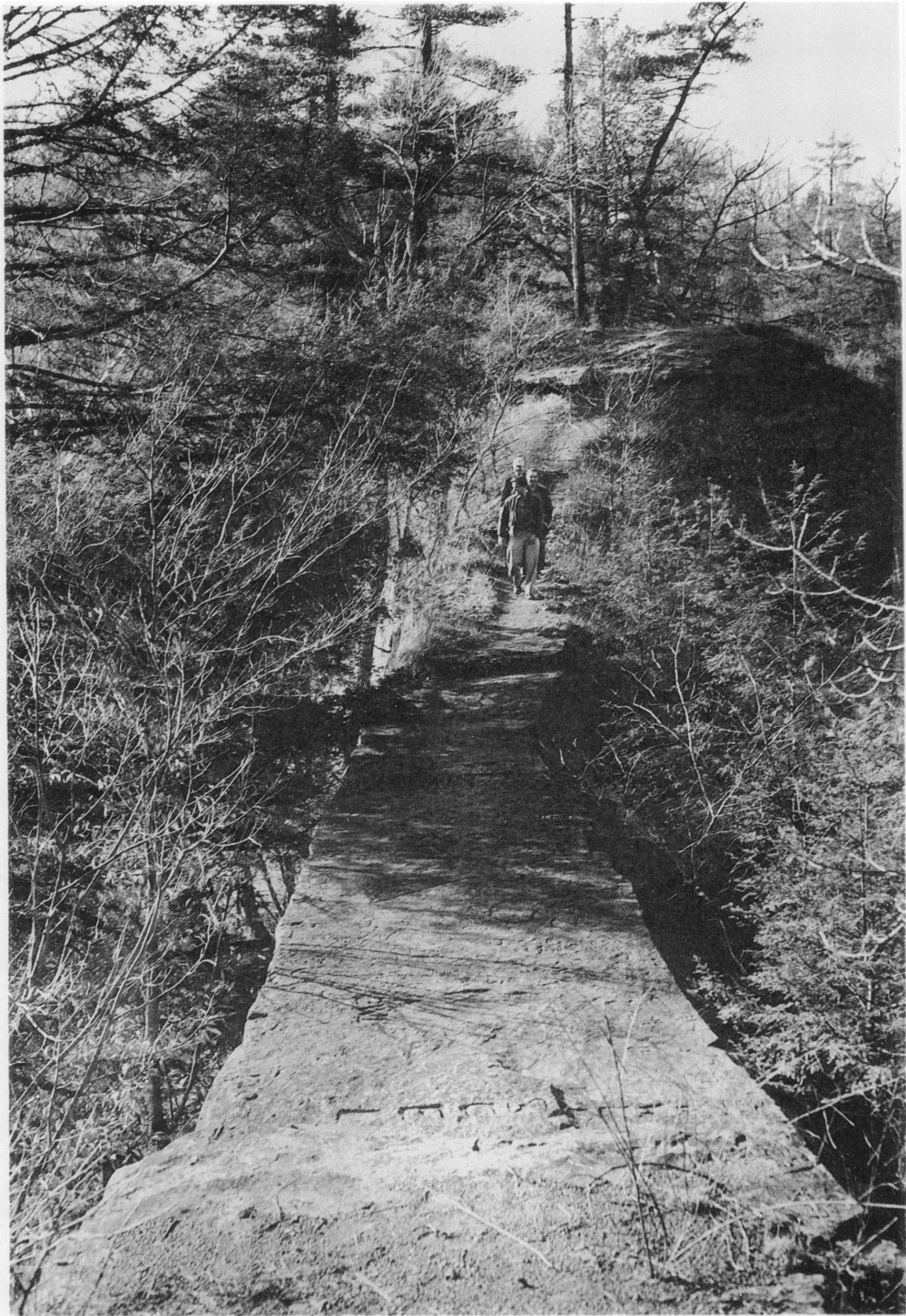
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- [MS b] Ninth census—industry volume—Township of Brown, County of Montgomery, State of Indiana—during the year ending June 1, 1870. Filed in the Indiana State Library, Indianapolis.
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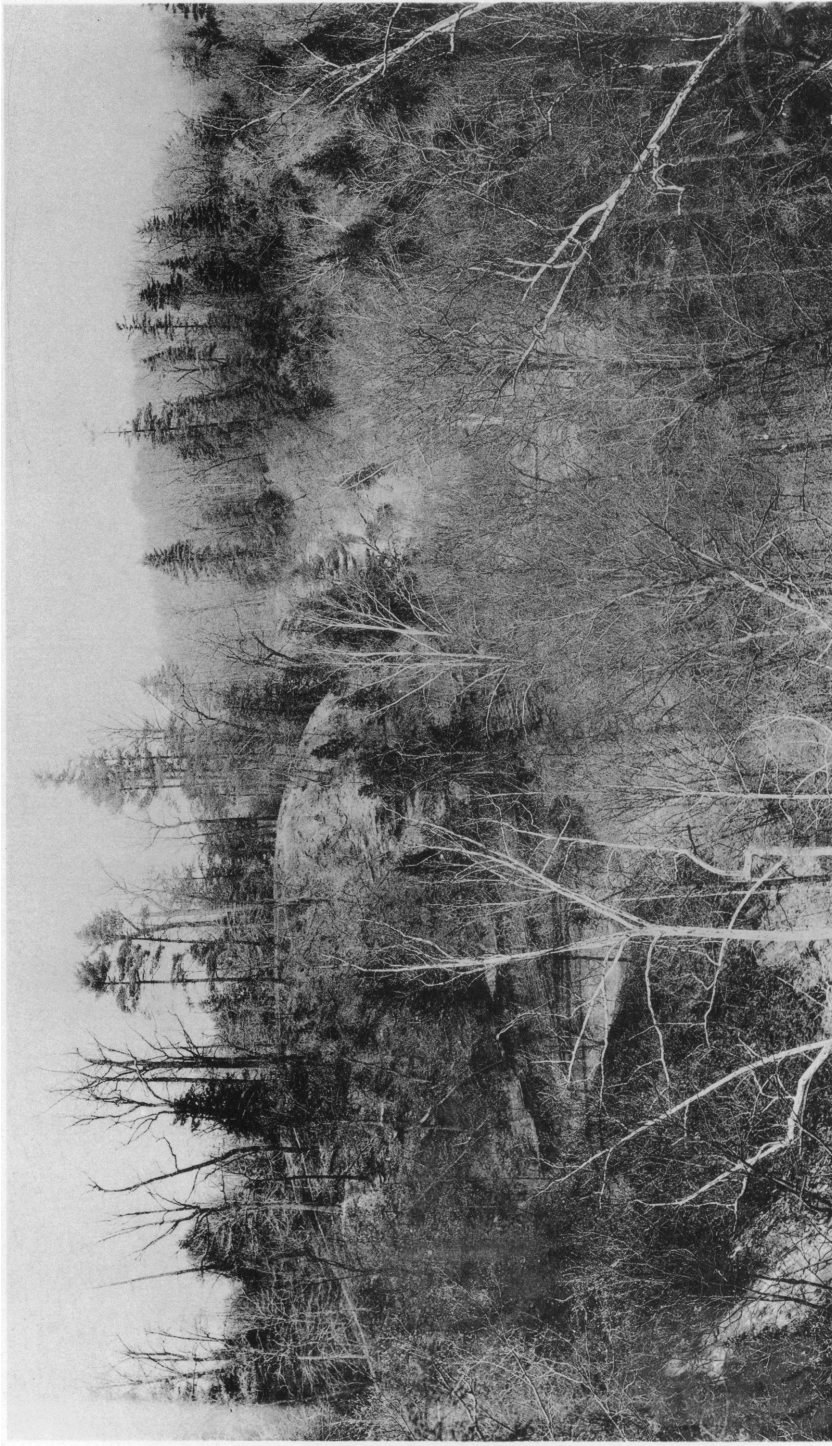
Sketch of Pine Hills and Bluff Mills from top of Pine Bluff made during summer of 1884 by George Wesley Reynolds. The Deer and Canine grist mill and sawmill are on the south bank of Sugar Creek in lower center. The Bluff Mills general store is on the roadside opposite the grist mill. All the land on the east side of the road (left), beyond the general store, and the land on the west side of the road, surrounding the gravel pit, are now included in Pine Hills Natural Area. The farm lands shown, except for a small area around the site of the mills and the general store, are covered by second-growth forests. Most of the buildings shown have been destroyed



The Devil's Backbone in Pine Hills Natural Area, a remnant of bedrock between the incised meanders of Indian and Clifty creeks, is the most spectacular scenic feature of the Survey Area. White pines (*Pinus strobus*) occur on the thin soil at the crest of the ridge



White pines (*Pinus strobus*) occupy the steep slopes of Turkey Backbone in Pine Hills Natural Area, and hemlock (*Tsuga canadensis*) groves occur on stream terraces along Clifty Creek south of the Backbone



View of Honey Peak and Pine Bluff in Pine Hills Natural Area, taken during the winter of 1923 by Frank G. Hasselman, showing the general distribution of forest types. Scattered white pines (*Pinus strobus*) occur along the upper slopes of the cliffs, mixed oak-maple-beech forests occupy the upland plateaus, hemlocks (*Tsuga canadensis*) grow on lower slopes and upper stream terraces, sycamores (*Platanus occidentalis*) line the stream channels, and a mixed lowland forest of maple, ash, elm, and other deciduous species occupies the lower stream terraces



Sycamores (*Platanus occidentalis*) line the banks of Indian Creek on the east side of Pine Backbone in Pine Hills Natural Area. The lower slope of the Backbone is covered by a dense stand of hemlock (*Tsuga canadensis*), and scattered white pines (*Pinus strobus*) occur along the crest of the ridge



Hemlock (*Tsuga canadensis*) forest on the lower slope of Turkey Backbone, Pine Hills Natural Area



This hemlock (*Tsuga canadensis*), on the bank of Indian Creek west of Pine Backbone, is one of the largest trees of this species on the Pine Hills tract. The diameter at breast height was 28 inches

