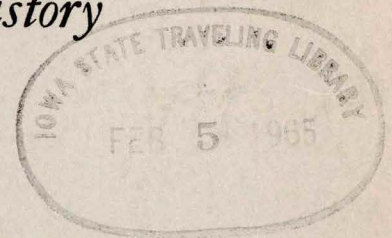


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*State University of Iowa Studies  
in Natural History*



RELICT NATURE OF THE FLORA  
OF WHITE PINE HOLLOW FOREST  
RESERVE, DUBUQUE COUNTY, IOWA

ROBERT F. THORNE

THE BRYOPHYTES OF  
WHITE PINE HOLLOW

ROBERT L. HULBARY

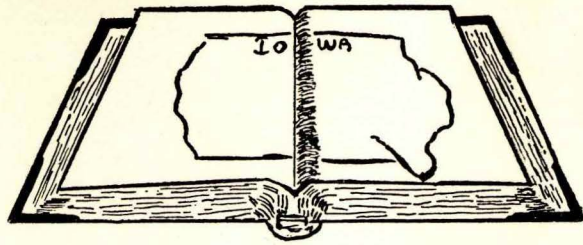
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### ABSTRACT

The relictual nature of White Pine Hollow Forest Reserve is discussed with particular attention to northern and eastern forest relicts on north-facing slopes in the deep ravines and gorges. The location, climate, geology, soils, vegetation, and twelve principal plant habitats of the Hollow are described. Included in an annotated check list of its flora are 519 species of 280 genera and 84 families of vascular plants, of which 445 species of 240 genera and 79 families are considered indigenous in the approximately one square-mile area of the reserve.

## RELICT NATURE OF THE FLORA OF WHITE PINE HOLLOW FOREST RESERVE, DUBUQUE COUNTY, IOWA<sup>1</sup>

Robert F. Thorne

### INTRODUCTION

Far from the mixed coniferous-deciduous forests of the Great Lakes Region is a small, densely forested area in northwestern Dubuque County, Iowa, that is dominated by large trees of the white pine, *Pinus strobus* L. Visible for more than a mile away, the pines tower over the deciduous oaks, hickories, aspens, maples, birches, basswoods, and other hardwoods of this outlier of the northern or "Lake" forest.

Most of the eastern part of this forest, an area slightly larger than a square mile—660 acres—is owned by the state of Iowa and maintained by the State Conservation Commission as White Pine Hollow Forest Reserve. Figure 1 indicates the boundaries of this reserve. The loess-covered uplands are deeply dissected by three branches of Pine Hollow Creek, a tributary of the Little Turkey River. In the reserve numerous plant habitats are supplied by the rolling uplands, deep gorges, shaded tributary ravines, limestone bluffs, ridges, crags, pinnacles, giant blocks, talus slopes, limesinks, springs, and alluvial bottoms. I know of no comparable square-mile area in Iowa that can approach the reserve in the richness of its flora. The botanists at the University of Iowa have collected or observed 519 species of 280 genera and 84 families of vascular plants in the parts of the reserve that have been rather intensively botanized for many years. I believe to be indigenous in the Hollow 445 species of 240 genera and 79 families of "pteridophytes" and seed plants. The area is also rich in bryophytes (Conard, 1932), fungi, and other plant groups. Professor R. L. Hulbary at the University of Iowa has recently compiled a list of 107 species of mosses and liverworts from the Hollow which is being published with this paper.

The portions of the rich flora that draw the botanists repeatedly to this rugged forest are the large northern or "boreal" and eastern forest elements. Some of the species are rare even in the immediately adjacent "driftless" area. Species like *Gymnocarpium robertianum* (Hoffm.) Newm., *Chrysosplenium ioense* Rydb., *Ribes hudsonianum* Richards,

<sup>1</sup>This project has been supported largely by funds from the National Science Foundation and from the Old Gold Development Fund of the University of Iowa. The author, formerly Professor of Botany, University of Iowa, is now Taxonomist, Rancho Santa Ana Botanic Garden, Claremont, California, and Professor, Claremont Graduate School.

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Figure 1. Aerial photograph of White Pine Hollow with boundaries indicated for the Forest Reserve owned by the state of Iowa. Note the three main branches—eastern, southeastern, and southwestern—of Pine Hollow Creek. The top of the figure is due north. (Taken from Stabilization Service, USDA, Aerial Photograph SV-IT-51.)

*Viola renifolia* Gray, and *Habenaria hookeri* Torr., might be expected more naturally in the boreal (Canadian) forests of northern Wisconsin and Minnesota and adjacent Canada. Other species that are rather rare in Iowa are *Lycopodium obscurum* L., *Dryopteris marginalis* (L.) Gray, *Adoxa moschatellina* L., *Jeffersonia diphylla* (L.) Pers., *Convolvulus spithameus* L., *Monotropa hypopithys* L., *Dicentra canadensis* (Goldie) Walp., *Aconitum noveboracense* Gray, *Clematis verticillaris* DC., *Hydrastis canadensis* L., *Rubus pubescens* Raf., *Salix sericea* Marsh., *Hybanthus concolor* (T.F. Forst.) Spreng., *Carex backii* Boott, *C. careyana* Torr., *Luzula acuminata* Raf., *L. campestris* (L.) DC., *Streptopus roseus* Michx., *Zigadenus glaucus* Nutt., *Corallorhiza maculata* Raf., *Triphora trianthophora* (Sw.) Rydb., *Elymus riparius* Wieg., *Oryzopsis asperifolia* Michx., *Poa paludigena* Fern. & Wieg., *P. wolfii* Scribn., and *Schizachne purpurascens* (Torr.) Swallen. Many other species, though not rare in northeastern Iowa, are essentially limited to the northeastern one-eighth of the state. *Floerkea proserpinacoides* Willd. has not yet been found elsewhere in Iowa.

#### LOCATION

White Pine Hollow Forest Reserve is located mostly in the SE  $\frac{1}{4}$  of Section 6, SW  $\frac{1}{4}$  of SW  $\frac{1}{4}$  of Section 5, E  $\frac{1}{2}$  of Section 7, and W  $\frac{1}{2}$  of Section 8 of Liberty Township (T 90 N, R 2 W) in the extreme northwestern corner of Dubuque County. Its approximate coordinates are 42° 38' north latitude and 91° 07' west longitude. The Hollow is two miles northwest of Luxemburg, about twenty-five miles west-northwest of the junction of the states of Illinois, Wisconsin, and Iowa at Dubuque on the Mississippi River, and sixty-six miles south of the Minnesota-Iowa state line.

#### CLIMATE

The local climate is the typically severe mid-continental type with very cold winters and hot summers. Records for Delaware and Dubuque show about thirty one inches of well-distributed precipitation per year, with about two-thirds falling during the warm season from April through September. At Delaware the average January temperature is 18.1° F, the average July temperature is 73.3° F, the lowest recorded temperature is -31°, and the highest is 108°. Dubuque is on the Mississippi River with a river level of 592 feet, more than 500 feet lower than the highest land in the Reserve. The growing season of consecutive frost-free days per year in the Hollow is therefore considerably less than

the 182-day average for Dubuque. The 158-day average for the vicinity of Delaware, a town to the southwest, is probably much closer to that of the Hollow, as is also the 155-day average at Oelwein. Northwest winds are prevalent in winter and southerly winds in the warm season. This climatic data and more can be obtained from *Climate and Man, Yearbook of Agriculture* (United States Department of Agriculture, 1941).

#### GEOLOGY

The Pine Hollow uplands lie along the eastern margin of the Kansan drift sheet, but the topography and flora of this deeply dissected area are more characteristic of the immediately adjacent "driftless" region with its occasional traces of Nebraskan drift. Only the uplands are now mantled with Kansan drift and wind-deposited loess. The spectacular scenery of the reserve can be attributed largely to the erosive action of the several branches of Pine Hollow Creek wearing through loess, Kansan drift, and the underlying bedrock. This last is the massive Niagara dolomitic limestone, which was deposited perhaps 370,000,000 years ago in a shallow, land-locked Silurian sea. The softer and older Ordovician Maquoketa shales below the Niagara series are exposed in the deepest ravines and gorges. As these shales have been eroded away by surface waters, particularly by floods sweeping through the narrow gorges, the overhanging limestone has broken off in great blocks and tumbled or slumped down the precipitous cliffs and steep slopes into the valley bottoms. On less steep slopes the massive blocks have moved apart sufficiently to form the extensive "rock city" in the northern part of the reserve. High, freshly exposed limestone bluffs along the main gorge, as shown in Figure 2, indicate that this process continues. The numerous deep sinks and caverns in the massive limestone, and the springs welling out of the bluffs at the base of the Niagara series probably assist materially the more violent destructive forces of the surface waters.

One of the most unusual features of the Hollow is the large "hogback," visible in Figures 3 and 4, in the eastern part of the reserve. The incised meanders of the main stream and its eastern branch, which joins the southeastern branch at the south end of the hogback, have nearly isolated an island of pine- and oak-clad uplands in the heart of the forest. This forested near-island is clearly demarked in Figure 1, whereas in most available topographic maps of the area, such as Calvin's geological map of Dubuque County (1900), this striking feature is entirely overlooked. Only a thin ridge, or "neck," with precipitous

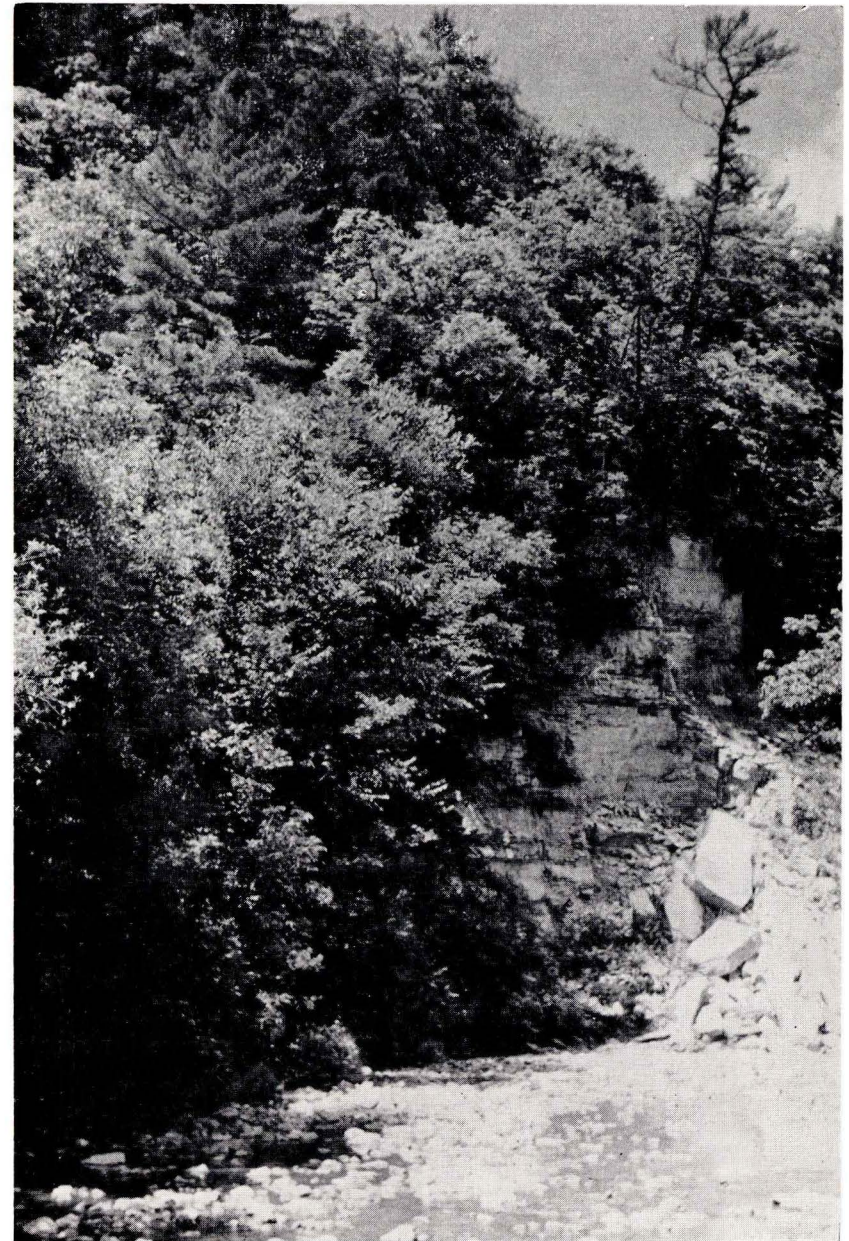


Figure 2. Freshly exposed Niagara limestone bluff in the main gorge, showing recent undercutting by Pine Hollow Creek and slumping of limestone blocks. This south-facing bluff appears as a white spot near the center of Figure 4.

slopes to east and west, maintains the continuity of the forest on the hogback and the adjoining east-west ridge. Tornadic winds in May, 1958, did much damage to the exposed pine-oak forest on the hogback, breaking and felling trees and large branches. Torrential rains accompanying the winds soon filled the bottoms of the ravines, and the resulting freshets (real "gully-washers") scoured the herbaceous vegetation from the stream beds and lower banks. My taxonomy class was with me in the reserve at the time, and we were much impressed by the destructive forces of wind and water.

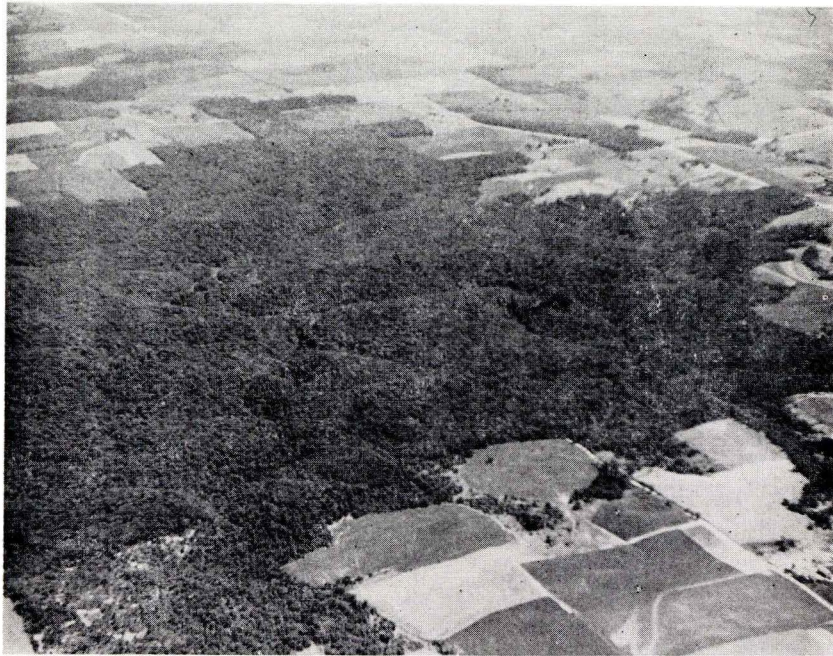


Figure 3. Aerial view of White Pine Hollow looking toward the northeast. Note the "hogback" to the right (east) side of the forest. Also shown is the entrance road at lower right.

The uplands in the reserve, as indicated in the Turkey River Quadrangle (United States Department of Interior, 1957), at several points reach elevations in excess of 1,100 feet. In the NW  $\frac{1}{4}$  of Section 8 an elevation of more than 1,140 feet is shown. The lowest point in the reserve, where Pine Hollow Creek leaves the northwest corner, has an elevation of only 820 feet. Thus within this square-mile area the range of elevation is at least 320 feet. The tops of the often precipitous, in

places nearly vertical, bluffs loom above the gorge bottoms from less than 100 feet near the south end to more than 300 feet at the northernmost boundary of the reserve. Figure 5 gives some idea of the depth of the gorge near the south end of the Hollow.

Pine Hollow Creek, formed by the three main branches in the reserve, joins the Little Turkey River in neighboring Delaware County. The Little Turkey in Clayton County to the north flows into the Turkey River, which in turn is tributary to the adjacent Mississippi River. All of these streams are confined to deep gorges in many places by tower-



Figure 4. Aerial view of White Pine Hollow looking toward the northwest. Note the "hogback" in lower center with the limestone bluff of Figure 2 just above it. The eastern branch enters from lower right and Pine Hollow Creek meanders northwestward at upper right.

ing limestone cliffs in the generally picturesque, rugged terrain of Iowa's "driftless" area. Further information about the geology of the

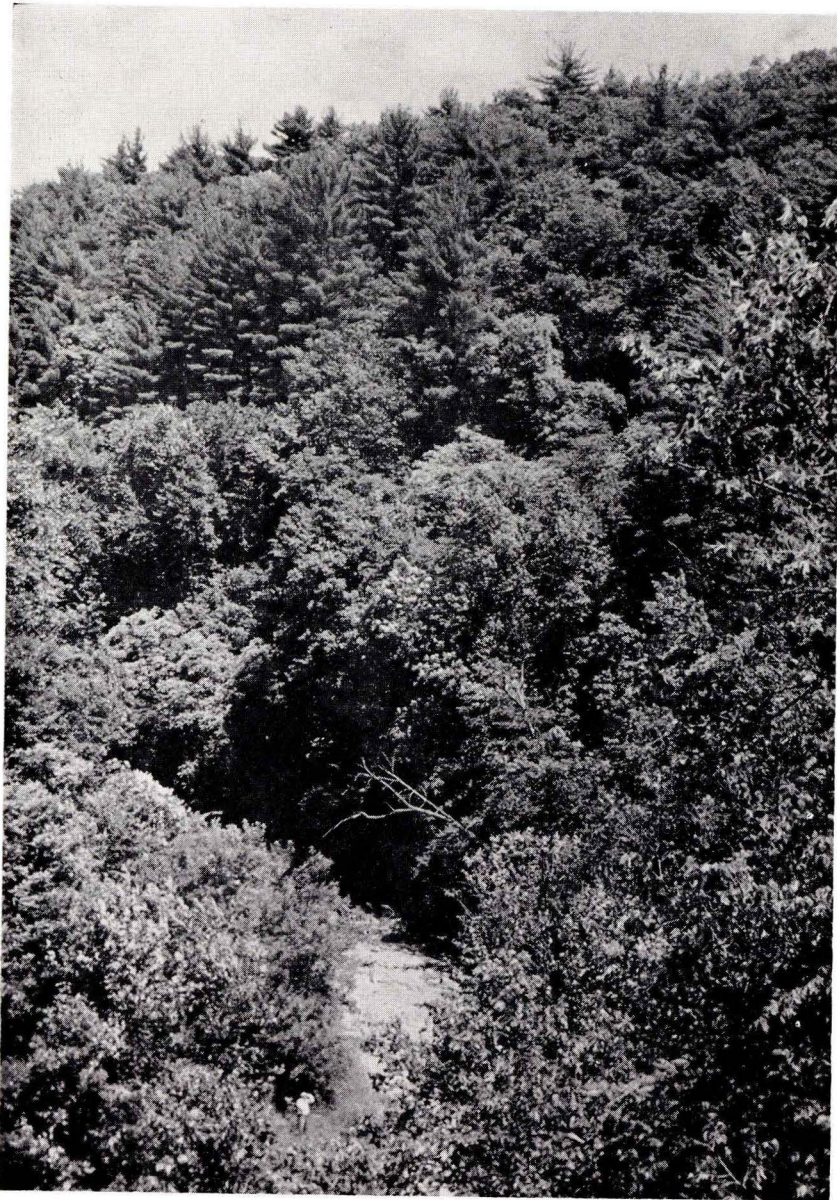


Figure 5. The gorge of the southeastern branch of Pine Hollow Creek with the bordering west-facing ridge of *Pinus strobus-Quercus* forest in the background. Note figure of man at bottom center.

Pine Hollow and Little Turkey areas can be obtained from Calvin (1898) and Calvin and Bain (1900).

#### SOILS

The loessial materials under forested conditions have developed on the rolling uplands into the acid, grayish Clinton silt loam and its steep phase. In the valleys and gorges the loessial and Kansan drift deposits have been washed down from the uplands and reworked along with residual talus to form the bottomland soils of the Wabash silt loam and its stony silt loam colluvial phase. These are the only soil types mapped by Stevenson, Brown, et al. (1924) for the Pine Hollow area.

#### VEGETATION

The "driftless" area in Iowa has apparently remained free of glacial ice since the Nebraskan glacier covered the landscape. How much of a refuge it provided the biota during succeeding glacial incursions of Iowa has been much debated. Shimek (1948) thought that severe climate in the area during the several subsequent glacial stages must have caused a nearly complete migration or elimination of the interglacial biotas. I agree with him. The most recent discussion of the botanical significance of the "driftless" area of the Upper Midwest is by Hartley (1961). His ideas are based upon an extensive and intimate knowledge of the flora and vegetation of the whole "driftless" region, and are, therefore, deserving of careful consideration.

With the recession of Kansan ice the Pine Hollow area has been available continuously for a changing biota. Presumably southern and eastern forms migrated into the region during interglacial stages, only to be replaced by northern forms during glacial stages. With the recession of the last glacier of the Wisconsin stage from nearby areas in Iowa and Illinois, northern species then in the neighborhood may have survived in the small islands of "boreal" microclimate in the Hollow afforded by the shaded north-facing talus slopes. These slopes are constantly chilled by cold air and seepage water flowing from crevices in the cavernous Niagara limestone and down the steep, rocky faces. Although perhaps preserved as relicts in these and similar small areas in other counties of northeastern Iowa, these northern species were eliminated by the warmer, dryer climate from the surrounding terrain, sometimes for a hundred or two hundred miles farther north. Examples of such presumed northern relicts in the Hollow are the above-listed *Lycopodium obscurum*, *Gymnocarpium robertianum*, *Adoxa moschatellina*, *Aconitum noveboracense*, *Rubus pubescens*, *Chrysocephalum*

*ioense*, *Ribes hudsonianum*, *Viola renifolia* and *Streptopus roseus*.

Another type of possibly relict community is the rich assemblage of eastern elements of the southern forest of Curtis (1959). Some of the species, like *Floerkea proserpinacoides*, *Jeffersonia diphylla*, *Hydrastis canadensis*, *Hybanthus concolor*, *Carex backii*, *C. careyana*, *C. woodii*, and *Triphora trianthophora* are known in the state only from the reserve or from a few other similar stations in eastern Iowa. These might have found permanent refuge in the deep, loamy, forested slopes of the reserve when the drier phases of postglacial climate eliminated them from less protected surrounding areas. Cooperrider (1962) has discussed the limitation of certain species to north-facing slopes in adjacent Iowa counties to the southeast.

Recent chance long-distance dispersal of seeds and other dispersal units is another possible explanation for these "relicts." Disseminules may have been carried by wind, birds, or other agents at random to suitable habitats in relatively recent years. Establishment of a few of the "driftless" area species in scattered habitats farther south in more recently glaciated Iowa terrain are perhaps examples of such chance dispersal. Yet even these disjuncts may be relicts of former more extensive ranges of species now largely confined to the "driftless" area. The strongest argument against long-distance dispersal as the explanation of the origin of northern and eastern species in White Pine Hollow is the rather large communities of characteristic species found both on the north-facing talus slopes and in the deep loam of the maple-basswood forests. Would random long-distance dispersal alone be adequate in a few thousand years to supply these habitats with rich, balanced biotas?

In a much larger sense the whole Pine Hollow forest is a relict. The obliteration or severe disturbance of favorable forest habitats elsewhere in eastern Iowa by man has, of course, greatly increased the apparent relictual nature of the reserve.

#### HABITATS

The diversity of the habitats for plants in the Hollow and their frequent study by botanists and other naturalists make desirable a brief consideration of the principal habitats and their most characteristic plants. In the following annotated check list of the vascular plants of White Pine Hollow Forest Reserve the range of habitats for each species in the Hollow is given by numerals corresponding to those used in the headings of the following descriptive paragraphs.

1. **Rolling uplands.** A rather extensive xeric phase of the southern forest (Curtis, 1959) has developed on the leached, acid, grayish Clinton silt loam on the loess-covered uplands surrounding the deep ravines and gorges of the reserve. The forest is dominated by *Quercus*, particularly *Q. alba*, *Q. ellipsoidalis*, and *Q. macrocarpa*, and by *Carya ovata* and *C. cordiformis*, with a scattering of *Prunus serotina*, *Populus grandidentata*, *P. tremuloides*, and *Ulmus americana*. *Pinus strobus* from the pine ridges is an occasional emergent in the forest, and *Acer saccharum*, *Tilia americana*, *Fraxinus americana*, *Ulmus rubra*, and *Ostrya virginiana* intrude on more mesic sites from the adjacent maple-basswood forests of the protected lower slopes. The species in the ground layer are quite numerous, as indicated in Figure 6.



Figure 6. *Quercus-Carya-Acer* forest in the southern part of the reserve. The herbaceous understory is richly developed, with *Osmunda claytoniana* and seedling *Acer saccharum* recognizable in the foreground.





Figure 7. *Pinus-Quercus* forest on west-facing ridge east of the southeastern branch of Pine Hollow Creek. The deciduous forest on the left is on the south end of the hogback.

2. **Ridges.** The tops and upper rocky slopes of ridges and exposed bluff crests support an open forest of *Pinus strobus*, *Quercus alba*, *Q. ellipsoidalis*, *Q. rubra*, *Betula papyrifera*, *Carya cordiformis*, *Populus grandidentata*, and *P. tremuloides*. The pine-needle-strewn, highly leached, acid, rocky soil is presumably the thin, steep phase of the Clinton silt loam. In it thrive such characteristic herbs as *Monotropa uniflora*, *Pyrola elliptica*, *Lathyrus ochroleucus*, *Carex pedunculata*, *Luzula acuminata*, *Maianthemum canadense*, *Goodyera pubescens*, *Habenaria hookeri*, *Danthonia spicata*, *Oryzopsis asperifolia* and *Schizachne purpurascens*. Excellent examples of this pine-oak forest cover the top of the hogback and the top and west-facing upper slopes of the pine ridge east of the southeastern and eastern branches of Pine Hollow Creek. The abundance of *Pinus strobus* on the west-facing ridge is illustrated by Figures 5 and 7. This ridge forest most closely approximates the northern, or "Lake," forest of Curtis (1959). On the lower slopes of these ridges the pine-oak forest grades into the sugar maple-basswood forest on rocky, deep loamy soil.

3. **Openings on limestone ridges and bluff crests.** The thinness of the soil on the tops of ridges and crests of bluffs, crags, pinnacles, and huge blocks permit in many places no, or only sparse, open growth of

pinus and oaks. Among the scattered trees miniature dry prairies occupy this thin, rocky soil on the limestone. Because of the limited total area of these prairie openings, the prairie grasses, legumes, composites, and other calcicolous heliophytes have a precarious existence in the local flora. The grassy openings and prairie species are best developed along the central ridge at the north end of the hogback west to the "rock city." A few of the prairie species restricted to these openings in the reserve are *Asclepias tuberosa*, *Lithospermum canescens*, *Coreopsis palmata*, *Parthenium integrifolium*, *Senecio plattensis*, *Solidago rigida*, *Convolvulus spithameus*, *Euphorbia corollata*, *Scutellaria parvula*, *Amorpha canescens*, *Desmodium paniculatum*, *Lespedeza capitata*, *Petalostemon purpureus*, *Oxalis violacea*, *Heuchera richardsonii*, *Viola pedatifida*, *Hypoxis hirsuta*, *Sisyrinchium campestre*, *Bouteloua curtipendula*, and *Sorghastrum nutans*.

4. **Exposed, dry limestone cliffs and ledges.** The precipitous bluffs and barren, south- or west-facing cliffs undercut by Pine Hollow Creek in the central gorge furnish a habitat for calcicolous plants in the crevices, on the ledges, and on the crests of the cliffs. Most of the species in this rather dry habitat are especially adapted for xeric environments. *Pinus strobus* and *Juniperus virginiana* cling to the very brink of the cliffs, often accompanied by *Betula papyrifera*, *Quercus muhlenbergii*, and the shrubby *Rhus typhina*, *Viburnum rafinesquianum*, *V. opulus trilobum*, *Cornus rugosa*, *Rhamnus lanceolata*, *Amelanchier arborea*, *A. spicata*, *Physocarpus opulifolius*, and *Prunus virginiana*. Vines are rather abundant, as *Lonicera prolifera*, *Celastrus scandens*, *Menispermum canadense*, *Clematis viticillaris*, *Parthenocissus quinquefolia*, *Vitis aestivalis*, and *V. riparia*. Often out of reach on the perpendicular cliffs are such crevice herbs as *Pellaea glabella*, *Campanula rotundifolia*, *Solidago sciaphila*, *Aquilegia canadensis*, *Galium boreale*, *Carex eburnea*, and *Zigadenus glaucus*. Figures 2 and 8 illustrate well this dry, calcareous habitat.

5. **Protected, moist limestone ledges.** The same Niagara dolomitic limestone, when shaded, especially on east- and north-facing bluffs, and moistened by water draining from the uplands, is mantled, as shown in Figure 9, with a green mat of mosses and liverworts and such delicate ferns and flowering plants as *Cystopteris bulbifera*, *Asplenium rhizophyllum*, *Cryptogramma stelleri*, *Mitella diphylla*, *Sullivantia renifolia*, *Hackelia americana*, and *Arabis hirsuta*.

6. **North-facing talus slopes.** Most noteworthy of the habitats in the Hollow are the north-facing, moist, steep, limestone talus slopes which are bathed continuously with cold air and often with cold seepage water flowing down the slopes from crevices in the cavernous Niagara

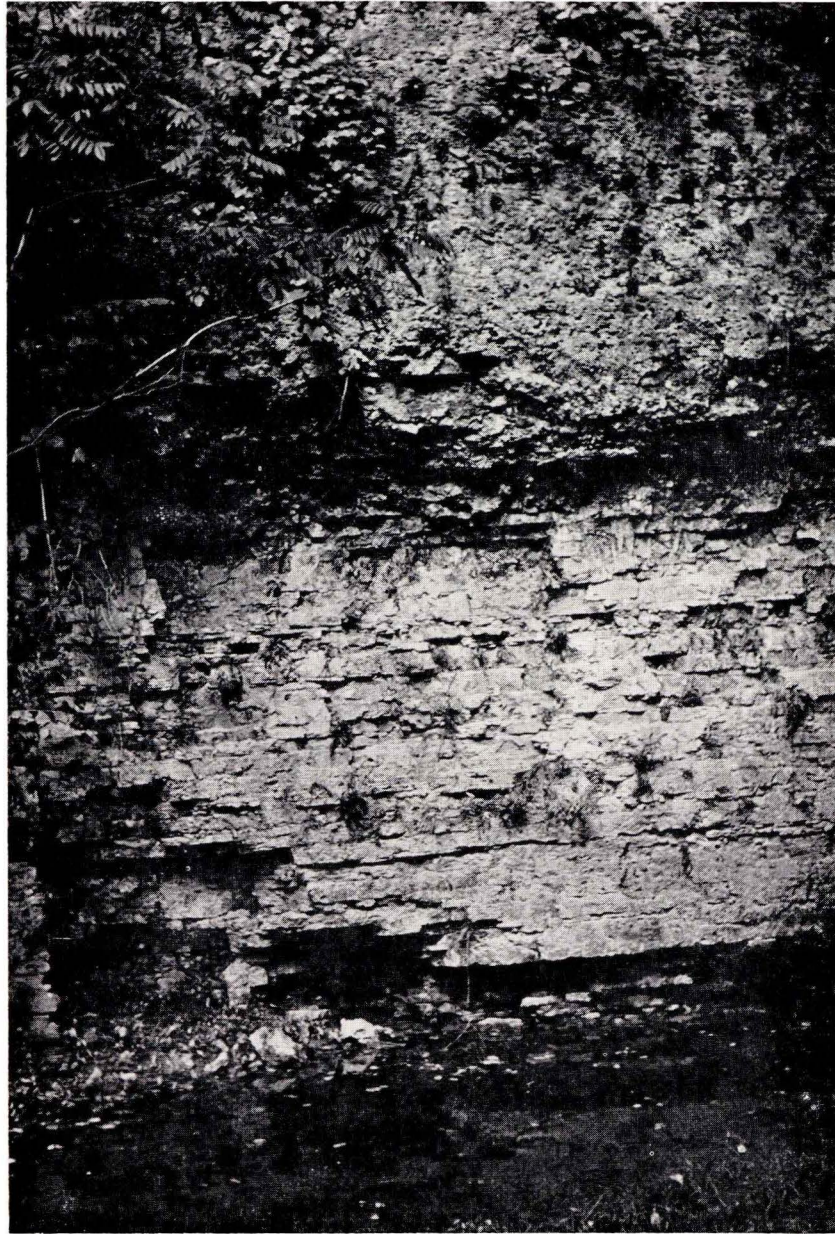


Figure 8. Vertical Niagara limestone bluff opposite cabin in southeastern corner of the reserve. Note *Rhus typhina* and *Vitis* at upper left and small clumps of crevice plants on dry cliff face.



Figure 9. Moist limestone blocks at southern end of the reserve covered with bryophytes and ferns, particularly *Cystopteris bulbifera*.

limestone. In some of the crevices ice can be found persisting into the summer. In this special "boreal" microclimate occur some of the rarest flowering plants and bryophytes in Iowa. The dripping, often overhanging, limestone ledges and talus are usually thickly carpeted with moss, and whole slopes are usually covered with a tangled mat of sprawling *Taxus canadensis*. The scattered trees on the slopes are mostly *Pinus strobus*, *Betula papyrifera*, *B. alleghaniensis*, and *Juglans cinerea*. Apparently limited to this habitat in the reserve are *Lycopodium lucidulum*, *L. obscurum*, *Gymnocarpium dryopteris*, *G. robertianum*, *Adoxa moschatellina*, *Corylus cornuta*, *Diervilla lonicera*, *Sambucus pubens*, *Stellaria longifolia*, *Circaea alpina*, *Epilobium angustifolium*, *E. glandulosum adenocaulon*, *Aconitum noveboracense*, *Rhamnus alnifolia*, *Amelanchier sanguinea*, *Rubus pubescens*, *Galium asprellum*, *Salix bebbiana*, *Chrysosplenium ioense*, *Ribes hudsonianum*, *Viola renifolia*, *Streptopus roseus*, *Agropyron trachycaulum*, *Bromus*

*latiglumis*, *Elymus riparius*, and *Poa paludigena* (?). Further discussions of these talus slopes in the Hollow and elsewhere in northern Iowa may be found in Conard (1932, 1938, 1940), Thorne (1953, 1956), and Hartley (1961). Figure 10 depicts a rather steep, rocky north-facing slope with some cold air drainage.

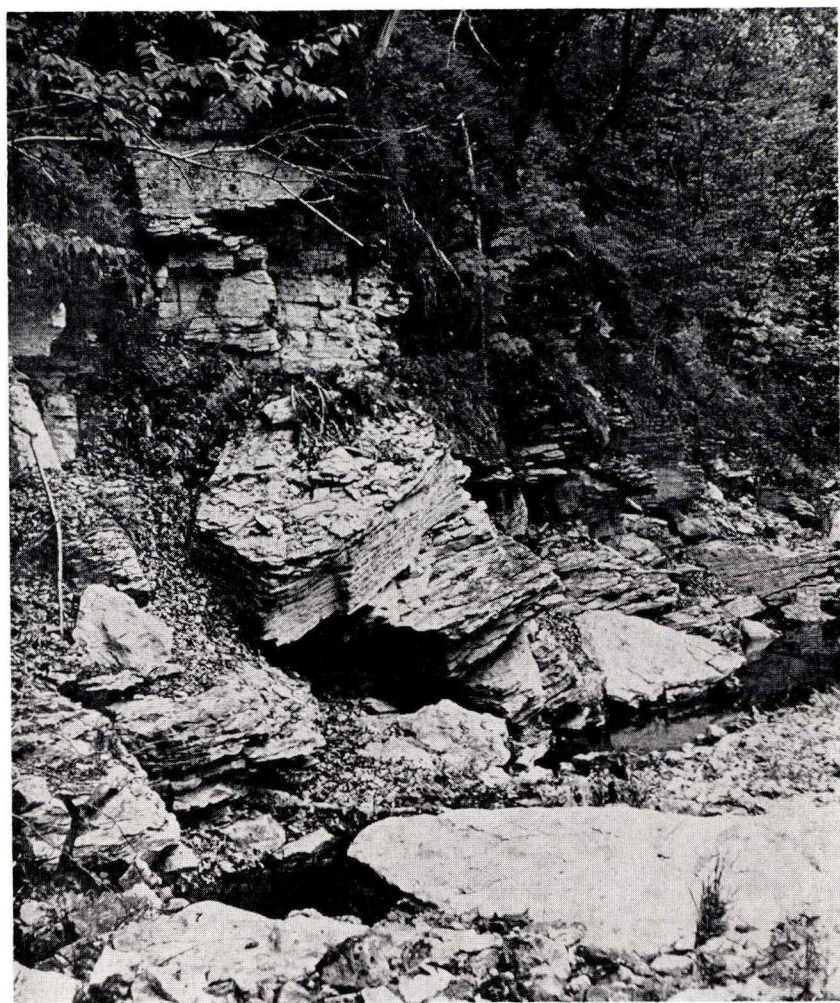


Figure 10. A rocky, steep north-facing slope undercut by Pine Hollow Creek across from the south end of the hogback. Branches of *Betula* are visible at the top and a *Taxus*-covered slope at upper right.

7. North and east-facing lower, rocky slopes. *Acer saccharum*-*Tilia americana* forest covers the protected, mostly north- and east-facing lower slopes in the deep ravines and gorges of the Hollow. Most of the lower slopes supporting this forest have a deep, loamy soil studded with talus blocks and boulders from the Niagara limestone bluffs above or with projecting ledges of this bedrock. Although the hard maples and basswood are dominant in this forest, many other trees, as *Quercus rubra*, *Juglans cinerea*, *Fraxinus americana*, and *F. nigra* are common. Characteristic small trees and shrubs are *Ostrya virginiana*, *Carpinus caroliniana*, *Hamamelis virginiana*, *Cornus alternifolia*, *Staphylea trifolia*, and *Dirca palustris*. The herbaceous ground layer is especially rich in ferns, sedges, and spring wild flowers, too numerous to list here. Figure 11 shows an *Acer*-*Tilia* forest on a lower slope, on which young maple trees dominate the undergrowth.



Figure 11. An *Acer saccharum*-*Tilia americana* forest on a lower ravine slope with rich *Acer* reproduction and a lush herbaceous ground layer.

8. **Springy, shaded ravines.** Wet soil due to continuous seepage separates the few springy, shaded ravines from the previous habitat. These deep, wet, loamy seepage slopes are usually included in maple-basswood forest. The only station known in Iowa for the inconspicuous herb *Floerkea proserpinacoides* is on a low, north-facing springy slope along Pine Hollow Creek in the northwestern corner of the reserve. With it grow such rarities as *Equisetum pratense*, *Athyrium pycnocarpon*, *Dryopteris goldiana*, *Thelypteris hexagonoptera*, and *Caltha palustris*.

9. **Alluvial bottomlands.** The Wabash silt loam is a bottomland soil that has been derived through washing down and reworking of loessial and glacially deposited upland soils like the Clinton silt loams. It is subject to flooding, scouring, and intermixing with quantities of rocky and sandy debris. It supports mainly a *Salix* forest or *Salix* thicket on the wettest sites along the main stream. The dominant species are *Salix amygdaloides*, *S. nigra*, the introduced *S. alba* and *S. fragilis*, *Acer negundo*, *Fraxinus pensylvanica*, and *Ulmus americana*. Less common are *Populus deltoides*, *Acer saccharinum*, *Quercus macrocarpa*, *Juglans nigra*, *Fraxinus nigra*, and *Celtis occidentalis*. *Salix interior* and *S. rigida* are the abundant thicket formers on sand bars. Depending on the richness of the loam and the degree of drainage, the bottomland forest can vary from the typical wet *Salix* forest through *Ulmus americana-Fraxinus pensylvanica-Acer saccharinum* forest on sites of intermediate drainage to *Acer saccharum-Tilia americana* forest at the foot of the bluff slopes. The best examples of alluvial bottomland forest are to be found near the junction of the southwest tributary with Pine Hollow Creek and thence down the Hollow to the northwest boundaries of the reserve.

10. **Spring holes and spring runs.** Potable, clear, cold water emerges in several springs from the junction of the Niagara limestone and the Maquoketa shales at various points along the main gorge and the lower reaches of the tributary streams. At the edge of the spring holes and along their spring runs are found several characteristic aquatic or marsh plants, particularly *Cardamine bulbosa*, *C. pennsylvanica*, *Senecio aureus*, *Polygonum sagittatum*, *Salix discolor*, *Glyceria grandis*, and *G. striata*.

11. **Stream margins.** The margins of Pine Hollow Creek and its main branches, chiefly above the alluvial forested bottoms, are characterized by a number of species of open, marshy, sandy, or rocky places. Most do not fit in any of the preceding communities. Perhaps the most striking plant in this habitat, shown in Figure 12, is *Equisetum hyemale*,

which forms extensive colonies on margins and terraces of the southeastern branch and the main stream. The less colonial members of the stream bank and stream bed community, infiltrated with numerous weeds of foreign or local origin, are frequently scoured out by freshets. Hence, this community is subject to rapid changes, both additions and deletions, in its species list. The weedy members of this much disturbed community are listed only under the next habitat.



Figure 12. A colony of *Equisetum hyemale* on a low terrace on the east side of the southeastern branch of Pine Hollow Creek.

12. **Disturbed habitats.** Most of the non-indigenous plants in the reserve flora are found in the beds and along the margins of the streams. The disseminules of these weeds are presumably washed into the Hollow from adjacent fields, roadways, and farmyards, or carried in

by visitors. Other areas of disturbance that permit invasion by ruderals are the parking lot at the entrance, paths, second-growth woods at the south end of the reserve, the area around the cabin of the Dubuque Nature Club, and the areas where the state has permitted timber operations.

ANNOTATED CATALOGUE OF THE VASCULAR PLANTS OF WHITE  
PINE HOLLOW FOREST RESERVE

In the following list of vascular plants the "°" represents species that I consider to be non-indigenous in the reserve. The "o" indicates that no voucher is as yet preserved from the Hollow in the University of Iowa Herbarium of this species, usually a conspicuous and abundant one. Conversely, those species without an "°" are believed to be indigenous in the reserve, and those without an "o" are represented from the Hollow by at least one voucher in the University of Iowa Herbarium. My students and I have collected or observed most of the listed species in the reserve during the more than ten years we have visited it, usually several times a year. A very few are represented only by old specimens collected by Shimek, because we have been unable to rediscover them in the Hollow. One such is the rare fern *Dryopteris marginalis*. To save space, collection numbers are omitted, as are data about frequency and abundance of each species. The range of habitats occupied by each species in the reserve, as already stated, is indicated by inserting after each species the numerals used in the preceding habitat descriptions.

**Equisetae**

Equisetaceae

- Equisetum arvense* L.—11  
*Equisetum hyemale* L.—11  
*Equisetum pratense* Ehrh.—7, 8

**Lycopodiaceae**

Lycopodiaceae

- Lycopodium lucidulum* Michx.—6  
*Lycopodium obscurum* L.—6

**Filices**

Aspidiaceae

- Athyrium filix-femina* (L.) Roth—1, 2, 7  
*Athyrium pycnocarpon* (Spreng.) Tidestr.—8

*Athyrium thelypteroides* (Michx.) Desv.—7, 8

*Cystopteris bulbifera* (L.) Bernh.—5, 6, 7

*Cystopteris fragilis* (L.) Bernh.—1, 2, 5, 7, 9

*Dryopteris goldiana* (Hook.) Gray—7, 8

*Dryopteris marginalis* (L.) Gray—7

*Dryopteris spinulosa* (O.F. Muell.) Watt.—2, 7

*Gymnocarpium dryopteris* (L.) Newm.—6

*Gymnocarpium robertianum* (Hoffm.) Newm.—6

*The Flora of White Pine Hollow*

*Matteucia struthiopteris* (L.) Tordaro—6, 7, 8, 9

*Onoclea sensibilis* L.—1, 8, 9

*Thelypteris hexagonoptera* (Michx.) Weatherby—8

Aspleniaceae

°*Asplenium platyneuron* (L.) Oakes—1

*Asplenium rhizophyllum* L.—5, 6

Ophioglossaceae

*Botrychium dissectum* Spreng.—1

*Botrychium virginianum* (L.) Sw.—1, 7

Osmundaceae

*Osmunda claytoniana* L.—1, 2, 7, 8

Pteridaceae

*Adiantum pedatum* L.—1, 2, 7

*Cryptogramma stelleri* (Gmel.) Prantl—5, 6

*Pellaea glabella* Rydb.—4, 5, 6

*Pteridium aquilinum* (L.) Kuhn—1, 2

**Coniferae**

Cupressaceae

*Juniperus virginiana* L.—1, 2, 3, 4

Pinaceae

*Pinus strobus* L.—1, 2, 4, 6

Taxaceae

*Taxus canadensis* Marsh.—6, 7

**Angiospermae-Dicotyledoneae**

Aceraceae

*Acer negundo* L.—1, 9

°*Acer saccharinum* L.—9

*Acer saccharum* Marsh. (incl. *A. nigrum* Michx. f.)—1, 2, 7, 9

Adoxaceae

*Adoxa moschatellina* L.—6

Amaranthaceae

°*Amaranthus retroflexus* L.—12

Anacardiaceae

*Rhus glabra* L.—1, 3

*Rhus typhina* L.—1, 2, 4, 7

*Toxicodendron radicans* (L.) O. Ktze.—1, 2, 4, 7, 9

Apiaceae (Umbelliferae)

°*Cicuta maculata* L.—11

*Cryptotaenia canadensis* (L.) DC.—1, 7, 9, 10

°°*Daucus carota* L.—12

*Heracleum maximum* Bartr.—1, 11

°*Osmorhiza claytonii* (Michx.) C. B. Clarke—1, 2, 7, 9

*Osmorhiza longistylis* (Torr.) DC.—1, 7

°*Pastinaca sativa* L.—12

°*Sanicula canadensis* L.—1

*Sanicula gregaria* Bickn.—1, 7

*Sanicula marilandica* L.—1, 7

*Sanicula trifoliata* Bickn.—1, 2, 7

*Taenidia integerrima* (L.) Drude—3

*Zizia aurea* (L.) W. D. J. Koch—1, 2, 3

Apocynaceae

*Apocynum androsaemifolium* L.—1, 2, 3

°°*Apocynum cannabinum* L.—12

Araliaceae

*Aralia nudicaulis* L.—1, 2, 3, 7

*Aralia racemosa* L.—1, 5, 6, 7, 8

*Panax quinquefolius* L.—1, 2, 7

Aristolochiaceae

*Asarum canadense* L.—7

Asclepiadaceae

*Asclepias exaltata* L.—1, 2, 7

*Asclepias incarnata* L.—11

°°*Asclepias syriaca* L.—12

*Asclepias tuberosa* L.—3

*Asclepias verticillata* L.—3, 11

Asteraceae (Compositae)

°*Achillea millefolium* L.—12

*Ambrosia artemisiifolia* L.—11

*Ambrosia trifida* L.—11

°*Antennaria neglecta* Greene—1, 3

*Antennaria plantaginifolia* (L.) Richards.—1, 2, 3

°*Anthemis cotula* L.—12

°*Arctium minus* (Hill) Bernh.—12

°*Artemisia biennis* Willd.—12

*Aster azureus* Lindl.—3

*Aster cordifolius* L.—1

*Aster drummondii* Lindl.—3

*Aster hesperius* Gray—11

*Aster lateriflorus* (L.) Britt.—2, 11

*Aster novae-angliae* L.—10

*Aster pilosus* Willd.—1, 11

*Aster prenanthoides* Muhl.—7, 10

- Aster sagittifolius* Wed.—1, 2, 7  
*Aster shortii* Lindl.—1, 7  
*Aster simplex* Willd.—1, 11  
*Bidens cernua* L.—11  
*Bidens frondosa* L.—11  
*Cacalia muhlenbergii* (Sch. Bip.)  
 Fern.—7  
 °°*Chrysanthemum leucanthemum*  
 L.—12  
*Cirsium altissimum* (L.) Spreng.—  
 1, 3  
 °*Cirsium arvense* (L.) Scop.—12  
 °*Cirsium discolor* (Muhl.) Spreng.—  
 11  
 °°*Cirsium vulgare* (Savi) Tenore—  
 12  
 °*Conyza canadensis* (L.) Cronq.—  
 12  
*Coreopsis palmata* Nutt.—3  
*Erigeron annuus* (L.) Pers.—11  
*Erigeron philadelphicus* L.—4, 11  
*Erigeron pulchellus* Michx.—2, 3  
*Eupatorium perfoliatum* L.—10, 11  
*Eupatorium purpureum* L.—1, 2, 7  
 °*Eupatorium rugosum* Houtt.—1, 7  
*Helenium autumnale* L.—11  
*Helianthus decapetalus* L.—1  
 °*Helianthus strumosus* L.—3  
*Heliopsis helianthoides* (L.) Sweet  
 —3, 11  
*Hieracium scabrum* Michx.—2, 3  
*Krigia biflora* (Walt.) Blake—2, 3  
*Kuhnia eupatorioides* L.—3  
*Lactuca biennis* (Moench.) Fern.—  
 1  
*Lactuca canadensis* L.—1, 3, 11  
*Lactuca floridana* (L.) Gaertn.—7  
*Parthenium integrifolium* L.—3  
*Polymnia canadensis* L.—6, 7  
*Prenanthes alba* L.—1, 2, 7  
*Ratibida pinnata* (Vent.) Barnh.—  
 3  
*Rudbeckia laciniata* L.—9, 11  
 °*Rudbeckia serotina* Nutt.—3  
 °*Rudbeckia triloba* L.—7, 11  
*Senecio aureus* L.—10  
*Senecio plattensis* Nutt.—3  
*Silphium perfoliatum* L.—11  
 °*Solidago altissima* L. ?—11  
*Solidago flexicaulis* L.—1, 7  
*Solidago gigantea* Ait.—11  
*Solidago nemoralis* Ait.—3  
*Solidago rigida* L.—3  
*Solidago sciaphila* Steele—4, 5  
 °*Solidago speciosa* Nutt.—3  
*Solidago ulmifolia* Muhl.—1, 3, 7  
 °*Taraxacum erythrospermum*  
 Andr.—12  
 °*Taraxacum officinale* Weber—12  
 °*Xanthium strumarium* L.—12  
 Balsaminaceae  
*Impatiens biflora* Walt.—8, 9  
 °*Impatiens pallida* Nutt.—7, 9  
 Berberidaceae  
*Caulophyllum thalictroides* (L.)  
 Michx.—7  
*Jeffersonia diphylla* (L.) Pers.—7  
*Podophyllum peltatum* L.—1, 7  
 Betulaceae  
*Betula alleghaniensis* Britt.—6, 7  
*Betula papyrifera* Marsh.—2, 3, 4, 6  
*Carpinus caroliniana* Walt.—7  
*Corylus americana* Walt.—1  
*Corylus cornuta* Marsh.—6  
*Ostrya virginiana* (Mill.) K. Koch  
 —1, 2, 4, 7  
 Boraginaceae  
*Hackelia americana* (Gray) Fern.—  
 5  
*Hackelia virginiana* (L.) I. M.  
 Johnston—1, 11  
*Lithospermum canescens* (Michx.)  
 Lehm.—2, 3  
*Lithospermum latifolium* Michx.—  
 7  
 Brassicaceae (Cruciferae)  
*Arabis canadensis* L.—2, 3  
*Arabis hirsuta* (L.) Scop.—5  
*Arabis laevigata* (Muhl.) Poir.—5, 7  
 °*Barbarea vulgaris* R. Br.—12  
 °*Capsella bursa-pastoris* (L.)  
 Medic.—12  
*Cardamine bulbosa* (Schreb.) B.S.-  
 P.—8, 10  
*Cardamine pensylvanica* Muhl.—8,  
 10  
*Dentaria laciniata* Muhl.—7, 8, 9  
 °*Descurainia sophia* (L.) Webb—  
 12  
 °*Lepidium virginicum* L.—12

- °*Rorippa islandica* (Oeder) Borbas  
 —11  
 °*Sisymbrium officinale* (L.) Scop.—  
 12  
 Campanulaceae (incl. Lobeliaceae)  
 °*Campanula americana* L.—1, 7  
*Campanula rotundifolia* L.—4, 5, 6  
*Lobelia inflata* L.—1  
*Lobelia siphilitica* L.—10, 11  
 °*Lobelia spicata* Lam.—3  
 °*Triodanis perfoliata* (L.) Nieul.—  
 12  
 Caprifoliaceae  
*Diervilla lonicera* Mill.—6  
*Lonicera dioica* L.—2, 6, 7  
*Lonicera prolifera* (Kirchn.) Rehd.—  
 1, 4, 5  
*Sambucus canadensis* L.—1, 9, 11  
*Sambucus pubens* Michx.—6  
*Triosteum aurantiacum* Bickn.—1  
*Triosteum perfoliatum* L.—1, 3, 7  
*Viburnum lentago* L.—1  
*Viburnum opulus* L. subsp. *trilobum*  
 (Marsh.) Clausen—2, 6  
*Viburnum rafinesquianum* Schultes  
 —1, 2, 4, 7  
 Caryophyllaceae  
*Arenaria lateriflora* L.—1, 2, 7  
*Arenaria stricta* Michx.—4  
*Cerastium nutans* Raf.—11  
 °*Cerastium vulgatum* L.—12  
 °*Lychnis dioica* L.—12  
 °*Stellaria aquatica* (L.) Scop.—12  
*Stellaria longifolia* Muhl.—6  
 °*Stellaria media* (L.) Cyrillo—12  
 Celastraceae  
*Celastrus scandens* L.—1, 2, 3, 4, 6,  
 7  
*Euonymus atropurpureus* Jacq.—1,  
 7, 9  
 Chenopodiaceae  
 °*Chenopodium album* L.—12  
 Clusiaceae (incl. Hypericaceae)  
*Hypericum punctatum* Lam.—11  
*Hypericum pyramidatum* Ait.—11  
 Convolvulaceae  
*Convolvulus sepium* L.—11  
*Convolvulus spithameus* L.—2, 3  
*Cuscuta gronovii* Willd. (on *Laportea canadensis*)—9  
 Cornaceae  
*Cornus alternifolia* L.f.—1, 2, 7  
*Cornus drummondii* Meyer—7  
*Cornus racemosa* Lam.—1, 3  
*Cornus rugosa* Lam.—2, 4, 6  
 Cucurbitaceae  
*Echinocystis lobata* (Michx.) T. &  
 G.—11  
 Ericaceae  
*Monotropa hypopithys* L.—1  
*Monotropa uniflora* L.—1, 2  
*Pyrola elliptica* Nutt.—1, 2  
 Euphorbiaceae  
*Acalypha rhomboidea* Raf.—11  
*Euphorbia corollata* L.—3  
 °*Euphorbia supina* Raf.—12  
 Fabaceae (Leguminosae)  
*Amorpha canescens* Pursh—3  
*Amphicarpa bracteata* (L.) Fern.—  
 1, 7, 9  
*Desmodium glutinosum* (Muhl.)  
 Wood—1, 2, 3, 7  
*Desmodium nudiflorum* (L.) DC.—  
 1, 2, 7  
*Desmodium paniculatum* (L.) DC.  
 (incl. *D. dillenii* Darl.)—3  
*Lathyrus ochroleucus* Hook.—2, 3  
*Lespedeza capitata* Michx.—3  
 °*Medicago lupulina* L.—12  
 °*Melilotus alba* Desr.—12  
 °*Melilotus officinalis* (L.) Lam.—  
 12  
*Petalostemon purpureus* (Vent.)  
 Rybd.—3  
 °*Trifolium hybridum* L.—12  
 °*Trifolium pratense* L.—12  
 °*Trifolium repens* L.—12  
 °*Vicia villosa* Roth—12  
 Fagaceae  
*Quercus alba* L.—1, 2, 7  
*Quercus ellipsoidalis* E. J. Hill—1,  
 2  
*Quercus macrocarpa* Michx.—1, 9  
*Quercus muehlenbergii* Engelm.—  
 3, 4  
*Quercus rubra* L.—1, 2, 7  
*Quercus velutina* Lam.—1

- Gentianaceae  
*Gentiana quinquefolia* L.—3, 4, 6
- Geraniaceae  
*Geranium maculatum* L.—1, 3, 7,
- Hamamelidaceae  
*Hamamelis virginiana* L.—1, 2, 7
- Hydrophyllaceae  
*Ellisia nyctelia* L.—9  
*Hydrophyllum appendiculatum*  
 Michx.—7, 8, 9  
*Hydrophyllum virginianum* L.—1,  
 7, 8, 9
- Juglandaceae  
*Carya cordiformis* (Wang.) K.  
 Koch—1, 2, 7  
*Carya ovata* (Mill.) K. Koch—1  
*Juglans cinerea* L.—1, 2, 7  
*Juglans nigra* L.—1, 7, 9
- Lamiaceae (Labiatae)  
*Agastache nepetoides* (L.) Kuntze  
 —1, 7, 9  
*Blephila hirsuta* (Pursh) Benth.—  
 7, 9  
 °*Glechoma hederacea* L.—12  
 °*Leonurus cardiaca* L.—12  
*Lycopus americanus* Muhl.—11  
*Lycopus uniflorus* Michx.—10  
 °*Mentha arvensis* L.—11  
*Monarda fistulosa* L.—3  
 °*Nepeta cataria* L.—12  
 °*Prunella vulgaris* L.—12  
*Scutellaria lateriflora* L.—10, 11  
*Scutellaria ovata* Hill—3  
*Scutellaria parvula* Michx. (incl. *S.*  
*leonardii* Epl.)—3  
*Teucrium canadense* L. (incl. *T.*  
*occidentale* Gray)—11
- Limnanthaceae  
*Floerkea proserpinacoides* Willd.—  
 8
- Malvaceae  
 °*Abutilon theophrastii* Medic.—12
- Menispermaceae  
*Menispermum canadense* L.—1, 4,  
 7, 9
- Oleaceae  
*Fraxinus americana* L.—1, 2, 7  
*Fraxinus nigra* Marsh.—7, 9  
*Fraxinus pennsylvanica* Marsh.—9
- Onagraceae  
*Circaea alpina* L.—6  
*Circaea quadrifida* (Maxim.)  
 Franch. & Sav.—1, 2, 7, 9  
*Epilobium angustifolium* L.—6  
*Epilobium coloratum* Biehler—10,  
 11  
*Epilobium glandulosum* Lehm. var.  
*adenocaulon* (Hausk.) Fern.—6  
 °*Oenothera biennis* L.—12
- Oxalidaceae  
*Oxalis dillenii* Jacq. (*O. stricta* of  
 Iowa authors)—11  
*Oxalis stricta* L. (*O. europaea*  
 Jord.)—11  
*Oxalis violacea* L.—3
- Papaveraceae  
*Dicentra canadensis* (Goldie) Walp.  
 —7  
*Dicentra cucullaria* (L.) Bernh.—1,  
 7
- Sanguinaria canadensis* L.—1, 7
- Plantaginaceae  
 °*Plantago lanceolata* L.—12  
 °*Plantago major* L.—12  
 °*Plantago rugelii* Dcne.—12
- Polemoniaceae  
*Phlox divaricata* L.—1, 7, 9  
*Phlox pilosa* L.—3  
*Polemonium reptans* L.—1, 7, 9
- Polygalaceae  
*Polygala senega* L.—2, 3
- Polygonaceae  
 °*Polygonum erectum* L.—12  
*Polygonum hydropiper* L.—11  
*Polygonum pennsylvanicum* L.—11  
 °*Polygonum persicaria* L.—12  
*Polygonum sagittatum* L.—10  
*Polygonum virginianum* L.—7, 9  
 °*Rumex acetosella* L.—12  
*Rumex altissimus* Wood—12  
 °*Rumex crispus* L.—12
- Portulacaceae  
*Claytonia virginica* L.—1, 7
- Primulaceae  
 °*Lysimachia ciliata* L.—9, 11
- Ranunculaceae  
*Aconitum noveboracense* Gray—6  
*Actaea pachypoda* Ell.—7  
*Actaea rubra* (Ait.) Willd.—1, 2, 6,

- Anemone canadensis* L.—9, 10, 11  
*Anemone quinquefolia* L.—1, 2, 6,  
 7  
*Anemone virginiana* L.—1, 3, 7  
*Aquilegia canadensis* L.—4, 5, 7  
*Caltha palustris* L.—8  
*Clematis verticillaris* DC.—2, 4, 6  
*Clematis virginiana* L.—1, 7, 9, 11  
*Hepatica acutiloba* DC.—7  
*Hydrastis canadensis* L.—7  
*Isopyrum biternatum* (Raf.) Torr.  
 & Gray—7, 9  
*Ranunculus abortivus* L.—1, 5, 7, 9  
*Ranunculus recurvatus* Poir.—7, 8  
*Ranunculus septentrionalis* Poir.—  
 1, 7, 9  
*Thalictrum dasycarpum* Fisch. &  
 Lall.—1, 9  
*Thalictrum dioicum* L.—1, 7  
*Thalictrum thalictroides* (L.)—  
 Eames & Boivin—1, 2, 7
- Rhamnaceae  
*Ceanothus americanus* L.—1, 2, 3  
*Rhamnus alnifolia* L'Her.—6  
*Rhamnus lanceolata* Pursh—1, 4
- Rosaceae  
*Agrimonia gryposepala* Wallr.—1  
*Agrimonia pubescens* Wallr.—1, 2  
*Amelanchier arborea* (Michx. f.)  
 Fern.—1, 4, 7  
*Amelanchier sanguinea* (Pursh)  
 DC.—6  
*Amelanchier spicata* (Lam.) K.  
 Koch—4  
*Crataegus calpodendron* (Ehrh.)  
 Medic.—1, 9  
*Crataegus coccinea* L.—1  
*Crataegus punctata* Jacq.—1, 9  
*Crataegus punctata* Jacq. x *C. cal-*  
*podendron* (Ehrh.) Medic. ?—1  
*Fragaria vesca* L.—1, 2, 4, 5, 6  
*Fragaria virginiana* Duchesne—1,  
 3, 4  
*Geum canadense* Jacq.—1, 7  
*Physocarpus opulifolius* (L.) Max-  
 im.—1, 2, 4  
 °*Potentilla norvegica* L.—12  
*Potentilla simplex* Michx.—1, 3, 4  
*Prunus americana* Marsh.—1  
*Prunus serotina* Ehrh.—1, 2, 7
- Prunus virginiana* L.—1, 4  
*Pyrus ioensis* (Wood) Bailey—1  
 °*Pyrus malus* L.—12  
*Rosa arkansana* Porter (incl. *R.*  
*suffulta* Greene)—3  
*Rubus allegheniensis* Porter—1  
*Rubus idaeus* L. (incl. *R. strigosus*  
 Michx.)—1, 2, 6, 7  
*Rubus occidentalis* L.—1, 9  
*Rubus pubescens* Raf.—6
- Rubiaceae  
*Galium aparine* L.—1, 7, 8, 9  
*Galium asprellum* Michx.—6  
*Galium boreale* L.—2, 4, 5  
*Galium circaezans* Michx.—1, 7  
*Galium concinnum* Torr. & Gray—  
 1, 2, 7, 9  
*Galium triflorum* Michx.—1, 7
- Rutaceae  
*Xanthoxylum americanum* Mill.—1,  
 3
- Salicaceae  
*Populus deltoides* Marsh.—9  
*Populus grandidentata* Michx.—1,  
 2  
*Populus tremuloides* Michx.—1, 2,  
 4  
 °*Salix alba* L.—9  
*Salix amygdaloides* Anders.—9  
*Salix bebbiana* Sarg.—6  
*Salix discolor* Muhl.—10  
 °*Salix fragilis* L.—9  
*Salix interior* Rowlee—9, 11  
*Salix nigra* Marsh.—9  
*Salix rigida* Muhl.—9, 11  
*Salix sericea* Marsh.—11
- Santalaceae  
*Comandra umbellata* (L.) Nutt.—  
 2, 3
- Saxifragaceae (incl. Hydrangeaceae)  
*Chrysosplenium ioense* Rydb.—6  
*Heuchera richardsonii* R. Br.—3, 4  
*Mitella diphylla* L.—5, 6, 7  
*Penthorum sedoides* L.—10, 11  
*Ribes cynosbati* L.—1, 4, 5, 6, 7  
*Ribes hudsonianum* Richards.—6  
*Ribes missouriense* Nutt.—1.  
*Sullivantia renifolia* Rosend.—5, 6
- Scrophulariaceae  
*Aureolaria grandiflora* (Benth.)

- Pennell—2, 3  
 °*Chelone glabra* L.—10  
*Lindernia dubia* (L.) Pennell—11  
 °*Mimulus ringens* L.—10, 11  
*Pedicularis canadensis* L.—2, 3  
*Scrophularia marilandica* L.—1, 7, 9  
 °°*Verbascum thapsus* L.—12  
*Veronica arvensis* L.—11  
*Veronica peregrina* L.—11  
 °*Veronica serpyllifolia* L.—12  
*Veronicastrum virginicum* (L.) Farw.—1
- Solanaceae  
 °*Datura stramonium* L.—12  
 °*Solanum nigrum* L.—12
- Staphyleaceae  
*Staphylea trifolia* L.—2, 4, 7
- Thymelaeaceae  
*Dirca palustris* L.—7
- Tiliaceae  
*Tilia americana* L.—1, 4, 7, 9
- Ulmaceae  
*Celtis occidentalis* L.—1, 7, 9  
*Ulmus americana* L.—1, 7, 9  
*Ulmus rubra* Muhl.—1, 7  
*Ulmus thomasii* Sarg.—7, 9
- Urticaceae  
*Laportea canadensis* (L.) Wedd.—7, 8, 9  
 °*Parietaria pensylvanica* Muhl.—1, 4, 5  
*Pilea pumila* (L.) Gray.—8, 9, 10  
*Urtica dioica* L. (incl. *U. procera* Muhl.)—9, 11
- Verbenaceae (incl. Phrymaceae)  
*Phryma leptostachya* L.—1, 7  
 °*Verbena bracteata* Lag. & Rodr.—12  
*Verbena hastata* L.—11  
 °*Verbena stricta* Vent.—12  
*Verbena urticifolia* L.—1, 9
- Violaceae  
*Hybanthus concolor* (T. F. Forst.) Spreng.—7  
*Viola nephrophylla* Greene—6, 10  
*Viola pedatifida* G. Don—3  
*Viola pensylvanica* Michx. (incl. *V. pubescens* Ait.)—1, 7  
*Viola renifolia* Gray—6
- Viola rugulosa* Greene—7  
*Viola sagittata* Ait.—3  
*Viola sororia* Willd.—1, 3, 7, 9
- Vitaceae  
*Parthenocissus quinquefolia* (L.) Planch.—1, 4, 5, 7, 9  
*Parthenocissus vitacea* (Knerr) Hitchc.—1  
*Vitis aestivalis* Michx.—2, 4  
*Vitis riparia* Michx.—1, 4, 7, 9
- Angiospermae—  
Monocotyledoneae**
- Araceae  
*Arisaema dracontium* (L.) Schott—9  
*Arisaema triphyllum* (L.) Schott—1, 7, 9
- Cyperaceae  
*Carex albursina* Sheldon—6, 7  
*Carex backii* Boott—1, 4  
*Carex blanda* Dew.—1, 2, 7, 9  
*Carex careyana* Torr.—7  
*Carex cephalophora* Muhl.—1, 2, 3  
*Carex communis* Bailey—7  
*Carex convoluta* Mack.—1, 7  
*Carex deweyana* Schwein.—2, 6, 7  
*Carex digitalis* Willd.—7  
*Carex eburnea* Boott—4, 5, 6, 7  
*Carex granularis* Muhl.—2  
*Carex grisea* Wahlenb.—7, 9  
*Carex hirtifolia* Mack.—7  
*Carex hitchcockiana* Dew.—7  
*Carex jamesii* Schwein.—7  
*Carex molesta* Mack.—1  
*Carex normalis* Mack.—1, 7, 9  
*Carex oligocarpa* Schk.—2, 7  
*Carex peckii* E. C. Howe—2, 6  
*Carex pedunculata* Muhl.—2, 6, 7  
*Carex pensylvanica* Lam.—1, 2, 3  
*Carex sparganioides* Muhl.—7  
*Carex sprengei* Dew.—2, 4, 7  
*Carex stipata* Muhl.—10, 11  
*Carex stricta* Lam.—10, 11  
*Carex trichocarpa* Muhl.—10  
*Carex vulpinoidea* Michx.—9, 10  
*Carex woodii* Dew.—7, 9  
*Cyperus rivularis* Kunth—11  
*Eleocharis calva* Torr.—10  
*Scirpus atrovirens* Willd.—10, 11

- Dioscoreaceae  
*Dioscorea villosa* L.—1, 2, 7, 9
- Iridaceae  
 °*Iris virginica* L. var. *shrevei* (Small) E. Anders.—10, 11  
*Sisyrinchium campestre* Bickn.—3
- Juncaceae  
 °°*Juncus tenuis* Willd.—12  
*Luzula acuminata* Raf.—2, 6, 7  
*Luzula campestris* (L.) DC. var. *multiflora* (Ehrh.) Celak—2
- Liliaceae (incl. *Amaryllidaceae*, *Hypoxidaceae*, *Smilacaceae*, and *Trilliaceae*)  
*Allium canadense* L.—1, 9  
*Allium cernuum* Roth—6, 7  
*Allium tricoccum* Ait.—7  
*Erythronium albidum* Nutt.—7, 9  
*Hypoxis hirsuta* (L.) Coville—3  
*Lilium michiganense* Farw.—11  
*Maianthemum canadense* Desf.—2, 6  
*Polygonatum canaliculatum* (Muhl.) Pursh—1, 7  
*Smilacina racemosa* (L.) Desf.—1, 7  
*Smilacina stellata* (L.) Desf.—1, 3  
*Smilax ecirrhata* (Engelm.) S. Wats.—1, 2, 7  
*Smilax herbacea* L.—1, 7, 9  
*Smilax hispida* Muhl.—1, 3, 7, 9  
*Streptopus roseus* Michx.—6  
*Trillium flexipes* Raf.—7  
*Trillium nivale* Riddell—7  
*Uvularia grandiflora* Sm.—1, 2, 7  
*Zigadenus glaucus* Nutt.—4
- Orchidaceae  
*Aplectrum hyemale* (Muhl.) Torr.—7  
*Corallorhiza maculata* Raf.—7  
*Corallorhiza odontorhiza* (Willd.) Nutt.—1  
*Cypripedium calceolus* L. var. *pubescens* (Willd.) Correll—1, 2, 6, 7  
*Goodyera pubescens* (Willd.) R. Br.—1, 2  
*Habenaria hookeri* Torr.—2  
*Habenaria viridis* (L.) R. Br. var. *bracteata* (Muhl.) Gray—2, 7, 11
- Liparis lilifolia* (L.) Richard—1  
*Orchis spectabilis* L.—1, 2, 7  
 °*Triphora trianthophora* (Sw.) Rydb.—1
- Poaceae (Gramineae)  
 °*Agropyron repens* (L.) Beauv.—12  
*Agropyron trachycaulum* (Link) Malte—6  
 °*Agrostis gigantea* Roth (A. *alba* of Iowa authors)—12  
*Agrostis hyemalis* (Walt.) B.S.P.—3  
*Agrostis perennans* (Walt.) Tuckerm.—5, 6  
 °*Andropogon gerardii* Vitman—3  
 °*Bouteloua curtipendula* (Michx.) Torr.—3  
*Brachyelytrum erectum* (Schreb.) Beauv.—7  
 °*Bromus inermis* Leyss.—12  
*Bromus kalmii* Gray—3  
*Bromus latiglumis* (Scribn.) Hitchc.—6  
*Bromus purgans* L.—1, 7  
 °*Calamagrostis canadensis* (Michx.) Nutt.—10  
 °*Cinna arundinacea* L.—8, 10  
 °*Dactylis glomerata* L.—12  
*Danthonia spicata* (L.) Beauv.—1, 2  
 °*Digitaria ischaemum* (Schreb.) Muhl.—12  
 °*Echinochloa crusgalli* (L.) Beauv.—12  
*Elymus canadensis* L.—3, 11  
*Elymus riparius* Wiegand—6  
*Elymus villosus* Muhl.—1, 7  
 °*Eragrostis cilianensis* (All.) Lut.—12  
*Eragrostis frankii* C. A. Mey.—11  
*Eragrostis pectinacea* (Michx.) Nees—11  
 °*Festuca elatior* L.—12  
*Festuca obtusa* Biehler—1, 2, 7  
*Glyceria grandis* S. Wats.—10  
*Glyceria striata* (Lam.) Hitchc.—10  
*Hystrix patula* Moench.—1, 7  
*Leersia virginica* Willd.—9, 11



<i>Muhlenbergia frondosa</i> (Poir.) Fern.—11	<i>Panicum leibergii</i> (Vasey) Scribn. —3
<i>Muhlenbergia racemosa</i> (Michx.) B.S.P.—3	<i>Panicum linearifolium</i> Scribn.—2
<i>Muhlenbergia schreberi</i> Gmel.—1, 11	<i>Phalaris arundinacea</i> L.—9, 10
<i>Muhlenbergia solifera</i> (Muhl.) Trin.—7	* <i>Phleum pratense</i> L.—12
<i>Muhlenbergia sylvatica</i> Torr. ?—2	* <i>Poa annua</i> L.—12
<i>Muhlenbergia tenuiflora</i> (Willd.) B.S.P.—2, 7, 11	* <i>Poa compressa</i> L.—12
<i>Oryzopsis asperifolia</i> Michx.—2	<i>Poa paludigena</i> Fern. & Wieg. ?—6
<i>Oryzopsis racemosa</i> (Sm.) Ricker— 7	<i>Poa palustris</i> L.—11
* <i>Panicum capillare</i> L.—11	* <i>Poa pratensis</i> L.—3, 12
<i>Panicum dichotomiflorum</i> Michx.— 11	<i>Poa sylvestris</i> Gray—7
<i>Panicum implicatum</i> Scribn.—3	<i>Poa wolfii</i> Scribn.—2
<i>Panicum latifolium</i> L.—1, 7	<i>Schizachne purpurascens</i> (Torr.) Swallen—2, 4
	* <i>Setaria lutescens</i> (L.) Beauv.—12
	* <i>Setaria viridis</i> (L.) Beauv.—12
	<i>Sorghastrum nutans</i> (L.) Nash—3
	<i>Sphenopholis intermedia</i> (Rydb.) Rydb.—5, 6

## STATISTICAL SUMMARY

## A. Components of the vascular flora of White Pine Hollow Forest Reserve:

	Species		Genera		Families	
	Native	*Ntlzd.	Native	Ntlzd.	Native	Ntlzd.
"Pteridophytes"	27	0	16	0	7	0
Coniferae	3	0	3	0	3	0
Dicotyledoneae	305	59	169	34	60	5
Monocotyledoneae	110	15	52	6	9	0
Totals	445	74	240	40	79	5
Grand Totals	519 Species		280 Genera		84 Families	

## B. Largest families, with ten or more indigenous species:

	Native	Ntlzd.		Native	Ntlzd.
Asteraceae	55	11	Aspidiaceae	13	0
Poaceae	44	14	Apiaceae	11	2
Cyperaceae	31	0	Lamiaceae	10	4
Rosaceae	22	2	Salicaceae	10	2
Ranunculaceae	19	0	Caprifoliaceae	10	0
Liliaceae	18	0	Orchidaceae	10	0

\* Naturalized, in addition to native.

## The Flora of White Pine Hollow

## C. Largest genera, with six or more indigenous species:

<i>Carex</i>	27	<i>Galium</i>	6
<i>Aster</i>	11	<i>Muhlenbergia</i>	6
<i>Solidago</i>	8	<i>Panicum</i>	6
<i>Viola</i>	8	<i>Quercus</i>	6
<i>Salix</i>	7		

## APPENDIX A

Nearly fifty additional species that might be expected to occur in the habitats of the reserve have been reported from White Pine Hollow by Shimek (unpublished field notebooks for 1901-1933, on file in the Herbarium of the University of Iowa), Pammel (1923), and Cooper-rider (1958). Because I have not seen these species yet in the reserve, I prefer to list them here separately. An intensive search should be made in the reserve for these species.

<i>Equisetum laevigatum</i> A. Br.	<i>Hedeoma hispida</i> Pursh
<i>Asclepias viridiflora</i> Raf.	<i>Pycnanthemum virginianum</i> (L.) Dur. & Jacks.
<i>Aster ericoides</i> L.	<i>Astragalus canadensis</i> L.
<i>Aster laevis</i> L.	<i>Petalostemon candidus</i> (Willd.) Michx.
<i>Aster praealtus</i> Poir.	<i>Dodecatheon meadia</i> L.
<i>Aster sericeus</i> Vent.	<i>Anemone cylindrica</i> Gray
<i>Bidens vulgata</i> Greene	<i>Ranunculus fascicularis</i> Muhl.
<i>Echinacea pallida</i> Nutt.	<i>Prunus pennsylvanica</i> L. f.
<i>Erigeron strigosus</i> Muhl.	<i>Rosa blanda</i> Ait.
<i>Eupatorium maculatum</i> L.	<i>Rosa woodsii</i> Lindl.
<i>Gnaphalium obtusifolium</i> L.	<i>Galium trifidum</i> L.
<i>Helianthus grosseserratus</i> Martens	<i>Castilleja coccinea</i> (L.) Spreng.
<i>Helianthus tuberosus</i> L.	<i>Veronica americana</i> (Raf.) Schwein.
<i>Hieracium umbellatum</i> L.	<i>Physalis virginiana</i> Mill.
<i>Lactuca scariola</i> L.	<i>Thaspium barbinode</i> (Michx.) Nutt.
<i>Solidago canadensis</i> L.	<i>Alisma subcordatum</i> Raf.
<i>Solidago missouriensis</i> Nutt.	<i>Sagittaria latifolia</i> Willd.
<i>Vernonia fasciculata</i> Michx.	<i>Tradescantia ohioensis</i> Raf.
<i>Mertensia virginica</i> (L.) Pers.	<i>Elymus virginicus</i> L.
<i>Symphoricarpos occidentalis</i> Hook.	<i>Hordeum jubatum</i> L.
<i>Silene antirrhina</i> L.	<i>Koeleria cristata</i> (L.) Pers.
<i>Silene nivea</i> (Nutt.) Otth.	<i>Leersia oryzoides</i> (L.) Sw.
<i>Helianthemum bicknellii</i> Fern.	<i>Milium effusum</i> L.
<i>Cornus obliqua</i> Raf.	
<i>Agastache scrophulariaefolia</i> (Willd.) Ktze.	

Because of this long list of reported species and because my own list

is certainly not exhaustive, I predict that ultimately the list of vascular plant species from the reserve will exceed 550 or even 600 species.

#### EPILOGUE

It is most unfortunate that the Conservation Commission has permitted the felling of white pines in this rich and picturesque reserve. It should be treated neither as a state forest nor as a state park open to all, but rather as a state biological and geological monument. It should be retained inviolate to remind Iowans of the changes that have taken place during the Pleistocene epoch of Iowa's long history. This square-mile area of Iowa terrain is priceless to present and future biologists, geologists, agronomists, conservationists, naturalists, and other field scientists.

#### ACKNOWLEDGMENTS

Although the included list of vascular plants in the Hollow is not exhaustive, it has been made relatively complete through the efforts of many botanists, students, and amateurs. I owe much to the studies in the area of B. Shimek, L. H. Pammel, H. S. Conard, and T. G. Hartley and to many of my present colleagues and recent students in taxonomy at the University, who have collected with me in the Hollow or on their own in all kinds of weather. The excellence of the illustrations is due largely to Fred Kent of the University Photographic Service, who took many of the photographs or made usable my kodachromes. I am particularly grateful to R. R. Mitchell and the late B. F. Stiles of the Iowa State Conservation Commission for their encouragement and help in this survey.

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THE BRYOPHYTES OF  
WHITE PINE HOLLOW

ROBERT L. HULBARY

## THE BRYOPHYTES OF WHITE PINE HOLLOW

Robert L. Hulbary<sup>1</sup>

In 1932, Conard<sup>2</sup> published a synopsis of the bryophytes from White Pine Hollow State Forest Preserve located in the northwest corner of Dubuque County in northeastern Iowa. After thirty two years the bryophyte flora of this interesting woodland on the border of the unglaciated "driftless area," of some modern geologists, is revised in the following list. It is based on collections made by H. S. Conard, Gary L. Smith, and students in the bryology classes at the University of Iowa. The sequence of families is that of Grout 1940<sup>3</sup>. Binomials for the mosses in general are those employed in this list. Deviations from these are supplemented by Grout's names given in parentheses. Liverwort nomenclature is based on Evans 1940<sup>4</sup>. Taxa preceded by the sign "\*" are newly reported. Each species listed is represented by at least one voucher specimen in the Conard Bryophyte Herbarium at the University of Iowa with the exception of those taxa preceded by an "o."

The mosses (Bryopsida) are represented by 95 species from 58 genera in 19 families. Families, such as Hypnaceae, have been validly divided in recent years by thorough monographs, but in the interest of consistency the familial circumscriptions of Grout 1940 are retained in this treatment. The liverworts (Hepaticopsida) are represented by 12 species from 11 genera in 9 families.

### Bryopsida

#### *Tetraphidaceae*

*Tetraphis pellucida* Hedw.

#### *Polytrichaceae*

*Atrichum angustatum* (Brid.) BSG.

\**A. undulatum* (Hedw.) Beauv.

\**Polytrichum ohioense* R. & C.

#### *Fissidentaceae*

*Fissidense cristatus* Wils.

\**F. minutulus* Sull.

#### *Ditrichaceae*

*Ceratodon purpureus* (Hedw.) Brid.

*Distichium capillaceum* (Hedw.)

BSG.

*Ditrichum pallidum* (Hedw.)

Hampe.

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<sup>2</sup> Conard, H. S. 1932. Mosses of Pine Hollow, Iowa. *Bryologist* 35:28-30.

<sup>3</sup> Grout, A. J. 1940. List of Mosses of North America North of Mexico. *Bryologist* 43:117-131.

<sup>4</sup> Evans, A. W. 1940. List of Hepaticae Found in the United States, Canada, and Arctic America. *Bryologist* 43:133-138.

## Dicranaceae

*Dicranella heteromalla* (Hedw.) Schimp.

*Dicranum flagellare* Hedw.

*D. montanum* Hedw.

*D. scoparium* Hedw.

*D. viride* (Sull. and Lesq.) Lindb.

*Oncophorus wahlenbergii* Brid.

## Leucobryaceae

\**Leucobryum glaucum* (Hedw.) Schimp.

## Ecalyptaceae

*Ecalypta streptocarpa* Hedw.

## Pottiaceae

*Barbula fallax* Hedw.

*Desmatodon obtusifolius* (Schwaegr.) Jur.

*Didymodon recurvirostris* (Hedw.)

Jennings

*Gymnostomum calcareum* Nees. & Hornsch.

*Tortella fragilis* (Hook. & Wils.) Limpr.

## Grimmiaceae

*Grimmia apocarpa* Hedw.

*G. pilifera* Beauv.

## Funariaceae

*Funaria hygrometrica* Hedw.

## Orthotrichaceae

*Orthotrichum pumilum* Dicks.

*O. strangulatum* Schwaegr.

## Timmiaceae

*Timmia megapolitana* Hedw.

## Bartramiaceae

*Bartramia pomiformis* Hedw.

*Plagiopus oederi* (Brid.) Limpr.

## Bryaceae

*Bryum argenteum* Hedw.

*B. caespiticium* Hedw.

*B. cuspidatum* (BSG.) Schimp.

\**B. pendulum* (Hornsch.) Schimp.

\**Leptobryum pyriforme* (Hedw.) Schimp.

*Pohlia wahlenbergii* (Web. & Mohr) Andrews

*Rhodobryum roseum* (BSG.) Limpr.

## Mniaceae

*Mnium cuspidatum* Hedw.

*M. medium* BSG.

*M. serratum* Brid.

*M. stellare* Hedw.

## Hypnaceae

*Amblystegiella confervoides* (Brid.) Loeske

*A. sprucei* (Hedw.) Loeske

\**A. subtilis* (Hedw.) Loeske

*Amblystegium serpens* (Hedw.) BSG.

*A. trichopodium* (Schultz.) C. Hartm.

(*Leptodictyum trichopodium* (Schultz.) Warnst.)

*A. varium* (Hedw.) Lindb.

*Brachythecium riculare* BSG.

*B. serrulatum* (Hedw.) Robins.

(*Eurhynchium serrulatum* (Hedw.) Kindb.)

*Brotherella recurvans* (Mx.) Fleisch.

*Bryhnia graminicolor* (Brid.) Grout

*Calliergonella schreberi* (BSG.) Grout

*Campylium chrysophyllum* (Brid.) Bryhn.

*C. hispidulum* (Brid.) Mitt.

*Chamberlainia acuminata* (Hedw.) Grout

(incl. *C. cyrtophylla* (Kindb.) Grout)

*C. calcarea* (Kindb.) Robins

(incl. *Brachythecium flexicaule* R. & C.)

*C. oxyclada* (Brid.) Robins.

(*Brachythecium oxycladon* (Brid.) Jaeg. & Sauerb.)

*C. salebrosa* (Web. & Mohr) Robins

(*Brachythecium salebrosus* (Web. & Mohr) BSG.)

*C. velutina* (Hedw.) Robins.

(*Brachythecium velutinum* (Hedw.) BSG.)

*Climacium americanum* Brid.

*Drepanocladus uncinatus* (Hedw.) Warnst.

*Entodon cladorrhizans* (Hedw.) C.M.

*Eurhynchium hians* (Hedw.) Jaeg. & Sauerb.

## The Flora of White Pine Hollow

*E. pulchellum* (Hedw.) Jenn. (incl. *E. strigosum* (Hoffm.) BSG. sensu Grout)

*Heterophyllum haldanianum* (Grev.) Kindb.

*Homomallium adnatum* (Schimp.) Loeske

*Hygroamblystegium irriguum* (Wils.) Loeske

*Hypnum crista-castrensis* Hedw.

*H. curvifolium* Hedw.

*H. imponens* Hedw.

\**H. reptile* Mx.

*H. patientiae* Lindb.

*Isothecium cristatum* (Hampe) Robins

(*Bestia breweriana* (Lesq.) Grout)

*Plagiothecium denticulatum* (Hedw.) BSG.

*P. deplanatum* (Sull.) Grout

*Platygyrium repens* (Brid.) BSG.

*Pylaisia selwynii* Kindb.

*Rhytidiadelphus triquetris* (Hedw.) Warnst.

\**Rhytidium rugosum* (Hedw.) Kindb.

## Leskeaceae

*Anomodon attenuatus* (Hedw.) Huben.

*A. minor* (Beauv.) Lindb.

*A. rostratus* (Hedw.) Schimp.

*A. tristis* (Cesati) Sull.

(*Haplohymenium triste* (Cesati) Kindb.)

*Leskea gracilescens* Hedw.

*L. obscura* Hedw.

*Myurella careyana* Sull.

\**Thelia asprella* Sull.

*Thuidium abietinum* (Brid.) BSG.

*T. delicatulum* (Hedw.) Mitt.

*T. pygmaeum* BSG.

*T. recognitum* (Hedw.) Lindb.

*T. virginianum* (Brid.) Lindb.

## Neckeraceae

*Neckera pennata* Hedw.

## Leucodontaceae

*Leucodon julaceus* (Hedw.) Sull.

*L. sciuroides* (Hedw.) Schwaegr.

## Hepaticopsida

## Ptilidiaceae

*Ptilidium pulcherrimum* (Web.) Hampe.

## Cephaloziaceae

*Cephalozia connivens* (Dicks.) Lindb.

## Harpanthaceae

*Lophocolea heterophylla* (Schrad.) Dumort.

## Plagiochilaceae

*Plagiochila asplenoides* (L.) Dumort.

## Porellaceae

*Porella platyphylla* (L.) Lindb. (incl. *P. platyphylloidea* (Schwein.) Lindb.)

## Radulaceae

*Radula complanata* (L.) Dumort

## Frullaniaceae

*Frullania eboracensis* Gottsche.

*F. riparia* Hampe.

## Lejeuneaceae

*Cololejeunea biddlecomiae* (Aust.) Evans

## Marchantiaceae

*Marchantia polymorpha* L.

*Preissia quadrata* (Scop.) Nees.

*Conocephalum conicum* (L.) Dumort.