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THE VEGETATION
OF THE OZARK REGION
IN SOUTHERN ILLINOIS

BY

HENRY ALLAN GLEASON, B. S., 1901

THESIS FOR THE DEGREE OF MASTER OF
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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

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Chapter 1, Introduction

The general surface of the state of Illinois is a vast plain, gently and uniformly sloping from the north to the south until within fifty miles of the southern extremity. There a range of hills, the Ozark uplift, extends across the state from west to east, reaching altitudes far above the general level, and rivalling those of the higher northern portion. The change in vegetation is equally gradual; from north to south species disappear and others appear in the landscape, but the general aspect of the plant associations varies but little over most of the state. But in the region of the Ozark uplift numerous new forms, mainly southern in their distribution, appear, resulting in a flora strongly in contrast with that of central and northern Illinois. The vegetation of this region is of interest not only on account of the difference in species, but also through the geographical relationships and associations of the plants.

Notwithstanding the extraordinary interest of the flora, extreme southern Illinois has received but little attention from botanists. Andre Michaux was undoubtedly the first botanical collector to traverse the region, and the type localities of many of the species named by him are in southern Illinois, seldom with a more definite location. To quote Gray #, Michaux, in August, 1795, "ascended the Wabash to Vincennes, crossed the country to the Illinois river, and devoted the months of September, October, and November to diligent herborizations along the course of that river,

Scientific Papers, 2: 30.

the Mississippi, the lower part of the Ohio, and throughout the country included by these rivers."

While it is possible that Thomas Nuttall and C. W. Short botanized in southern Illinois in the first half of the nineteenth century, but little more was done until 1850 or later, when the organization of the State Natural History Society caused renewed interest in scientific matters. Robert Kennicott, of Chicago, collected there in the early fifties, discovering among others, the Umbrella-tree, *Magnolia tripetala* L. In Patterson's Catalogue of the Plants of Illinois Lapham is quoted: "My herbarium contains a specimen of leaves from the late Robert Kennicott marked 'No. 6, Cucumber Magnolia; Cache bottoms.' As the leaves are too narrow and too much tufted at the ends of the branches to agree with *M. acuminata*, I added to the label the specific name Umbrella: this is my authority for including it in the list of Illinois plants." Dr. Frederick Brendel, of Peoria, author of the *Flora Peoriana*, and now retired from active work on account of advanced age, collected in Jackson, Union, Alexander and Pulaski counties in 1860. Professor S. A. Forbes, of the University of Illinois, studied the plants of Jackson and Union counties in the sixties, confirming the presence of the yellow pine, *Pinus echinata* Mill., in the state, and discovering a new species of saxifrage, named in his honor by Dr. Vasey *Saxifraga Forbesii*. Other early collectors in this field were John Wolf, of Canton, and Dr. George Vasey, of Ringwood. Professor G. H. French, of the Southern Illinois Normal University, and Dr. Jacob Schneck, of Mt. Carmel, have been active students of the flora for

many years, the one in the Ozarks of Jackson and Union counties, the other in the Wabash valley. Dr. Schneck and Robert Ridgeway were the first adequately to describe the forests of southern Illinois, and Dr. Schneck's name is perpetuated in *Quercus Schneckii* Britton. Professor French was the first to observe a variety of shooting-star native in the Ozarks, and now known as *Dodecatheon Meadia Frenchii* Vasey. The list of southern Illinois species in Patterson's catalogue is almost entirely the work of these early botanists, Kennicott, Brendel, Forbes, Vasey, Wolf, Schneck, and French.

Of later years Dr. F. S. Earle, Mr. M. B. Waite, and particularly Mr. A. B. Seymour have studied the plants of the region. The work of the latter was especially full, and added much to the knowledge of the flora. Still more recently Mr. C. F. Baker, then at the St. Louis High School, and Dr. G. P. Clinton, formerly of the University of Illinois, now of the Connecticut Agricultural Experiment Station, have carried on field work in southern Illinois.

The field work of the writer, upon which this thesis is based, has extended through portions of four summer vacations, from 1900 to 1903, and one spring visit in May, 1902. During this time every county of the Ozark range has been covered, and some hundreds of specimens collected. He takes this opportunity to express his thanks to his companion, Mr. C. A. Hart, of the Illinois State Laboratory of Natural History, for abundant assistance in the field, and to Professor T. J. Burrill, under whose direction and guidance the work has been carried on.

It has not been possible to construct a complete bibliography of Southern Illinois botany, but there are many articles upon it in the more easily accessible periodicals and reports, and these are here listed. Other works of a more general nature, not bearing directly upon the subject, but used by the writer in his work, are also included.

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Chapter 2, Climatology

The Ozark region of southern Illinois lies entirely within the warm temperate zone, no month having a mean temperature of less than 0°C . The absolute minimum, however, usually reaches or exceeds -15° , while temperatures as low as minus 30° have been reported. The summers are hot, with maxima frequently reaching 40° , or even 44° , as in July, 1901. The rainfall is normally copious and well distributed throughout the year. In the tables on the following page are given the mean monthly rainfall and temperature for Cobden, Union County, and Raum, Pope County, the only weather bureau stations in Illinois situated on the Ozark uplift. Cobden is in a rolling country, most of which is under cultivation. Its altitude is 594 feet above tide, while the neighboring hills rise one to two hundred feet above it. Raum lies in a fairly level plateau, and has an altitude of 575 feet.

Although the Ozark region is more abundantly supplied with moisture than any other part of Illinois, it is, like the remainder of the state, subject to droughts in summer. These dry periods occur principally in the summer months, July, August and September, and are frequently of such duration that plant life is seriously affected by them. Weather Bureau reports covering the years 1901 to 1903 show droughts extending over seven or more days as follows: Cobden, 1903, 9 droughts, average duration, 11 days, maximum, 17 days. Raum, 1903, 7, average length, 13 days, maximum, 26; Cobden, 1902, 3, average length 16 days, maximum 18; Raum, 1902, 2, each of 8 days; Cobden, 1901, 8, average length, 15 days, maximum 27; Raum,

Mean monthly and annual temperature (in degrees Centigrade)
and rainfall (in millimeters).

	Temperature		Rainfall	
	Cobden	Raum	Cobden	Raum
January	0.9	1.1	86	89
February	2.2	2.6	90	96
March	7.4	7.8	127	113
April	13.9	14.6	101	94
May	19.6	19.8	124	102
June	23.7	24.1	142	102
July	26.1	26.1	94	85
August	25.3	25.5	92	76
September	21.3	21.8	68	77
October	15.9	15.6	86	68
November	8.0	8.1	113	108
December	1.2	2.9	97	85
Year	13.8	14.2	1220	1095

1901, 6, average length 17 days, maximum 24. In a hilly country, like the Ozark region, the surface drainage is more complete, and the effect of drought is also increased by the abnormally warm weather usually associated with them. Thus at Cobden, in the twenty-seven day drought of 1901, the mean daily maximum was 38°, while a temperature of 40° or above was reached on seven days. The luxuriant vegetation which formerly covered the whole of the

Ozark uplift shows that the droughts have not been an important factor in the ecology of the region. Their injurious effect is lim- mostly to cultivated crops and to the native vegetation of cleared lands, where the removal of shade and the consequent drying out of the leaf-mold prevent the growth of many species. In such places the plants may become partially wilted or even killed in dry seasons.

Spring opens with the blooming of the elms and soft maples in the first half of March. Frosts continue usually until the first decade of April, but the season is always about two weeks farther advanced than in central Illinois. The first frosts in autumn do not begin until the middle of October or later; and the actual growing season from the last killing frost in spring until the first in autumn averages 190 days.

Chapter 3, Geology.

The Ozark region of Illinois is the eastern end of the general Ozark system, which lies in a long S-shaped curve across Indian Territory, Arkansas, Missouri and Illinois. The total length of the range is about 500, and the maximum breadth in Missouri and Arkansas about 200 miles. No definite date can be assigned to its formation, but frequent oscillations have probably taken place since Archæan time along the line of the present uplift, and there is evidence that elevation has occurred since the close of the Tertiary #. In Illinois the total amount of elevation, according to Worthen ##, exceeds 3000 feet, bringing above the surface strata of the Carboniferous, Devonian, Upper Silurian and Lower Silurian ages. Erosion has worn down the uplift to its present height. In Johnson and Pope counties near the middle of the ridge, the elevation is less, and the oldest strata exposed are the Lower Carboniferous. In Hardin county, at the extreme eastern end, the upper beds of the Devonian outcrop in several places, and in Union county, where the strata doubtless show the effect of the proximity of the Iron Mountain region of Missouri, beds of the Lower Silurian age form the river bluffs in some places. Here the Carboniferous and Devonian strata have all been removed by erosion, leaving the upper Silurian as the surface rock. As will be shown later, this part of the uplift is also characterized by certain peculiarities of vegetation. The conglomerate sandstones of the upper Carboniferous first appear some

Keyes, Characteristics of the Ozark Mountains.

Economic Geology of Illinois, vol. 1.

distance inland in the vicinity of Alto Pass, Union county, and the crest of the ridge is capped with this rock from that place east to the Ohio river. South of the crest the country is mainly underlaid with Lower Carboniferous limestones of the Chester and St. Louis groups, which outcrop along the southern boundary of the uplift. South of the uplift the broad flood-plains of the Ohio and Mississippi rivers are filled with alluvial soil of great depth, but in Pulaski and Massac counties there are also extensive deposits of Tertiary clays, forming hills 200 to 250 feet above the Ohio river.

The following is a geological section of the region, adapted from Worthen's report on the geology of Illinois.

Quaternary	Alluvium and loess, 0-200 feet. Extensive deposits of loess cap the hills throughout the length of the range, except in the extreme western parts of Jackson and Union counties.
Tertiary	Lafayette (?), Pulaski and Massac counties.
Upper Carboniferous.	Conglomerate sandstones, 500-600 feet.
Lower Carboniferous.	Chester group, 800 feet.
	St. Louis group, 250 feet.
	Keokuk limestone, 150 feet.
	Burlington limestone, 100 feet.
	Kinderhook group, 100 feet.
Devonian	Black slate, 40-60 feet.
	Hamilton limestone, 40-75 feet.

Corniferous limestone, 20-30 feet.

Onondaga limestone, 20-60 feet.

Quartzose sandstones, 40-60 feet.

Clear Creek limestones, 200-250 feet.

Upper Silurian

Lower Helderberg limestone, 200-250 feet.

Lower Silurian

Cincinnati group, 150 feet.

Trenton limestone, 75 feet.

Chapter 4, Topography.

The hills of the Ozark uplift stand in such prominent relief above the adjacent plains that they have attracted attention since the time of the earliest settlements as the most prominent physiographic feature of that part of the state. The uplift is in the form of a broad ridge, crossing the southern end of the state from west to east, and occupying all or part of Jackson, Union, Alexander, Williamson, Johnson, Saline, Pope, Gallatin and Hardin counties. The general surface of the state slopes gently to the south to the northern edge of the ridge, and south of it are the low Tertiary hills and alluvial deposits of the Ohio and Mississippi rivers. The general altitude of the country at the north is about 410 feet above tide, and that of the extensive bottoms at the south only 360 feet. Above this low flat country the Ozarks rise to a height of from four hundred to six hundred feet, reaching an average elevation at the crest of 850 feet, and a maximum of 1046 feet above tide.

The hills rise abruptly from the plain on the north, and the crest lies near the northern side; this enters the state from Missouri in southwestern Jackson county, and extends southeast across Union county, the towns of Cobden (594 feet) and Alto Pass (752 feet) being situated upon or near it. The principal elevations in this county are Bald Knob (985 feet) at Alto Pass, and Wing Hill (870) east of Cobden. The crest of the divide then turns to the east across the north part of Johnson, Pope and Hardin counties, passing near Goreville (700 feet), Tunnel Hill (661 feet), Ozark

(698 feet), Eddyville (660 feet), and Herod (450 feet), and reaching altitudes of 800 feet or more. In the northeast part of Pope county, and extending into Hardin, Saline and Gallatin counties, is one of the roughest parts of the range, locally known as the Eagle mountains. Williams Mountain, near Herod, in Pope county, has a height of 1046 feet, nearly 700 feet above the bottomlands of the Saline river at its base, and the highest point in southern Illinois. Along the crest of the ridge the topography is, for Illinois, exceedingly rough and broken. The creeks flow through narrow flood-plains in deep valleys, usually bounded by towering cliffs; the hill sides are steep and rocky, and the greater portion of the land is too rough for cultivation. The scenery throughout the length of the ridge is without rival in Illinois for picturesque ruggedness.

South of the crest there is a broad, gently rolling belt with an average altitude of from 500 to 600 feet, and usually separated from the crest by a conspicuous escarpment. Here the hills are broader and with gentler slope, the flood-plains are wider, high cliffs and rocky gorges are less frequent, and in general the region is much less mountainous in character. It might well be spoken of as a Piedmont plateau.

A third type of landscape occurs along the bluffs of the Mississippi river from Jackson county south to Alexander, where the geological formation is different. Here there is no deposit of loess, as over the other parts of the uplift, and the bluffs, composed principally of Clear Creek limestone, have been eroded deeply, leaving steep, rocky, narrow ridges, rising abruptly from the Miss-

Mississippi bottoms to a height of three to four hundred feet, and so narrow at the top that, as Worthen says, there is scarcely room for a road upon them. In the northwestern part of Union county the especially high hills of this character are known as the Pine Hills, and have long been noted as the Illinois home of the yellow pine.

Drainage is effected by numerous small streams, which rise near the crest and flow north or south into the lowlands. North-flowing streams at the western end of the uplift empty into Crab Orchard creek, and Big Muddy river, and thence into the Mississippi, and at the eastern end into the Saline river, a tributary of the Ohio. South-flowing streams empty into the Ohio river in Hardin and Pope counties, or into the Mississippi in the western part of Union county. The central portion in Union and Johnson counties drains into the Cache river, which empties into the Ohio a short distance above Cairo.

Chapter 5, The Vegetation.

The plant associations in the Ozark region fall naturally into three great groups, the upland societies, the cliff societies, and the flood-plain and swamp societies. In each of these groups there are minor divisions, usually intergrading one with the other, and thus producing a complex of associations. By normal processes of erosion and base-leveling the character of the plant growth on any one area is constantly changing, one society giving way to another better suited to the changing ecological conditions. Thus, as a ravine is eroded back into the uplands, the land formerly occupied by a typical upland forest is replaced by a cliff flora, which in turn gives way to the associations of flood-plain or swamp. Such changes are very slow in a region like the one under discussion, where the rock surface lies at such little depth, and offers such effectual resistance to erosion. More rapid is the change produced through the agency of man in the drainage of swamps and the clearing of timber, thereby altering the conditions of light, moisture and soil.

During the rapid development in the last few years of study and description of plant societies some confusion in nomenclature has arisen, so that it becomes necessary to explain the use of certain words in this article. By plant society or plant association, here used interchangeably, is meant an assemblage of plants growing together under uniform conditions of soil, light, heat, and moisture. Minor differences in the associations, due to the greater abundance of one or more species and usually denoting biological rather physical

differences, are here termed facies, or else neglected entirely. Facies; in this sense of the word, have by different authors been associations or formations. The term formation, seldom used in this article, refers to an assemblage of associations all characterized by the same vegetation form, such as forests or prairies, and possessing essentially the same developmental history.

The societies of the Ozark uplift may be classified as follows:

A. The upland group.

The xerophytic forest association.

The mesophytic forest association.

The rock barren association.

B. The cliff group.

The cliff association.

C. The flood-plain group.

The flood-plain forest association.

The honey-locust and cypress swamp association.

The sand-bar and river-strand association.

D. The cultural group.

The sassafras barren association.

Garden, field, and roadside weed association.

The uplands are composed typically of broad, rounded hills, traversed by steep or rocky ravines, which carry away the excess of moisture and frequently are eroded so deeply that they reach into the underlying rock strata. The soil is loess, with occasionally

small tracts of shaly residual soil along the cliffs, and of a depth which varies with the locality, but is always sufficient to support a heavy forest growth, except near the rock outcrops, where it becomes gradually thinner until in many places the surface of the rock is exposed. There are no extensive areas of level ground, but the gently sloping hill-tops descend either directly to the cliffs or into the numerous ravines. The flora of these steeper hillsides is closely related to that of the uplands proper, and will be considered with it, although it represents another stage in the life-history of the vegetation, the transition from upland to flood-plain.

The character of the vegetation upon the upland hills is governed principally by the water supply as affected by the degree of slope, the exposure to the light, the depth and slope of the underlying strata, and the physical nature of the soil. The slope and exposure to light have also some effect on the temperature and thereby influence to some degree the distribution of plants. Plants of northern distribution are usually found on hillsides or cliffs which face the north, and which consequently have a slightly lower mean temperature in summer and are much less exposed to the intense heat of summer afternoons. The distribution of forest trees is apparently governed entirely by the water relation, except in the Pine Hills in western Union county, where the presence of the yellow pine is doubtless due to the physical character of the residual soil. The herbaceous and shrubby vegetation, while no less dependent on the available water supply in the soil, is also modified

directly by the amount of light. Under the heaviest forest growth the vegetation is usually sparse, and the individuals of each species frequently gregarious. In lighter shade grasses and sedges are more numerous, and both species and individuals generally more abundant. When the timber is removed the aspect of the herbaceous vegetation is entirely changed on account of the abundant growth of certain formerly secondary species, such as *Solidago nemoralis* and *Eupatorium serotinum*, but this may be due as much to a change in moisture as to the increased amount of light. The depth of the soil, while it affects the amount of moisture in it, also limits directly the growth of plants. Forest trees cannot reach full size in thin soil, so that near the brow of cliffs the vegetation may be limited to shrubs or herbs, or a scanty tree growth may develop in the soil lodged in fissures and cavities of the rock.

The upland forest shows two distinct facies, one mesophytic in character, the other xerophytic, but the two intergrade so closely that only the broadest distinctions can be drawn between them. Certain features are common to both, while others, affecting the water relations of the soil, are sufficient to cause the difference in vegetation between the two extremes.

The xerophytic upland forest covers, except where the land has been cleared for agricultural purposes, by far the greater portion of the uplands. It extends down the gently sloping hillsides to the brow of the cliffs if the depth of the soil is slight or the exposure is southerly, or, when the hillside soil is full of rock fragments, even to the level of the flood-plain. At other

places it grades imperceptibly into the mesophytic society of the hillside and upland, or into the rock barren society at the edge of the cliffs.

The forest flora is especially characterized by the oaks, which predominate both in species and in number of individuals. Among the dominant forms are the white oak, *Quercus alba*, the bur oak, *Q. macrocarpa*, the chestnut oak, *Q. acuminata*, the red oak, *Q. rubra*, and the black oak, *Q. velutina*. The order in which they are named represents approximately the importance of the different species. In the most xerophytic places, especially in the thin soil near the cliffs, a different facies is developed, with the post oak, *Q. minor*, and the scrub oak, *Q. Marylandica*, as the characteristic species, while the white and bur oaks are less prominent. The reason for this change in character is the depth of the soil, which in the latter facies is much thinner than in the typical white oak-bur oak portion. In still thinner soil the post oak disappears and the scrub oak remains as the dominant species of oak, although not larger than a shrub in size. There is, therefore, in these two facies of the upland forest a gradual transition to the rock barren society, where the depth of soil is only a matter of inches. The first five species of oak mentioned reached gigantic size in the original forest, but at present the trees are mostly small and of second growth stock. Post oak is not only a smaller tree, but, from the limited use which has been made of it, appears to be of poorer quality. It is usually crooked, gnarly, and full of dead branches. The scrub oak is at best a small tree, and never reaches a size

suitable for lumbering.

Associated with the oaks are several other arborescent species, the most characteristic of which are *Ulmus alata*, *Hicoria ovata*, *Hicoria microcarpa*, *Cornus florida*, *Ostrya Virginiana*, *Juniperus Virginiana*, and *Sassafras Sassafras*. Still other species more typical of other societies may occur occasionally, such as *Diospyros Virginiana*, *Acer saccharum*, *Fraxinus lanceolata*, or *Liquidambar Styraciflua*. While the oaks are the dominant species throughout most of the area covered by this society, certain ones of the secondary forms may be locally of such abundance that the oaks become there of minor importance. Thus there are different facies in which *Ulmus alata*, *Cornus florida*, or the hickories are the most prominent tree species, and in the thinner soil a different facies may be formed by the substitution of the red cedar. *Juniperus Virginiana*, for the post oak. On the xerophytic rocky slopes of the Devil's Backbone, near Grand Tower, the gum, *Liquidambar Styraciflua*, *sassafras*, and ash are the principal tree species. The undershrubs and herbs are not changed by the difference in the arborescent flora.

Shrubs are poorly developed, both in number of species and in individuals. The most abundant are *Rhus copallina*, *Rhus aromatica*, *Ceanothus Americanus*, and *Batodendron arboreum*. The latter species grows normally in the post oak-scrub oak facies, while the first three are equally common throughout. *Batodendron* is typical of the rock barren society; it seldom extends far away from it into the uplands, and its presence in the upland societies may always be taken as indicative of the presence of rock within a short distance

of the surface. Shrubby species of secondary importance are *Hydrangea arborescens*, *Hydrangea cinerea*, *Ascyrum hypericoides* and *Salix tristis*. The occurrence must also be mentioned of some swamp species of southern affinities in the upland woods. On the rocky slopes of the Devil's Backbone are found *Rhamnus Caroliniana*, *Arundinaria tecta*, *Celtis Mississippensis*, *Adelia acuminata*, and *Planera aquatica*. The significance of this will be discussed later. The lianas of the society are *Parthenocissus quinquefolia*, *Rhus radicans*, *Menispermum Canadense*, *Bignonia crucigera* (also a swamp species), *Cebatha Carolina*, *Celastrus scandens*, and *Vitis aestivalis*.

Here, as in other associations, the herbaceous flora depends principally upon the light. In the more open woods sedges and grasses, especially species of *Panicum* of the dichotomum group, are abundant, growing in scattered stools. *Danthonia spicata* is likewise abundant, and might be called the most characteristic grass of the uplands. No plant is entirely limited in its growth to sunny or to shady woods, but many are more abundant in one than in the other. Thus *Lespedeza striata*, *Dasystoma Virginica*, and *Rudbeckia fulgida* are more plentiful in the shade, and *Solidago Radula*, *Cassia nictitans*, and *Psoralea pedunculata* in the sun. On the driest spots or over thin soil *Agave Virginica*, *Kneiffia linearis*, and other rock barren plants are associated with the rock barren shrub, *Batodendron arboreum*. The flora is rich in species, and is especially distinguished by the large number of legumes. These plants are the most striking feature of the vegetation in July and August when most of the species are in bloom. The following list includes the

typical species of this society:

<i>Danthonia spicata</i>	<i>Lechea tenuifolia</i>
<i>Panicum barbulatum</i>	<i>Passiflora lutea</i>
<i>Panicum polyanthes</i>	<i>Polytaenia Nuttallii</i>
<i>Tricuspis seslerioides</i>	<i>Ipomoea pandurata</i>
<i>Carex glaucoidea</i>	<i>Cunila origanoides</i>
<i>Carex triceps</i>	<i>Koellia incana</i>
<i>Cyperus ovularis</i>	<i>Monarda Bradburiana</i>
<i>Tradescantia reflexa</i>	<i>Dasystoma Virginica</i>
<i>Anychia dichotoma</i>	<i>Galium pilosum</i>
<i>Ranunculus hispidus</i>	<i>Houstonia longifolia</i>
<i>Agrimonia punila</i>	<i>Specularia perfoliata</i>
<i>Cracca Virginiana</i>	<i>Hieracium Gronovii</i>
<i>Cassia nictitans</i>	<i>Antennaria plantaginifolia</i>
<i>Lespedeza hirta</i>	<i>Brauneria purpurea</i>
<i>Lespedeza striata</i>	<i>Carduus altissimus</i>
<i>Lespedeza Virginica</i>	<i>Coreopsis tripteris</i>
<i>Meibomia nudiflora</i>	<i>Coreopsis pubescens</i>
<i>Meibomia paniculata</i>	<i>Helianthus divaricatus</i>
<i>Psoralea pedunculata</i>	<i>Rudbeckia fulgida</i>
<i>Stylosanthes biflora</i>	<i>Solidago nemoralis</i>
<i>Viola pedata</i>	<i>Solidago Radula</i>

The xerophytic vegetation of the Pine Hills in western Union county calls for special notice. The characteristic topography of this region, steep narrow ridges of rocky residual soil, has already been mentioned. The underlying rock, which by its decompo-

sition has produced the sterile stony soil, is probably Clear Creek limestone, an impure siliceous stratum of the Devonian group. Drainage from these hillsides is very rapid, especially since there is no protective covering of leaf mold, except near the bottom of the more sheltered ravines. There, where the ecological conditions are entirely mesophytic, a luxuriant vegetation is developed, consisting of species typical of such localities in southern Illinois. *Cimicifuga racemosa*, *Erigeron pulchellus* and *Cynoglossum Virginicum*, species rare or infrequent elsewhere in the region, were especially noted. *Aralia racemosa* is very abundant and reaches a large size. It is on the sides and tops of the hills, where the xerophytic conditions prevail, that the peculiar and characteristic flora is found. The pine trees, *Pinus echinata*, which give the place its name, grow most abundantly along the crests of the ridges, or a short distance down the slopes. They are quite abundant, some of them two feet or more in diameter and of considerable height. Cones are produced plentifully, and seedlings are springing up under the larger trees. Other species of trees are post oak, scrub oak, and hickory, common in all similar sterile soils in the Ozark region. *Azalea nudiflora*, a small, stiffly branched shrub, is quite abundant, and, so far as known, is limited in southern Illinois to this single station. The herbaceous species observed in early May were *Pentstemon canescens*, *Asclepias quadrifolia*, *Houstonia longifolia*, *Monarda Bradburiana*, *Cracca Virginiana*, *Viola pedata* and its parti-colored form known as variety *bicolor*, *Adopogon Dandelion*, and *Plantago aristata*. The bluffs along the Mississippi river have

a similar topography south in to Alexander county, but the ridges are usually covered with leaf mold and are consequently more mesophytic in character. Pines are said to occur near Elco, in Alexander county, and until recently there were a few trees on Pine Knob, west of Mill Creek, in southern Union county.

The foregoing descriptions apply only to the most typically xerophytic portions of the upland forest. No sharp line can be drawn between them and the mesophytic extreme, but the two intergrade imperceptibly. Species after species of mesophytic nature appear in the flora as the conditions of soil moisture or shade become suited to their needs, and the xerophytic species as gradually disappear. Some of the most xerophytic ridges support a few specimens of such mesophytes as *Cercis Canadensis* or *Houstonia lanceolata*, while others, as *Ranunculus recurvatus* and *Arisaema triphyllum* occur only in thick leaf mold under dense shade. Similarly, certain xerophytes are occasional in the moisture places, while *Polytaenia Nuttallii* has never been observed beyond the drier places in the uplands, or on the rock barrens. Distinction must also be made between the different quantitative moisture requirements of arborescent and herbaceous species. The forest cover, whether mesophytic or xerophytic, receives practically uniform insolation and its ecological character depends almost entirely on the amount of available moisture in the soil. The herbaceous species require less soil for their development and are protected by the trees from the drying influence of the atmosphere. On that account a flora of mesophile herbs may develop under a cover of xerophytic trees if the shade is sufficient.

ly dense. Instance of this are by no means rare in southern Illinois. For the same reason there is less difference between the tree flora of the two extremes than between the undershrubs and herbs, since in the one only the moisture varies, in the other the heat and light also.

The most pronounced areas of the uplands are the sloping sides of the numerous small ravines, which, starting in the higher parts of the upland, gradually widen and deepen until they reach the flood-plain. The smaller of these ravines are covered almost entirely with mesophytic forest, while the larger, if the exposure to the sun is direct or especially if they have cut deep enough to reach the cliffs, are frequently xerophytic in nature. An illustration of the effect of exposure may be taken from Fountain Bluff. At the south and north ends of this hill are high cliffs and in the interior the surface rises until it reaches an elevation of one hundred and fifty feet or more above the level of the cliffs. The drainage is by numerous small ravines, few of which have cut deeper than the top of the cliffs. At the south end, where the exposure to the sun is more direct, the mesophytic flora is confined to the sides of the steeper ravines, while the smaller ravines and the intervening ridges are all covered with a typical xerophytic society. At the north end, where the general exposure is away from the sun, all of the slope, whether crest or cliff, is occupied by a mesophytic flora.

The forest trees on the mesophytic hillsides and uplands include some species common also to the drier soils, such as

Quercus alba, *Quercus macrocarpa*, *Juglans cinerea*, and *Hicoria ovata*, as well as a number of typical mesophytes as *Liriodendron tulipifera*, *Acer saccharum*, *Acer nigrum*, and *Gymnocladus dioica*. Other trees are *Celtis occidentalis*, *Liquidambar styraciflua*, *Diospyros Virginiana*, *Fagus Americana*, *Ulmus Americana*, *Ulmus fulva*, *Tilia Americana*, *Fraxinus quadrangulata*, and *Quercus imbricaria*. The growth of these trees in the original forest was exceedingly heavy, but by far the larger part has been removed for lumber. Logging is still in progress in southwestern Jackson county, but elsewhere the stand is principally second growth.

The undergrowth of shrubs is much better developed than in the xerophytic forest, and consists principally of the following species:

<i>Carpinus Caroliniana</i>	<i>Ptelea trifoliata</i>
<i>Morus rubra</i>	<i>Staphylea trifolia</i>
<i>Benzoin Benzoin</i>	<i>Cornus Anomum</i>
<i>Cercis Canadensis</i>	<i>Sambucus Canadensis</i>
<i>Amelanchier Canadensis</i>	<i>Viburnum prunifolium</i>
<i>Malus coronaria</i>	

The density of the undergrowth and of the herbaceous flora as well varies with the amount of light, so that under the heaviest shade both shrubs and herbs are almost entirely absent, leaving the soil covered only with a thick deposit of leaf mold and dead leaves, while in the more open places there is a dense undergrowth of plants. Some of the more characteristic species of the herbaceous flora are:

<i>Adiantum pedatum</i>	<i>Filix fragilis</i>
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<i>Brachyelytrum erectum</i>	<i>Aralia racemosa</i>
<i>Bromus ciliatus</i>	<i>Asclepias variegata</i>
<i>Panicum Porterianum</i>	<i>Hydrophyllum appendiculatum</i>
<i>Trillium erectum</i>	<i>Phacelia Purshii</i>
<i>Boehmeria cylindrica</i>	<i>Phryma Leptostachya</i>
<i>Actaea alba</i>	<i>Galium concinnum</i>
<i>Caulophyllum thalictroides</i>	<i>Lobelia inflata</i>
<i>Stylophorum diphyllum</i>	<i>Aster Shortii</i>
<i>Arabis laevigata</i>	<i>Polymnia Uvedalia</i>
<i>Viola palmata</i>	<i>Solidago caesia</i>
<i>Ranunculus recurvatus</i>	<i>Eupatorium purpureum</i>
<i>Circaea Lutetiana</i>	<i>Solidago flexicaulis</i>

Uplands that have been cleared and cultivated frequently wash so badly with rains that they are abandoned after a few years, and left to grow up with native plants. On account of the prevailing species in such abandoned fields they are known as sassafras barrens. The soil here is clay without any covering of leaf mold or sod, and usually deeply furrowed with small vertical sided ravines. At first the vegetation is thin and scanty, but with each succeeding year it becomes denser, the saplings of sassafras and persimmon grow into trees, and eventually the area is covered with a forest. A great variety of species thrive in the barrens, mostly xerophytes of the upland woods, which can grow without shade. The typical species are the following:

Shrubs and trees.

Sassafras Sassafras

Rhus copallina

*Diospyros Virginiana**Rhus glabra**Quercus alba**Vitis aestivalis**Rubus* sp., a creeping form locally called dewberries.

Herbs.

*Andropogon scoparius**Leptandra Virginica**Panicum*, several species of the dichotomum group*Festuca octoflora**Plantago Virginica**Cassia Chamaechrista**Solidago nemoralis**Meibomia paniculata**Aster ericoides**Lespedeza frutescens**Rudbeckia hirta**Acalypha gracilens**Helianthus scaberrimus**Onagra biennis**Coreopsis pubescens**Prunella vulgaris**Carduus altissimus**Koeleria Virginiana*

The removal of the trees from the upland is alone sufficient to cause considerable change in the vegetation. Some shade-loving species are killed, while others, more tolerant of light, grow in great abundance, and by their numbers change the aspect of the society. This may be illustrated by a comparison of the plants on a cleared hillside near Makanda with those on a forested portion of the same hill. Further observation might reduce the difference between the two, but the lists as given will serve to show something of the effect of clearing. It will be understood that the tree species were represented on the cleared hillside by two or three year old sprouts from the old stumps or by seedlings.

1. Plants common to both hillsides.

<i>Eupatorium purpureum</i>	<i>Monarda Bradburiana</i>
<i>Cercis Canadensis</i>	<i>Leptandra Virginica</i>
<i>Quercus rubra</i>	<i>Morus rubra</i>
<i>Sassafras Sassafras</i>	<i>Panicum polyanthes</i>
<i>Oxalis cymosa</i>	<i>Campanula Americana</i>
<i>Leptilon Canadense</i>	<i>Silene stellata</i>
<i>Ulmus Americana</i>	<i>Scutellaria incana</i>

2. Plants observed only on the cleared hillside.

<i>Helianthus strumosus</i>	<i>Solidago serotina</i>
<i>Cassia Chamaechrista</i>	<i>Solidago Canadensis</i>
<i>Sambucus Canadensis</i>	<i>Solidago nemoralis</i>
<i>Tradescantia flexuosa</i>	<i>Lactuca sp.</i>
<i>Apocynum cannabinum</i>	<i>Vernonia fasciculata</i>
<i>Mesadenia atriplicifolia</i>	<i>Cicuta maculata</i>
<i>Heliopsis helianthoides</i>	<i>Koellia Virginiana</i>
<i>Eryngium aquaticum</i>	<i>Uniola latifolia</i>
<i>Fraxinus Americana</i>	<i>Ambrosia trifida</i>
<i>Corylus Americana</i>	<i>Ambrosia artemisiaefolia</i>
<i>Carduus discolor</i>	<i>Prunella vulgaris</i>
<i>Onagra biennis</i>	

3. Plants observed only on the wooded hillside.

<i>Agrimonia sp.</i>	<i>Verbesina alternifolia</i>
<i>Phryma leptostachya</i>	<i>Blephilia hirsuta</i>
<i>Aster Shortii</i>	<i>Erigeron ramosus</i>
<i>Impatiens biflora</i>	<i>Polystichum schrostichoides</i>

<i>Adiantum pedatum</i>	<i>Solidago ulmifolia</i>
<i>Hicoria ovata</i>	<i>Quercus alba</i>
<i>Smilax herbacea</i>	<i>Tecoma radicans</i>
<i>Hystrix Hystrix</i>	<i>Rudbeckia hirta</i>
<i>Ostrya Virginiana</i>	<i>Acer saccharum</i>
<i>Anemone Virginiana</i>	<i>Koellia incana</i>

A transition between the cliff societies and the xerophytic upland forest is seen in the rock barren society, the flora of which, however, is closely related to that of the uplands. Where the dip of the strata is up into the hill much of the overlying soil is washed away, leaving strips of nearly naked rock, known as rock barrens. These may be small in size, or may extend for long distances along the edge of the cliffs. The meager supply of soil is either washed down by rains from the loess deposits above or is formed in situ from the decomposition of the rocks themselves. The farther from the cliffs, the greater is the average depth of the soil, until the vegetation merges insensibly into that of the typical upland forest. In the thinnest soil only small plants can grow, such as *Plantago aristata Nuttallii* or *Polygonum tenue*; when the deposits are thicker other larger herbs appear, and in the deeper crevices some shrubs grow to a considerable size. It may be stated generally, that where the soil is thick enough to accommodate any species of the upland forest association it may be expected, and that other species from the cliffs may also occur.

Betodendron arboreum is the most characteristic species of the rock barren flora. On account of the size which it attains a

greater depth of soil is necessary for its growth than for most herbaceous species, but it is seldom found in soil of a depth exceeding two feet. Detached patches of it in the forest usually surround a large rock, or soundings show that the rock is nearer the surface at that point. *Juniperus Virginiana* is also prominent in the rock barrens, and may reach a height of thirty feet. *Ulmus alata*, *Quercus minor*, and *Quercus Marylandica*, which are trees in the upland forest, are on the rock barrens bushy, widely branched shrubs, rarely over ten feet high, except where larger fissures in the rock permit the development of a more extensive root system. *Rhus aromatica* is very abundant as an undershrub, growing in dense circular patches.

The principal herbaceous species are the following:

<i>Lechea tenuifolia</i>	<i>Plantago elongata</i>
<i>Ruellia ciliosa</i>	<i>Plantago aristata</i>
<i>Sedum pulchellum</i>	<i>Plantago aristata Nuttallii</i>
<i>Sedum telephioides</i>	<i>Plantago Virginica</i>
<i>Specularia perfoliata</i>	<i>Agave Virginica</i>
<i>Adopogon Dandelion</i>	<i>Pentstemon hirsutus</i>
<i>Crotonopsis linearis</i>	<i>Polygonum tenue</i>
<i>Kneiffia linifolia</i>	<i>Opuntia humifusa</i>

As erosion progresses the deepening of the ravines is carried on through the overlying deposits of soil into the rock strata. There results from this ravines with their sides broken by cliffs and ledges of rock, or, if the erosion is sufficiently rapid, the rock may be partially or wholly covered with talus washed down from

the uplands. There is no relation between the size or depth of the ravine and the amount of outcropping. In some of the deeper valleys two hundred or three hundred feet of rock may be entirely covered with earth so that no outcrops occur, as in some places in Drury Creek valley, while again some of the smallest ravines may have cut gorges with high vertical walls of rock. The position of the stream in its flood-plain affects the character of the adjoining bluffs, so that those more distant from the stream have smaller outcrops, while the nearer bluffs, where erosion is more active, present numerous cliffs and ledges. Throughout the Ozark region the rock is always near enough to the surface that cliffs of considerable size may be formed. Some of the highest along the Big Muddy river in Jackson county exceed two hundred feet, and cliffs of one hundred feet height are frequent along all of the streams.

The ecological factors heat, light, and moisture, which influence the vegetation of the cliffs, are extremely varied, and nearly all the differences in the flora are due to one or more of them. The composition of the rock, whether limestone or sandstone, is of minor importance, since only three species are found exclusively upon limestone, *Cheilanthes Feei*, *Solidago Drummondii*, and *Pellaea atropurpurea*.

On most of the rock outcrops there is sufficient light to permit the growth of many species of plants. In deep gorges or under overhanging ledges the light is weaker, excluding certain forms, or even all green vegetation. In these darker recesses the most characteristic plants are *Asplenium platyneuron*, *Heuchera parviflo-*

ra, and *Asplenium Trichomanes*, and of these three the latter extends farthest back into the shade.

The temperature in the shaded ravines is not only less subject to extremes of heat on account of the low insolation, but the daily mean is always below that of the uplands. From these conditions in the more shaded places there is every gradation to the exposed cliffs, receiving the maximum insolation through the full length of the summer day, where the rock itself is sometimes so hot that the hand cannot be borne upon it. But a number of species, as *Cheilanthes Feei* and *Phlox Stellaria* live and apparently thrive in these torrid conditions.

In the moisture relations the cliff flora is also subject to widely different conditions. The available water for the growth of plants must either drip down from above, or be held in pockets and crevices in the rock, where it is protected from evaporation by the rock and the foliage above it. In the deep gorges, sheltered both from the sun and the wind, the atmosphere is always humid, and the cliffs often dripping with moisture, while the flora comprises such typically mesophytic species as *Adicea pumila* and *Impatiens biflora*. On exposed cliffs where the heat is intense evaporation is very rapid and the water supply is at a minimum. In such places but few plants are able to live in pockets in the rock, which soon lose their moisture, but most species have long roots or root-stocks which penetrate far into the crevices, reaching to depths where the moisture is better conserved. Even with these adaptations many species roll up their leaves and become stiff and dry in

texture during the hot months of July and August, showing unmistakeable evidence of injury by drought. Thus stems and leaves of *Phlox Stellaria*, which are green and in full bloom in May, are nearly all killed completely by the first of August.

No flowering plant lives directly upon the rock itself, but in soil which collects in pockets and crevices, or on ledges, and which is formed by the direct decomposition of the rock, or is washed down by rains from the soil deposits above. The amount of soil thus collected may vary from extremely small quantities to deposits of such depth that trees may grow upon them. Mosses and lichens are the pioneers upon the cliffs, and by their activities pave the way for flowering plants. Only a small quantity of soil is necessary for the growth of some species. A cavity in the rock half an inch across and the same in depth filled with soil will support a fruiting plant of *Pellaea atropurpurea*, and two or three stems of *Solidago Drummondii* will grow from a pocket of soil containing not more than two cubic inches. In respect to the soil, at least, only arbitrary distinctions can be drawn between the cliff, the upland, and the flood-plain societies. A soil deposit six inches deep on a ledge of a moist shaded cliff may be sufficient to support such a plant as *Impatiens aurea*, which strictly speaking does not belong to the cliff flora. For the *Impatiens* the six inches of soil, sheltered by its location from excessive heat, light, and evaporation, is not at all different from the deep soil of the flood-plain. But with it may be growing an ironwood, for which the thin layer of soil alone is not sufficient, and which with its roots

penetrates deeply into fissures in the rock. Thus the same area is supporting species, which, according to their ecological requirements at least, belong to two different plant societies

The cliff flora must be regarded as a complex of species derived not only from the mesophytic and xerophytic upland woods, but also from the flood-plain, with a limited number which, because of their peculiar physiological requirements, or possibly through competition with other plants, are confined to the cliffs. The vegetation shows a mesophytic and a xerophytic extreme, as well as all gradations between the two. Possibly the best idea of the cliff flora may be given by a description of some of the most typical cliffs. As examples of mesophytic sandstone cliffs those of Fountain Bluff and Makanda will be taken.

At Fountain Bluff the cliffs outcrop along a deep ravine, which shelters the plants from the sun. The rocky ledges are covered with thick leaf mold, and only in few places is much of the bare rock exposed. In the thicker soil deposits are growing numerous ferns of the following species: *Dryopteris marginalis*, *Polystichum schrostichoides*, *Adiantum pedatum*, *Asplenium angustifolium*, and *Filix bulbifera*. With them are *Adicea pumila*, *Impatiens pallida* and *biflora*, and other shade-loving herbs. Trees of beech, tulip, and hard maple indicate a close relationship to the flora of the mesophytic woods, while the two ironwoods, *Ostrya* and *Carpinus*, are more typical of the cliffs themselves. On other rocks, which because of their surface or position cannot hold large quantities of soil, smaller ferns grow in profusion, *Polypodium vulgare*, *Asplenium*

platyneuron, *Filix fragilis*, and *Camptosorus rhizophyllus*. The latter covers the rock with a dense mat of fronds, which root at the ends. On the vertical walls of rock are *Heuchera parviflora*, *Aquilegia Canadensis*, *Hydrangea arborescens*, and a few ferns.

Other members of the cliff flora here, but less common, are *Vaccinium vacillans*, *Dodecatheon Meadia*, and *Campanula rotundifolia*.

In similar situation at Makanda there are no large trees, and fewer shrubs, most of the shade received being from trees growing upon the talus slopes below the cliffs. Growing on the soil deposits on ledges and shelves of the rock are *Rhus radicans*, *Staphylea trifolia*, *Fraxinus Americana*, *Ostrya Virginiana*, and *Juniperus Virginiana*, all of small size except the ironwood, with the following herbs: *Hydrophyllum appendiculatum*, *Aster Drummondii*, *Parietaria Pennsylvanica*, *Geum album*, *Solidago caesia*, *Carex mirabilis*, *Adiantum pumila*, *Aralia racemosa*, *Vagnera racemosa*, *Arisaema triphyllum*, and *Polystichum schrostichoides*. The distinctive cliff flora of the crevices and pockets, each species of which grows also on the ledges, are *Heuchera parviflora*, *Parthenocissus quinquefolia*, *Polypodium vulgare*, *Hydrangea arborescens*, *Camptosorus rhizophyllus*, *Dryopteris marginalis*, *Asplenium platyneuron*, *Asplenium Trichomanes*, *Saxifraga Forbesii*, and *Conocephalus conicus*.

On the xerophytic cliffs overlooking the Mississippi river at Grand Tower the most characteristic plants of crevices and pockets are *Heuchera hirsuticaulis*, *Pellaea atropurpurea*, *Thellanthus Feei*, *Phlox Stellaris*, and especially *Solidago Drummondii*. Fully seventy five per cent of the individuals belong to the latter species.

Other species are *Elymus Virginicus*, *Scutellaria cordifolia*, *Oxalis cymosa*, *Croton monanthogynus*, *Lepidium Virginicum*, and *Ostrya Virginiana*. None of these are common except *Scutellaria*, which prefers positions which are shaded at least part of the afternoon. On shelves and ledges there are many more species, all of which, however, extend also into other societies. The most abundant are *Croton monanthogynus*, *Rhus aromatica*, *Parthenocissus quinquefolia*, *Ulmus alata*, *Solidago Drummondii*, *Scutellaria cordifolia*, *Tecoma radicans*, and *Rhus radicans*. Other species, less abundant, are *Oxalis cymosa*, *Carduus altissimus*, *Euphorbia nutans*, *Oenothera sinuata*, *Eragrostis major*, *Lepidium Virginicum*, *Silene antirrhina*, *Quercus acuminata*, *Ostrya Virginiana*, *Solanum nigrum*, *Rhus glabra*, *Arundinaria tecta*, *Monarda fistulosa*, *Verbena stricta*, *Rosa humilis*, *Cenchrus tribuloides*, *Cercis Canadensis*, *Solanum Carolinense*, *Cornus Amomum*, *Viburnum rufotomentosum*, *Opuntia humifusa*, *Celtis Mississippensis*, *Verbascum Thapsus*, *Vitis vulpina*, *Vernonia* sp., *Juniperus Virginiana*, and *Juniperus communis*.

Other species occur on the cliffs at different places, but all of the more common and characteristic forms are in the foregoing lists. One species needs individual mention, *Polypodium polypodioides*. This fern, which never grows on trees in Illinois, is found on the driest as well as the moistest cliffs, and although not common, is usually abundant wherever it grows.

In conclusion it may be said that the cliff flora, in the strictest sense, is very limited in species, but that numerous forms of other societies find there suitable conditions for growth.

Few species, therefore, are in themselves characteristic of the cliff society, but the association of species constitutes a typical and distinctive group, radically different from any other society of the region.

The final stage in the erosion series is represented by the flood-plains which border all of the larger streams throughout the region. The Mississippi river flows through a flood-plain from three to six miles wide in Jackson and Union counties, and there is a similar extensive development along the Big Muddy, the Saline, and the Cache rivers, where they run through or along the Ozark uplift. The smaller streams, like Drury creek, Lusk creek, Grand Pierre creek, and Mill creek have bottomlands with an average width of one-fourth to one-half a mile. The soil is all of alluvial origin and along the larger rivers is of immense depth. When subject to inundation by annual floods the depth is increased each year by deposits frequently exceeding a foot in thickness for a single flood. Over such a level area the variation in the vegetation is determined by the elevation, those flood-plains subject to heavy overflow being quite different from those in which the inundation is slight or irregular. On the larger flood-plains, like those along the Mississippi river, a secondary drainage system has been worked out. The level surface is then intersected by shallow but broad depressions, sometimes full of standing or slowly moving water, and always occupied by a pronounced hydrophytic plant society.

The flora of the flood-plains consists of a dense growth of forest with or without undergrowth. The principal arborescent species are:

Liquidambar Styrciflua	Liriodendron Tulipifera
Quercus alba	Hicoria Pecan
Quercus macrocarpa	Ulmus Americana
Quercus platanoides	Ulmus fulva
Quercus imbricaria	Gleditsia triacanthos
Quercus palustris	Catalpa speciosa
Celtis occidentalis	Populus deltoides
Celtis Mississippiensis	Populus heterophylla
Acer Negundo	Platanus occidentalis
Acer saccharinum	Fraxinus profunda
Acer saccharum	Fraxinus quadrangulata
Acer rubrum	Fraxinus lanceolata
Fagus Americana	Nyssa sylvatica
Tilia Americana	Gymnocladus dioica
Juglans cinerea	Betula lenta
Juglans nigra	Betula nigra
Hicoria ovata	

Not all of these species are found together. On the higher bottoms which are but little subject to inundation such species predominate as Tilia Americana, Liriodendron Tulipifera, Acer saccharum, Fraxinus quadrangulata, and Fagus sylvatica, while others, including Acer rubrum, Gleditsia triacanthos, Hicoria Pecan, and Celtis Mississippiensis grow in the wettest places of the flood-plains, where the land is inundated every year. The trees

of the higher bottoms are very similar the those of the mesophytic uplands, the two together constituting the climax forests of the region.

The immense size reached by many species of the flood-plain society has been described by Ridgeway#, who gave the following maximum heights in feet for some of the species: *Quercus macrocarpa*, 162; *Populus deltoides*, 165; *Platanus occidentalis*, 168; *Hicoria Pecan*, 175; *Liriodendron Tulipifera*, 182. The larger trees have now been lumbered from nearly all of the bottomlands, and much of their area has been cleared for cultivation.

Under the heaviest growth of forest where the light is intercepted by the trees, and in forests subject to long periods of inundation, there is usually little undergrowth of shrubs and small trees, and the herbaceous species grow usually in patches. After the forest has been partially cleared it is occupied by a dense growth of various species of shrubs, and the number of individuals of herbaceous plants is also greatly increased. There is a great contrast in appearance between the open park-like forest on the one hand, and the tangled thickets on the other. Lianas of many species are very common, and give a semi-tropical aspect to the vegetation. The principal shrubs and small trees are:

<i>Ilex decidua</i>	<i>Planera aquatica</i>
<i>Styrax Americana</i>	<i>Rhamnus Caroliniana</i>
<i>Carpinus Caroliniana</i>	<i>Malus coronaria</i>
<i>Ptelea trifoliata</i>	<i>Eonymus atropurpureus</i>

Amer. Nat. 6: 658.

*Aralia spinosa**Celtis crassifolia**Rosa Carolina**Celtis Mississippiensis**Adelia acuminata**Benzoin Benzoin**Asimina triloba**Cercis Canadensis**Xanthoxylum Americanum**Staphylea trifolia**Alnus rugosa**Morus rubra**Arundinaria tecta***Lianas:***Rhus radicans**Celastrus scandens**Smilax glauca**Bignonia crucigera**Smilax bona-nox**Parthenocissus quinquefolia**Smilax hispida**Bradleya macrostachys**Menispermum Canadense**Vitis vulpina**Calycocarpum Lyoni**Vitis cinerea**Cebatha Carolina**Vitis palmata**Tecoma radicans**Vitis cordifolia**Ampelopsis cordata*

The herbaceous flora is so varied that only a portion, representing the most typical species, is here given.

*Botrychium Virginianum**Dioscorea villosa**Panicum Porterianum**Saururus cernuus**Panicum rostratum**Brunnichia cirrhosa**Uniola latifolia**Polygonum Virginianum**Arundinaria tecta**Anemone Canadensis**Carex Asa-Grayii**Tradescantia pilosa**Carex Frankii**Penthorum sedoides*

<i>Carex squarrosa</i>	<i>Aquian Illinoense</i>
<i>Cassia Marylandica</i>	<i>Dentstemon Digitalis</i>
<i>Impatiens aurea</i>	<i>Phryma leptostachya</i>
<i>Impatiens biflora</i>	<i>Lobelia syphilitica</i>
<i>Cubelium concolor</i>	<i>Sitilias Caroliniana</i>
<i>Passiflora lutea</i>	<i>Ambrosia trifida</i>
<i>Rhexia Virginica</i>	<i>Bidens bipinnata</i>
<i>Circaea Lutetiana</i>	<i>Elephantopus Carolinianus</i>
<i>Steironema ciliatum</i>	<i>Stachys tenuifolia</i>
<i>Frasera Carolinensis</i>	<i>Eupatorium purpureum</i>
<i>Asclepias incarnata</i>	<i>Verbesina alternifolia</i>
<i>Polemonium reptans</i>	<i>Verbesina Virginica</i>
<i>Phlox divaricata</i>	<i>Vernonia maxima</i>
<i>Phlox maculata</i>	<i>Helenium autumnale</i>
<i>Hydrophyllum appendiculatum</i>	<i>Mesadenia reniformis</i>
<i>Phacelia Purshii</i>	<i>Fluchea petiolata</i>
<i>Agastache nepetoides</i>	<i>Scutellaria incana</i>
<i>Agastache scrophulariaefolius</i>	<i>Polymnia Canadensis radiata</i>

A considerable portion of the bottom lands, especially along the Mississippi and Cache rivers, are covered for a part or all of the year with water, causing the development of extensive swamp areas. Those along the Mississippi in Union county have originated mostly from ox-bows of the Big Muddy river; the largest of these are known locally as lakes, as Wolf Lake, Clear Lake, and Grass Lake. Those of the Cache river are apparently due to the general level of the country, which is so little above the Ohio that the

drainage is not sufficient to remove the water completely. The bald cypress is found only in the Cache river swamps and along some of the smaller tributaries of the Ohio.

The swamps in the Mississippi river bottoms are inundated every year, and in the larger lakes there is always standing water. The principal trees there are the following:

<i>Acer rubrum</i>	<i>Platanus occidentalis</i>
<i>Acer saccharinum</i>	<i>Populus heterophylla</i>
<i>Acer Negundo</i>	<i>Populus deltoides</i>
<i>Gleditsia triacanthos</i>	<i>Quercus palustris</i>
<i>Hicoria Pecan</i>	<i>Liquidambar Styraciflua</i>
<i>Salix amygdaloides</i>	<i>Nyssa sylvatica</i>
<i>Salix nigra</i>	<i>Fraxinus lanceolata</i>
<i>Celtis Mississippensis</i>	

All except the two willows reach large dimensions and are often conspicuous because of the conical basal portion of the trunk. One specimen of *Gleditsia triacanthos* measured eleven feet in circumference at the base, but only three feet six inches at a height of four feet from the ground.

Of the shrubby species *Cephalanthus occidentalis* is everywhere abundant, growing not only in all of the wettest places of the land, but extending some distance into the water. Other typical shrubs are:

<i>Rosa Carolina</i>	<i>Planera aquatica</i>
<i>Adelia acuminata</i>	<i>Salix fluviatilis</i>
<i>Rhamnus Caroliniana</i>	<i>Ilex decidua</i>

Benzoin Benzoin

The same species of lianas occur in the swamps as in the flood-plain society.

Herbaceous species:

<i>Jussiaea diffusa</i>	<i>Boltonia asteroides</i>
<i>Jussiaea decurrens</i>	<i>Ludwigia alternifolia</i>
<i>Saururus cernuus</i>	<i>Typha latifolia</i>
<i>Alisma Plantago-aquatica</i>	<i>Eragrostis hypnoides</i>
<i>Sagittaria latifolia</i>	<i>Zizania aquatica</i>
<i>Scirpus cyperinus</i>	<i>Polygonum incarnatum</i>
<i>Scirpus atrovirens</i>	<i>Polygonum incarnatum</i>
<i>Scirpus lineatus</i>	<i>Achillea tamariscina</i>
<i>Scirpus lacustris</i>	<i>Koripa palustris</i>
<i>Penthorum sedoides</i>	<i>Ammannia coccinea</i>
<i>Isnardia palustris</i>	<i>Cicuta maculata</i>
<i>Samolus floribundus</i>	<i>Asclepias perennis</i>
<i>Ipomoea lacunosa</i>	<i>Lippia lanceolata</i>
<i>Spermacoce glabra</i>	<i>Eclipta alba</i>
<i>Helenium tenuifolium</i>	<i>Senecio lobatus</i>
<i>Teucrium Americanum</i>	<i>Mentha Canadensis</i>
<i>Conoclinium multifidum</i>	<i>Monnina rotundifolia</i>
<i>Ilysanthes attenuata</i>	<i>Mimulus alatus</i>
<i>Ilysanthes dubia</i>	<i>Mimulus ringens</i>

All of these species are likewise found in the cypress swamps, and in addition the following:

Trees:

Taxodium distichum

Catalpa speciosa

Fraxinus profunda

Shrubs.

*Styrax Americana**Itea Virginica*

Herbs:

*Paspalum mucronatum**Passiflora incarnata**Fluchea petiolata**Hymenocallis occidentalis*

The largest cypress swamps are along the Cache river in Johnson and Massac counties, just south of the Ozark hills, and in the flat undrained country between the Cache river and the head-waters of Big Bay creek. The drainage is very poor, so that at most seasons of the year the ground is covered one to two feet with stagnant water, and some of the swamps, particularly near Big Bay, Massac county, are inundated at all times. The Cache river, however, has a channel that serves to remove the water, so that the swamps bordering it are usually dry for a portion of the summer. Artificial drainage, together with the partial clearing of the river channel, has also aided in carrying off the water and leaving parts of the swamps open for cultivation. The swamps near Big Bay are between Cache river and Big Bay creek, and at flood time empty indiscriminately into either or both of them. An extensive system of dredge ditches will be necessary to drain them thoroughly. Cypress swamps also occur north of the Ozarks in Saline county, and along the Wabash river as far north as Wabash county.

Nearly all of the largest trees have been cut for lumber, and some sawmills are even yet in operation. There are many small trees and seedlings, and the size which cypress may reach in this

latitude is evidenced by huge stumps sometimes eight feet across, and by an occasional immense tree, which was left by the lumbermen, and which by its rounded spreading top stands in sharp contrast with the pyramidal shape of the younger trees. Ridgeway reports that the tree may surpass one hundred and fifty feet in height.

Field work upon the river-bank and strand and the weed societies has not been carried on sufficiently to warrant description of the vegetation here.

Chapter 6, List of species.

Sufficient information is not available for the publication of a complete list of the species composing the flora of southern Illinois. Patterson's catalogue of Illinois plants is entirely out of date, and the accessible herbaria contain few specimens or none at all of the more difficult genera, such as *Panicum*, *Cratogeomys*, *Sisyrinchium*, *Viola*, or *Antennaria*, and generally but a poor representation of the others. Until further collections are made, and further field study given to the flora, a complete list will be impossible. On this account it has been deemed advisable to limit the following list to species actually collected or observed by the writer in his field work, and to exclude all others, even though there is not the slightest doubt of their occurrence.

The nomenclature followed is that used in Britton's Manual of the flora of the northern States and Canada, that being at present the most comprehensive work on the flora of the region, and therefore best suited to the use of the ecologist who does not wish to become involved in the nomenclatorial discussion which is still attracting the attention of systematists.

Species with limited range in the state or in the Ozark region have their range indicated, as well as the plant societies in which they occur.

Subkingdom PTERIDOPHYTA

OPHIOGLOSSACEAE

Botrychium Virginianum (L.) Sw. Mesophytic woods and the higher flood-plains.

OSMUNDACEAE

Osmunda regalis L. Flood-plain woods, Jackson county.

Osmunda cinnamomea L. Rich woods and on shaded cliffs.

Osmunda Claytoniana L. In similar situations.

POLYPODIACEAE.

Polypodium vulgare L. Mesophytic cliffs.

Polypodium polypodioides (L.) A. S. Hitchcock. Mesophytic or xerophytic sandstone cliffs. Illinois: the Ozark region.

Adiantum pedatum L. Rich woods and mesophytic cliffs, particularly on shaded hillsides.

Pteridium aquilinum (L.) Kuhn. Mesophytic and xerophytic cliffs, dry upland woods, particularly in the limestone region.

Pellaea atropurpurea (L.) Link. Limestone cliffs.

Cheilanthes lanosa (Michx.) Watt. Xerophytic cliffs. Illinois: the Ozark region and bluffs along the Mississippi river from St. Louis south.

Cheilanthes Feei Moore. Dry limestone cliffs, Jackson and Union counties. Illinois: bluffs of the Mississippi river throughout its length.

Asplenium platyneuron (L.) Oakes. Mesophytic cliffs.

Asplenium Trichomanes L. Shaded sandstone cliffs.

Asplenium angustifolium Michx. Rich upland woods and shaded cliffs.

Asplenium Filix-foemina (L.) Bernh. Rich woods, especially in the flood-plains; occasional on cliffs.

Camptosorus rhizophyllus (L.) Link. Damp shaded sandstone cliffs.

Polystichum achrostichoides (Michx.) Schott. Shaded cliffs and moist upland hillsides.

Dryopteris marginalis (L.) Gray. Shaded sandstone cliffs and occasional in rich upland woods, one of the commonest ferns.

Dryopteris spinulosa (Retz) Kuntze. Shaded upland hillsides, sometimes on cliffs.

Phegopteris hexagonoptera (Michx.) Fee. Rich shaded upland woods and cliffs.

Filix bulbifera (L.) Underw. Mesophytic sandstone cliffs.

Filix fragilis (L.) Underw. Mesophytic upland woods.

Woodsia obtusa (Spreng.) Torr. Ledges of sandstone cliffs, Jackson county.

Onoclea sensibilis L. Mesophytic flood-plain woods.

EQUISETACEAE

Equisetum arvense L. Springy places on hillsides and cliffs.

Equisetum laevigatum A. Br. In similar situations.

Subkingdom Spermatophyta

FINACEAE

Pinus echinata Mill. Dry rocky limestone soil, Union and Alexander counties. Illinois: The Ozark region.

Taxodium distichum (L.) L.C. Rich. In swamps along the Ohio river and its tributaries in Alexander, Union, Pulaski, Massac, Johnson, Pope, Hardin, Saline, Gallatin, and White counties. Illinois:

distribution as given.

Juniperus communis L. Dry upland woods, rock barrens, and xerophytic cliffs.

Juniperus Virginiana L. Dry upland woods, xerophytic cliffs, and common on rock barrens.

TYPHACEAE

Typha latifolia L. In open swamps and along the edge of ponds.

ALISMACEAE

Alisma Plantago-aquatica L. In swamps and wet river bottoms.

Echinodorus cordifolius (L.) Griseb. In swamps and on muddy river banks. Illinois: central and southern portions.

Sagittaria latifolia Willd. Ponds, swamps, and along slow streams.

VALLISNERIACEAE

Philotria Canadensis (Michx.) Britton. Still or slowly running water.

GRAMINEAE

Andropogon scoparius Michx. Dry upland woods and sassafras barrens.

Andropogon Virginicus L. Dry upland woods. Illinois: central and southern portions.

Andropogon furcatus Muhl. Dry upland woods and sassafras barrens.

Sorghastrum avenaceum (Michx.) Nash. Dry upland woods.

Sorghum Halepense (L.) Pers. In gardens and on roadsides, Union county. Illinois: the extreme southern part.

Paspalum mucronatum Muhl. In cypress swamps, Johnson county. Illinois: St. Clair county and southward.

Paspalum laeve Michx. Dry upland woods, rock barrens, and waste places. Illinois: Marion county and southward.

- Paspalum setaceum* Michx. Dry upland woods. Illinois: central and southern parts, Kankakee county and southward.
- Syntherisma sanguinalis* (L.) Dulac. Waste places.
- Echinochloa Crus-Galli* (L.) Beauv. Swamps and waste places.
- Panicum capillare* L. Common in waste places and in upland woods.
- Panicum Philadelphicum* Bernh. Dry upland woods, Union county. Illinois: distribution not known, probably only in the southern part.
- Panicum cognatum* Schultes. Dry rocky upland woods, Jackson county.
- Panicum proliferum* Lam. Waste places and especially along riverbanks.
- Panicum virgatum* L. Dry upland woods, rare.
- Panicum agrostoides* Spreng. Wet river bottoms, Jackson county. Illinois: Hancock county and southward.
- Panicum rostratum* Muhl. Wet river bottoms and along streams, Jackson and Johnson counties. Illinois: central and southern parts.
- Panicum barbulatum* Michx. Dry upland woods, common. Illinois: probably throughout.
- Panicum Tennesseeense* Ashe. Very common in dry upland woods. Illinois: probably throughout.
- Panicum meridionale* Ashe. Dry upland woods. Illinois: the Ozark region and north along the Mississippi to St. Louis.
- Panicum polyanthes* Schult. Dry upland woods, one of the commonest of southern Illinois grasses.
- Panicum Porterianum* Nash. Rich shaded woods.
- Panicum pubifolium* Nash. Rich wooded hillsides, Union county. Ill-

inois: probably only in the Ozark region.

Chaetochloa glauca (L.) Scribn. Waste places.

Cenchrus tribuloides L. Sandy river banks and waste places.

Homalocenchrus oryzoides (L.) Poll. River bottoms and in wet upland woods.

Aristida oligantha Michx. Dry upland woods and waste places.

Illinois: Henderson county and southward.

Muhlenbergia diffusa Willd. Rich woods and in gardens and roadsides.

Brachyelytrum erectum (Schreb.) Beauv. Rich wooded hillsides.

Phleum pratense L. Fields and roadsides.

Cinna latifolia (Trev.) Griseb. Rich upland woods, Jackson county.

Agrostis alba L. Dry upland woods and sassafras barrens.

Danthonia spicata (L.) Beauv. Kerophytic upland woods.

Spartina cynosuroides (L.) Willd. Open swamps.

Atheropogon curtispendus (Michx.) Fourn. Rich upland woods, Jackson county.

Eleusine Indica (L.) Gaertn. Waste places, abundant.

Tricuspis seslerioides (Michx.) Torr. Dry upland woods and sassafras barrens. Illinois: central and southern portions.

Eragrostis Frankii Steud. Waste places and along river banks.

Eragrostis major Host. Waste places, common.

Eragrostis pectinacea (Michx.) Steud. Dry upland woods and sassafras barrens.

Eragrostis hypnoides (Lam.) B.S.P. Muddy river banks.

Koeleria cristata (L.) Pers. Dry upland woods and rock barrens.

Melica mutica Walt. Dry upland woods and rock barrens.

Uniola latifolia Michx. Mesophytic woods. Illinois: central and southern portions, Macon county and southward.

Poa pratensis L. Upland woods and roadsides.

Poa compressa L. Dry upland woods and rock barrens.

Panicularia nervata (Willd.) Kuntze. Swamps and especially along slow streams.

Festuca octoflora Walt. Dry upland woods, common on rock barrens.

Bromus ciliatus L. Mesophytic upland woods and shaded hillsides.

Bromus secalinus L. Introduced in waste places.

Hordeum nodosum L. Waste places, common.

Hordeum pusillum Nutt. Waste places, abundant. Illinois: western portion, from Henry county southward in the Mississippi valley.

Hordeum jubatum L. Fields, gardens, and roadsides.

Elymus striatus Willd. Mesophytic upland woods and cliffs.

Elymus Virginicus L. Dry upland woods, cliffs, and sassafras barrens.

Elymus Canadensis L. Open sunny places, especially in bottoms.

Hystrix Hystrix (L.) Millsp. Xerophytic hillsides and cliffs.

Arundinaria tecta (Walt.) Muhl. Wet bottom lands and swamps.

Union county and southward and occasional in mesophytic upland woods and cliffs throughout the Ozark region. Illinois: the Ozark region and southward. A characteristic member of the swamp flora producing small cane breaks and often attaining a height of twelve feet.

CYPERACEAE J.

Cyperus diandrus Torr. River bottoms and sand bars.

Cyperus erythrorhizos Muhl. Wet bottom lands and muddy river banks.

Cyperus strigosus L. River bottoms, marshes, and introduced in waste places.

Cyperus ovularis (Michx.) Torr. Xerophytic upland woods, rock barrens, sassafras barrens, and cliffs.

Kyllinga pumila Michx. Sandy river banks.

Eleocharis obtusa Sch. Swamps, common.

Eleocharis acicularis (L.) R. & S. Muddy river banks.

Eleocharis acuminata (Muhl.) Nees. Muddy river banks.

Stenophyllus capillaris (L.) Britton. Sand bars and gravelly creek beds.

Fimbristylis autumnalis (L.) R. & S. Gravelly stream banks, Massac county.

Scirpus lacustris L. Open swamps and along creeks.

Scirpus atrovirens Muhl. Swamps.

Scirpus lineatus Michx. Swamps and wet bottom lands.

Scirpus cyperinus (L.) Kunth. Gravelly creek beds in Massac county.

Hemicarpha micrantha (Vahl.) Britton. Sandy river banks.

Carex Asa-Grayi Bailey. Mesophytic flood plains.

Carex Frankii Kunth. Wet bottom land woods. Jackson county, and southward. Illinois: the extreme southern portion.

Carex squarrosa L. Wet bottom land woods. Illinois: from Macon county southward.

Carex Shortiana Dewey. Wet flood plain woods.

Carex triceps Michx. Xerophytic upland woods and rock barrens.

Carex glaucoidea Tuckerm. Dry upland woods and occasional on rock barrens. Illinois: central and southern portions.

Carex vulpinoidea Michx. Wet ground.

Carex rosea Schk. Dry upland woods and sassafras barrens.

Carex straminea Willd. Mesophytic soil.

ARACEAE

Arisaema triphyllum (L.) Torr. Mesophytic upland woods and flood plains.

Arisaema Drachontium (L.) Schott. Flood plain woods.

Commelina Virginica L. Escaped or introduced along road sides.

Commelina hirtella Vahl. Cypress swamps in Johnson county. Illinois: extreme southern portion.

Tradescantia Virginiana L. Upland woods.

Tradescantia reflexa Raf. Xerophytic upland woods, Union county.

Illinois: apparently only in the central and southern portions.

Tradescantia pilosa Lehm. Shaded mesophytic woods.

JUNACEAE

Juncus interior Wieg. Xerophytic upland woods and rock barrens. Jackson county.

Juncus tenuis Willd. Very abundant in xerophytic upland woods and sassafras barrens.

Juncus Torreyi Coville. Swamps and wet grounds.

Juncoides campestre (L.) Kuntze. Mesophytic upland woods and hillsides.

MELANTHACEAE

Ocularia grandiflora J.E. Smith. Mesophytic woods.

LILIACEAE

Heimerocallis fulva L. Escaped from cultivation.

- Allium Canadense* L. Open bottom land woods and frequently as a weed along roadsides.
- Nothoscordum bivalve* (L.) Britton. Bottom land woods, especially in sandy soil. Illinois: from Macon county southward.
- Lilium Canadense* L. Mesophytic upland woods.
- Erythronium albidum* Nutt. Mesophytic wood lands.
- Quamasia hyacinthina* (Raf.) Britton. Upland woods and frequently in cleared soil.

CONVALLARIACEAE

- Asparagus officinalis* L. Escaped from cultivation.
- Vagnera racemosa* (L.) Morong. Mesophytic upland woods and flood-plains.
- Vagnera stellata* (L.) Morong. Mesophytic wood lands.
- Salomonina commutata* (R. & S.) Britton. Mesophytic upland woods and flood-plains.
- Trillium recurvatum* Beck. Mesophytic upland woods and common in flood-plains.
- Trillium erectum* L. Mesophytic upland woods Jackson county.

SMILACEAE

- Smilax herbacea* L. Mesophytic woods and flood plains.
- Smilax pulverulenta* Michx. Wet river bottoms, Union county.
- Smilax glauca* Walt. Very abundant in a variety of situations, especially in swamps.
- Smilax hispida* Muhl. Mesophytic woods.
- Smilax Bona-nox* L. Flood-plains and swamps.

AMARYLLIDACEAE

- Hymenocallis occidentalis* (Le Conte) Kunth. Cypress swamps, Johnson

county and southward. Illinois: in the extreme southern portion.

Agave Virginica L. Xerophytic upland woods and rock barrens.

Illinois: the Ozark region.

Hypoxis hirsuta (L.) Coville. Mesophytic upland woods.

DIOSCOREACEAE

Dioscorea villosa L. Mesophytic woods.

IRIDACEAE

Iris versicolor L. Open swamps.

Gemmingia Chinensis (L.) Kuntze. Escaped from cultivation in Jackson and Pulaski counties.

SAURURACEAE

Saururus cernuus L. Very abundant in swamps.

SALICACEAE

Populus heterophylla L. Wet river bottoms and cypress swamps.

Jackson county and southward. Illinois: the extreme southern portion.

Populus deltoides Marsh. River bottoms.

Salix nigra Marsh. River bottoms and along streams.

Salix amygdaloides Anders. Sand bars of the Mississippi river.

Salix fluviatilis Nutt. River banks, common.

Salix humilis Marsh. Xerophytic upland woods, Jackson county.

JUGLANDACEAE

Juglans nigra L. Upland woods and flood plains.

Juglans cinerea L. Mesophytic upland woods and floor plains.

Hicoria Pecan (Marsh.) Britton. Bottom-lands, abundant. Illinois:

the valleys of the larger rivers as far north as Vincennes, Peoria and Keokuk.

Hicoria ovata (Mill.) Britton. Mesophytic upland woods.

Hicoria laciniosa (Michx. f.) Sarg. River bottoms.

Hicoria microcarpa (Nutt.) Britton. Xerophytic upland woods and rock barrens.

BETULACEAE

Carpinus Caroliniana Walt. Mesophytic upland woods, cliffs, and very abundant on flood-plains.

Ostrya Virginiana (Mill.) Willd.. Upland woods, rock barrens, and Xerophytic cliffs.

Corylus Americana Walt. Upland woods.

Betula nigra L. River bottoms and along the smaller streams.

Alnus rugosa (Du Roi) K. Koch. Along the shores of streams and ponds.

FAGACEAE

Fagus Americana Sweet. Mesophytic woodlands from Jackson county southward. In the mesophytic flood-plains of Union county it is one of the commonest and largest trees. Illinois: the shore of Lake Michigan and the Ozark region.

Quercus rubra L. Upland woods.

Quercus palustris DuRoi. Flood plain woods.

Quercus velutina Lam. Upland woods.

Quercus Marylandica Muench. Upland woods and rock barrens.

Quercus imbricaria Michx. Flood-plain woods.

Quercus alba L.

Quercus minor (Marsh.) Sarg. Xerophytic upland woods and rock

'barrens.

Quercus macrocarpa Michx. Upland woods and flood plains.

Quercus platanoides (Lam.) Sudw. Flood plain woods.

Quercus acuminata (Michx. Upland woods.

ULMACEAE

Ulmus Americana L. Mesophytic woods.

Ulmus alata Michx. Xerophytic upland woods and rock barrens.

Ulmus fulva Mich. Mesophytic woods.

Planera aquatica (Walt.) J. F. Gmel. Wet flood plains and occasional xerophytic upland woods, Jackson county and southward.

Illinois: the Ozark region and southward.

Celtis occidentalis L. Mesophytic upland woods and common in flood plains.

Celtis crassifolia Lam. Wet flood-plain woods. Illinois: the Ozark region and southward.

Celtis Mississippensis Bosc. Wet flood plain woods and swamps and occasional in xerophytic upland woods. Illinois: the Ozark region and southward.

MORACEAE

Morus rubra L. Mesophytic woods.

URTICACEAE

Urticastrum divaricatum (L.) Kuntze. Mesophytic flood-plain woods and cliffs.

Adicea pumila (L.) Raf. Flood-plains and shaded mesophytic cliffs.

Boehmeria cylindrica (L.) Willd. Mesophytic woods and cliffs.

Parietaria Pennsylvanica Muhl. Upland woods.

IORANTHACEAE

Phoradendron flavescens (Pursh) Nutt. On tupelo, elm, and maple.

Illinois: the Ozark region and southward.

ARISTOLOCHIACEAE

Asarum reflexum ambiguum Bicknell. Moist shaded hillsides.

Aristolochia tomentosa Sims. Xerophytic upland woods and rock barrens, Jackson county. Illinois: Wabash county to Jackson county and southward.

POLYGONACEAE

Rumex Acetosella L. Waste places.

Rumex crispus L. Waste places, road-side, and gardens.

Rumex obtusifolius L. Waste places.

Rumex persicarioides L. Sand bars of the Mississippi river, Jackson county.

Polygonum emersum (Michx.) Britton. River bottoms and sand bars.

Polygonum incarnatum Ell. River bottoms and swamps and common along the shores of the Mississippi river.

Polygonum lapathifolium L. Roadsides and gardens.

Polygonum Pennsylvanicum L. Fields, roadsides and low places.

Polygonum hydropiperoides Michx. Swamps and wet grounds.

Polygonum punctatum Ell. Swamps and rock barrens.

Polygonum Virginianum L. Mesophytic woods.

Polygonum aviculare L. Yards and waste places.

Polygonum erectum L. Roadsides and waste places.

Polygonum tenue Michx. Xerophytic upland woods and rock barrens.

Polygonum Convolvulus L. Waste places.

Polygonum scandens L. Mesophytic woods.

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Polygonum sagittatum L.. Wet river bottoms, Jackson county.

Brunnichia cirrhosa Banks. Shores of the Ohio river, Massac county.

Illinois: extreme southern portion.

CHENOPODIACEAE

Chenopodium album L. Waste places and gardens.

Chenopodium album viride (L.) Moq. Upland woods.

Chenopodium hybridum L. Mesophytic woods, Jackson county.

Chenopodium Botrys L. Sand bars of the Mississippi river.

Chenopodium ambrosioides L. Roadsides, yards and waste places,
Jackson county.

Cycloloma atriplicifolium (Spreng.) Coult. Sand bars of the
Mississippi river.

Atriplex hastata L. Waste places.

AMARANTHACEAE

Amaranthus retroflexus L. Roadsides gardens, and waste places.

Amaranthus hybridus L. Waste places, not common.

Amaranthus spinosus L. Roadsides and gardens. Illinois: southern
portion, gradually extending its range northward.

Acnida tamariscina (Nutt.) Wood. Swamps and river banks.

PHYTOLACCACEAE

Phytolacca decandra L. Common in moist ground.

NYCTAGINACEAE

Allionia nyctaginea Michx. In dry soil.

AIZOACEAE

Mollugo verticillata L. River banks, sand bars, and waste places.

PORTULACACEAE

Claytonia Virginica L. Mesophytic upland woods and flood-plains.

Portulaca oleracea L. Cultivated soil.

CARYOPHYLLACEAE

Agrostemma Githago L. Roadsides, waste places, and cultivated fields, especially in wheat . .

Silene stellata (L.) Ait. Mesophytic upland woods and shaded cliffs.

Silene antirrhina L. Dry upland woods, waste places and xerophytic cliffs.

Saponaria officinalis L. Escaped from cultivation.

Alsine media L. Naturalized in waste ground.

Cerastium vulgatum L. Road sides, lawns, and waste places.

Cerastium longipedunculatum Muhl. Exceedingly common in mesophytic upland woods and on shady cliffs.

Sagina decumbens (Ell.) T. & G. Xerophytic upland woods and cliffs.

Anychia dichotoma Michx. Dry upland woods.

NYMPHAEACEAE

Nymphaea advena Soland. Abundant in ponds.

MAGNOLIACEAE

Magnolia acuminata L. Mesophytic upland woods and flood-plains.

Liriodendron Tulipifera L. Mesophytic woods.

ANONACEAE

Asimina triloba (L.) Dunal. Mesophytic woods, especially common in flood-plains at the base of cliffs.

RANUNCULACEAE

- Hydrastis Canadensis* L. Mesophytic upland woods and flood-plains.
- Isopyrum biternatum* (Raf.) T. & G. Rich, shaded woods.
- Actaea alba* (L.) Mill. . Moist or dry upland woods and cliffs.
- Cimicifuga racemosa* (L.) Nutt. Shaded hillsides in the Pine Hills,
Union county.
- Aquilegia Canadensis* L. Mesophytic upland woods and especially
common on cliffs.
- Delphinium tricornis* Michx. Mesophytic woods.
- Anemone cylindrica* A. Gray. Xerophytic upland woods.
- Anemone Virginiana* L. Xerophytic upland woods and rock barrens.
- Anemone Canadensis* L. Mesophytic woods and flood-plains.
- Hepatica acuta* (Pursh) Britton. Shaded hillsides, Jackson county.
- Syndesmon thalictroides* (L.) Hoffmg. Rich, upland woods.
- Clematis Virginiana* L. Alluvial soil.
- Clematis Simsii* Sweet. River-bottoms.
- Myosurus minimus* L. Waste places and road sides.
- Ranunculus abortivus* L. Rich, moist woods.
- Ranunculus recurvatus* Poir. Mesophytic upland woods and hillsides.
- Ranunculus septentrionalis* Poir. Wet places in alluvial soil.
- Ranunculus hispidus* Michx. Xerophytic upland woods.
- Thalictrum dioicum* L. Rich woods.
- Thalictrum purpurascens* L. Moist shady places.

BERBERIDACEAE

- Caulophyllum thalictroides* (L.) Michx. Mesophytic woods.
- Podophyllum peltatum* L. Mesophytic upland woods and flood-plains.

MENISPERMACEAE

Calyocarpum Lyoni (Pursh) Nutt. Rich shade hillsides. Illinois: the Ozark region and southward.

Cebatha Carolina (L.) Britton. Alluvial soil along rivers and occasional on rock barrens. Illinois: the Ozark region and southward.

Menispermum Canadense L. Mesophytic woods.

LAURACEAE

Sassafras Sassafras (L.) Karst. Dry upland woods and sassafras barrens.

Benzoin Benzoin (L.) Coulter. Mesophytic woods especially along rivers and in the cypress swamps.

PAPAVERACEAE

Sanguinaria Canadensis L. Moist shaded woods.

Stylophorum diphyllum (Michx.) Nutt. Rich moist woods.

Bicuculla Cucullaria (L.) Millsp. Mesophytic wood lands.

Capnoides flavulum (Raf.) Kuntze. Moist flood plain woods, Jackson county. Illinois: Wabash county and southward.

CRUCIFERAE

Lepidium Virginicum L. Road sides and waste places.

Lepidium apetalum Willd. Dry soil.

Sisymbrium officinale (L.) Scop. Gardens and lawns and along roadsides.

Brassica nigra (L.) Koch. Fields, roadsides, and waste places.

Brassica campestris L. Wet, cultivated fields, Jackson county.

Iodanthus pinnatifidus (Michx.) Steud. Wet, low woods.

Roripa palustris (L.) Bess. Wet soil and muddy river banks.

Roripa sessiliflora (Nutt.) Banks of the Mississippi river.

Jackson county. Illinois: the central and southern portions from Peoria county southward.

Cardamine Pennsylvanica Muhl. Moist soil and shaded cliffs.

Cardamine arenicola Britton. Ledges of sandstone cliffs, Jackson county. Illinois: the Ozark region.

Cardamine bulbosa (Schreb.) B.S.P. Moist shaded alluvial soil.

Dentaria lacinata Muhl. Mesophytic wood lands.

Bursa Bursa-pastoris (L.) Britton. Yards, road sides and waste places.

Camelina sativa (L.) Crantz. Introduced in waste places, Jackson county.

Draba Caroliniana Walt. Dry soil.

Draba brachycarpa Nutt. Dry upland woods and waste places. Illinois: the southern portion.

Sophia intermedia Rydb. Dry sandy soil.

Stenophragma Thaliana (L.) Celak.) Mesophytic cliffs and rocky soil.

Arabis Virginica (L.) Trelease. Common on mesophytic cliffs and shaded rocky soil.

Arabis laevigata (Muhl.) Poir. Shaded wooded hillsides and mesophytic cliffs.

Arabis dentata T. & G. Moist shaded woods.

CRASSULACEAE

Sedum telephioides Michx. Ledges of sand stone cliffs, Pope county. Illinois: the Ozark region.

Sedum pulchellum Michx. Mesophytic sand stone cliffs and ledges. Illinois: the Ozark region.

PENTHORACEAE

Penthorum sedoides L. Wet, shaded places.

SAXIFRAGACEAE

Saxifraga Forbesii Vasey. Heavily shaded sand-stone cliffs. ~~Makan-~~
da, Jackson county. Illinois: the Ozark region.

Heuchera parviflora Bartl. Damp, shaded sand-stone cliffs. Illinois:
the Ozark region.

Heuchera hirsuticaulis (Wheelock)^{Rydb.} Mesophytic or xerophytic lime-
stone or sand-stone cliffs. Illinois: the Ozark region and the
bluffs of the Mississippi river as far north as Madison county.

HYDRANGEACEAE

Hydrangea arborescens. L. Mesophytic upland woods and shaded sand-
stone cliffs. Illinois: the central and southern portions.

Hydrangea cinerea Small. Xerophytic upland woods and cliffs.
Illinois: the Ozark region and north to Vermillion county.

ITEACEAE

Itea Virginica L. Cypress swamps of Johnson county. Illinois:
the extreme southern portion.

GROSSULARIACEAE

Ribes Cynosbati L. Moist shaded hill sides, Jackson county.

HAMAMELIDACEAE

Liquidambar Styraciflua L. Mesophytic woods, flood-plains and
swamps. Occasional on xerophytic hillsides. Illinois: the
Ozark region and southward.

PLATANACEAE

Platanus occidentalis L. Wet low woods and along streams.

ROSACEAE

Aruncus Aruncus (L.) Karst. Moist shaded hillsides.

Porteranthus stipulatus (Muhl.) Britton. Moist or dry upland woods.

Illinois: the central and southern portions.

Rubus occidentalis L. Common in moist soil.

Rubus sp. A form known as dewberry. Abundant in dry upland woods and especially on sassafras barrens.

Fragaria Virginiana Dichesne. Dry upland woods.

Potentilla Monspeliensis L. Road sides, gardens, and waste places.

Potentilla paradoxa Nutt. Banks and sand bars of the Mississippi river.

Potentilla Canadensis L. Dry upland woods, cliffs, and barrens.

Geum vernum (Raf.) T. & G. Mesophytic upland woods.

Geum Canadense Jacq. Moist shaded soil.

Agrimonia striata Michx. Dry upland woods. Illinois: probably only in the central and southern portions.

Agrimonia pumila Muhl. Dry upland woods. Illinois: the Ozark region.

Agrimonia Brittoniana Bicknell. In open sunny bottom lands.

Rosa setigera Michx. Open places in alluvial soil.

Rosa Carolina L. Swamps, and river bottoms.

Rosa humilis Marsh. Dry upland woods.

POMACEAE

Malus coronaria (L.) Mill. Mesophytic wood lands.

Amelanchier Canadensis (L.) Medic. Upland woods and mesophytic cliffs.

Crataegus Crus-galli L. Moist woods and thickets.

DRUPACEAE

Prunus Americana Marsh. Mesophytic woods.

Prunus serotina Ehrh. Rich woods.

MIMOSACEAE

Acacia Illinoensis (Michx.) Kuntze. Banks of the Mississippi river.

CAESALPINIACEAE

Cercis Canadensis L. Rich upland woods and flood-plains.

Cassia nictitans L. Dry upland woods and cliffs. Illinois: the central and southern portions.

Cassia Chamaecrista L. Dry soil.

Cassia Marylandica L. Rich alluvial soil. A form from Vienna, Johnson county has ascending, sharply acute leaflets, and may be a distinct variety.

Gleditsia triacanthos L. Swamps and flood-plains.

Gymnocladus dioica (L.) Koch. Mesophytic woodlands.

PAPILIONACEAE

Crotalaria sagittalis L. Dry upland woods.

Medicago sativa L. Introduced or escaped along roadsides.

Melilotus alba Desv. Naturalized in waste places.

Trifolium procumbens L. Dry upland woods and waste places, Jackson county.

Trifolium pratense L. Naturalized along roadsides.

Trifolium reflexum L. Moist shaded hillsides. Illinois: the central and southern portions from Peoria county southward.

- Trifolium repens* L. Naturalized in lawns and roadsides.
- Psoralea pedunculata* (Mill.) Vail. Dry upland woods and barrens.
Illinois: from Marion county southward.
- Amorpha fruticosa* L. River banks.
- Parosela Dalea* (L.) Britton. Muddy river banks and sand bars of the Mississippi river, Jackson county. Illinois: the western part along the Mississippi and Illinois rivers.
- Kuhinstera candida* (Willd.) Kuntze. Dry upland woods.
- Kuhnistera purpurea* (Vent.) MacM. Dry upland woods.
- Cracca Virginiana* L. Dry upland woods, particularly in rocky soil, and on rock barrens.
- Robinia Pseudacacia* L. frequently escaped from cultivation.
- Astragalus Carolianus* L. Mesophytic woodlands.
- Stylosanthes biflora* (L.) B.S.P. Dry upland woods. Illinois: the Ozark region.
- Meibomia nudiflora* (L.) Kuntze. Xerophytic upland woods.
- Meibomia grandiflora* (Walt.) Kuntze. Moist shaded woods.
- Meibomia pauciflora* (Nutt.) Kuntze. Rich moist woods particularly in flood-plains. Illinois: central and southern portions.
- Meibomia canescens* (L.) Kuntze. Moist sunny places.
- Meibomia paniculata* (L.) Kuntze. Dry soil.
- Meibomia Dillenii* (Darl.) Kuntze. Upland woods.
- Meibomia Marylandica* (L.) Kuntze. Dry upland woods.
- Meibomia obtusa* (Muhl.) Vail. Dry upland woods. Illinois: the Ozark region.
- Lespedeza violacea* (L.) Pers. Upland woods.
- Lespedeza prairiea* (MacK. and Bush.) Small. Dry upland woods. Illinois: the Ozark region.

Lespedeza frutescens (L.) Britton. Dry or moist upland woods.

Lespedeza Virginica (L.) Britton. Upland woods.

Lespedeza hirta (L.) Ell. Upland woods.

Lespedeza capitata Michx. Dry upland woods.

Lespedeza striata (Thumb.) H. & A. Moist or dry upland woods.

Illinois: the Ozark region and north to Wabash county.

Clitoria Mariana L. Dry upland woods, Pope county. Illinois: the Ozark region.

Falcata comosa (L.) Kuntze. Moist shaded woods.

Apios Apios (L.) MacM. Rich woods.

Phaseolus polystachyus (L.) B.S.P. Upland woods and thickets.

Illinois: the Ozark region.

Strophostyles helvola (L.) Britton. Moist, sunny places. Common on sassafras barrens.

Strophostyles umbellata (Muhl.) Britton. Dry sandy soil and sassafras barrens. Illinois: its southern portion.

Strophostyles pauciflora (Benth.) S. Wats. Sand bars of Mississippi river.

GERANIACEAE

Geranium maculatum L. Rich woods.

Geranium Carolinianum L. Dry waste places.

OXALIDACEAE

Oxalis stricta L. Moist soil.

Oxalis Bushii Small. A form at present referred to this species is frequent in moist shady woods.

Oxalis cymosa Small. Open places in woods and on cliffs.

LINACEAE

Linum sulcatum Riddell. Xerophytic upland woods.

RUTACEAE

Xanthoxylum Americanum Mill. Moist woods.

Ptelea trifoliata L. Rich, upland woods and flood-plains.

EUPHORBIACEAE

Phyllanthus Carolinensis Walt. Gravel beds of Massac Creek, Massac county. Illinois: the central and southern portions from the Sangamon river southward.

Croton glandulosus L. Dry soil. Illinois: southern and southwestern parts from Peoria and Henderson county southward.

Croton capitatus Michx. Dry soil and road sides. Illinois: the southern portion, extending north to the Wisconsin moraine.

Croton monanthogynus Michx. Upland woods, waste places and xerophytic cliffs. Illinois: the southern portion.

Crotonopsis linearis Michx. Rock barrens. Illinois: the central and southern parts from LaSalle county southward.

Acalypha Virginica L. Moist soil.

Acalypha gracilens A. Gray. Mesophytic woodlands. Illinois: the Ozark region.

Euphorbia maculata L. Moist open places, and on sand bars.

Euphorbia nutans Lag. Gardens, road sides and waste land.

Euphorbia corollata L. Dry sunny places.

Euphorbia dentata Michx. Moist or dry upland woods and xerophytic cliffs.

ANACARDIACEAE

Rhus copallina L. Xerophytic upland woods and rock barrens.

Rhus glabra L. Dry or moist upland woods.

Rhus aromatica Ait. Dry upland woods and a characteristic member of the rock barren society.

Rhus radicans L. Common in all kinds of soil.

ILICACEAE

Ilex decidua Walt. Flood-plains and swamps.

CELASTRACEAE

Euonymus obovatus Nutt. Moist shaded cliffs, Jackson county.

Euonymus atropurpurens Jacq. Rich woods, especially in alluvial soil.

Celastrus scandens L. Damp woods.

STAPHYLEACEAE

Staphylea trifolia L. Moist woods and thickets.

ACERACEAE

Acer saccharinum L. Moist alluvial soil.

Acer rubrum L. Wet river bottoms and swamps.

Acer Saccharum Marsh. Rich upland woods and occasional in the bottom lands.

Acer nigrum Michx. Rich upland woods.

Acer Negundo L. Wet woods and swamps in alluvial soil.

HIPPOCASTANACEAE

Aesculus glabra Willd. Rich upland woods and flood-plains.

BAISAMINACEAE

Impatiens biflora Walt. Moist shaded places , especially in alluvial soil.

Impatiens aurea Muhl. Damp shaded places.

RHAINACEAE

Rhamnus Caroliniana Walt. Rich shaded flood plains and swamps.

Illinois: extreme southern portion.

Ceanothus Americanus L. Dry upland woods.

VITACEAE

Vitis aestivalis Michx. Dry upland woods and sassafras barrens.

Illinois: the southern portion extending north to Wabash county.

Vitis vulpina L. Alluvial soil and along streams.

Vitis cordifolia Michx. Moist woods.

Ampelopsis cordata Michx. Rich moist flood-plain woods.

Illinois: extreme southern portion.

Parthenocissus quinquefolia (L.) Planch. In dry or moist soil , especially on cliffs.

TILIACEAE

Tilia Americana L. Mesophytic woodlands.

MALVACEAE

Malva rotundifolia L. Yards and waste places.

Sida spinosa L. Roadside gardens, and waste places.

Abutilon Abutilon (L.) Rusby. Fields, gardens, and waste grounds.

Hibiscus lasiocarpus Cav. Wet river bottoms, and swamps, especially where the timber has been cleared. Illinois: the southern portion from Macoupin county southward.

Hibiscis militaris Cav. Swamps.

HYPERICACEAE

Ascyrum hypericoides L. Dry, rocky, upland woods. Illinois: the Ozark region.

Hypericum sphaerocarpum Michx. Dry rocky woods and xerophytic cliffs.

Hypericum maculatum Walt. Mesophytic woodlands.

Hypericum mutilum L. Moist shady places.

Sarothra gentianoides L. Rock barrens.

Triadenum petiolatum (Walt.) Britton. Cypress swamps, Johnson county. Illinois: the extreme southern portion.

CISTACEAE

Lechea tenuifolia Michx. Xerophytic upland woods and rock barrens.

VIOLACEAE.

Viola palmata L. Moist or dry upland woods.

Viola pedata L. Dry rocky upland woods.

Viola papilionacea Pursh. Moist shaded ground.

Viola scabriuscula (T. & G.) Schwein. Rich woods, especially in the river bottoms.

Viola striata Ait. Moist, low woods.

Viola Rafinesquii Greene. Dry soil and waste places. Illinois: the southern portion.

Cubelium concolor (Forst.) Raf. Rich moist woods and on mesophytic cliffs.

PASSIFLORACEAE

Passiflora incarnata L. Cypress swamps in Johnson county. Illinois:

the extreme southern portion.

Passiflora lutea L. Moist or dry upland woods and thickets. Illinois: from Macoupin county southward.

CACTACEAE

Opuntia humifusa Raf. Rock barrens and xerophytic cliffs. Illinois: the southern and western parts.

HELMINTHACEAE

Limnania coccinea Rottb. Swamps, river banks, and open places in the bottoms.

Parsonia petiolata (L.) Rusby. Dry, sunny places.

MELASTOMACEAE

Rhexia Virginica L. Open swamps, Massac county. Illinois: the Ozark region and in La Salle county.

ONAGRACEAE

Isnardia palustris L. Swamps and muddy river banks.

Ludwigia alternifolia L. Wet, sunny places.

Jussiaea diffusa Forskl. Swamps and muddy river banks. Illinois: the southern portion from Madison county southward.

Jussiaea decurrens (Walt.) DC. Gravelly creek beds. Illinois: the extreme southern portion. The stems root in the sand on the creek banks or in shallow water. Lateral roots extend for some distance under the water and send up at intervals short vertical branches which reach to the surface and are thickly covered with aerenchyma.

Onagra biennis (L.) Scop. Dry soil.

Oenothera laciniata Hill. Dry sandy soil. Illinois: the central

and southern portions from Mason county southward.

Kneiffia linifolia (Nutt.) Spach. Rock barrens. Johnson and Jackson counties. Illinois: the Ozark region.

Gaura biennis L. Dry sunny places.

Circaea Lutetiana L. Mesophytic upland woods and flood plains.

ARALIACEAE

Aralia spinosa L. Mesophytic woods and flood plains. Sometimes twelve to fifteen feet high. Illinois: the extreme southern portion.

Aralia racemosa L. Moist shaded hillsides.

Panax quinquefolium L. Rich wooded hillsides, rare.

UMBELLIFERAE

Sanicula Marylandica L. Upland woods.

Sanicula Canadensis L. Upland woods.

Eryngium aquaticum L. Open, sunny swamps and on rock barrens.

Chaerophyllum procumbens (L.) Crantz. Mesophytic woodlands. Some specimens from Jackson county may be referable to *Chaerophyllum Teinturierii* Hook., which is reported from southeastern Missouri by B. F. Bush.

Washingtonia Claytoni (Michx.) Britton. Mesophytic woodlands.

Erigenia bulbosa (Michx.) Nutt. Rich, moist woods.

Zizia aurea (L.) Koch. Mesophytic upland woods and flood-plains.

Cicuta maculata L. Swamps and wet places.

Deringa canadensis (L.) Kuntze. Damp shaded soil.

Taenidia integerrima (L.) Drude. Dry hillsides and xerophytic cliffs.

Thaspium trifoliatum (L.) Britton. Xerophytic upland woods, especially in cleared soil. Illinois: the Ozark region.

Thaspium trifoliatum aureum (Nutt.) Britton. With the type.

Polytaenia Nuttallii DC. Dry upland woods and rock barrens.

Pastinaca sativa L. Naturalized in waste places.

Daucus Carota L. A weed in dry soil.

CORNACEAE

Cornus florida L. Upland woods.

Cornus Amomum Mill. Mesophytic woods and alluvial soil.

Nyssa sylvatica Marsh. Flood-plains. Illinois: extreme southern portion.

ERICACEAE

Azalea nudiflora L. Dry rocky hillsides, in the Pine Hills of Union county. Illinois: the Ozark region.

VACCINIACEAE

Gaylussacia resinosa (Ait.) T. & G. Upland woods and mesophytic cliffs.

Batodendron arboreum (Marsh) Nutt. Dry, upland woods and characteristic of rock barrens. Illinois: the Ozark region.

Vaccinium vacillans Kalm. Mesophytic ledges of sand-stone cliffs.

PRIMULACEAE

Samolus floribundus H.B.K. Swamps and muddy river banks.

Steironema ciliatum (L.) Raf. Moist alluvial soil and on mesophytic cliffs.

Dodecatheon Meadia L. Mesophytic upland woods and cliffs.

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EBENACEAE

Diospyros Virginiana L. Xerophytic upland woods and sassafras barrens. Illinois: the central and southern portions from Shelby county southward.

STYRACACEAE

Styrax Americana Lam. Cypress swamps and wet woods in Johnson and Massac counties. Illinois: extreme southern portion.

OLEACEAE

Fraxinus lanceolata Borek. Mesophytic woods.

Fraxinus Pennsylvanica Marsh. Mesophytic woods, Pope county.

Fraxinus profunda Bush. Wet, low woods and cypress swamps. Johnson and Massac counties. Illinois: the extreme southern portion.

Fraxinus quadrangulata Michx. Mesophytic woodlands.

Adelia acuminata Michx. Swamps and wet woods. Occasional on xerophytic hillsides. Illinois: the Ozark region and extending northward along the rivers to Wabash and Morgan counties.

GENTIANACEAE

Frasera Carolinensis Walt. Mesophytic upland woods and hillsides.

APOCYNACEAE

Apocynum cannabinum L. Moist soil and waste places.

ASCLEPIADACEAE

Asclepias tuberosa L. Dry upland woods and sassafras barrens.

Asclepias incarnata L. Wet woods and swamps.

Asclepias variegata L. Moist shaded hillsides. Illinois: the Ozark region.

Asclepias quadrifolia Jacq. Xerophytic upland woods and hillsides.

In the Pine Hills Union county.

Asclepias Syriaca L. Fields, roadsides, and waste places.

Asclepias perennis Walt. Wet bottom lands and swamps. Illinois:
extreme southern portion and along the Mississippi river to
St. Clair county.

Asclepias verticillata L. Dry soil.

Gonolobus laevis Michx. Moist, shaded ground and becoming a weed in
gardens.

CONVOLVULACEAE

Ipomoea pandurata (L.) Meyer. Dry upland woods and sassafras barrens.

Ipomoea lacunosa L. Muddy river banks. Illinois: the central and
southern portions from Macon county southward.

Ipomoea purpurea (L.) Roth. Escaped from cultivation.

Ipomoea hederacea Jacq. Escaped.

Convolvulus sepium L. Dry or moist open places.

CUSCUTACEAE

Cuscuta Gronovii Willd. River bottoms and wet places.

POLEMONIACEAE

Phlox maculata L. Wet woods.

Phlox pilosa L. Dry upland woods.

Phlox divaricata L. Rich moist soil, especially in river bottoms.

Phlox Stellaria A. Gray. Xerophytic lime-stone or sand-stone cliffs.
Jackson and Union counties. Illinois: the Ozark region.

Polemonium reptans L. Mesophytic woodlands.

HYDROPHYLLACEAE

Hydrophyllum appendiculatum Michx. Mesophytic upland woods and flood-plains.

Macrocalyx Nyctelea (L.) Kuntze. damp shaded soil.

Phacelia Purshii Buckl. Rich moist woods, Jackson county.

BORAGINACEAE

Heliotropium Indicum L. Naturalized in waste places. Illinois: the southern portion.

Cynoglossum Virginicum L. Rich wooded hillsides in the Pine Hills Union county.

Lappula Virginiana (L.) Greene. Moist or dry upland woods.

Mertensia Virginica (L.) DC. Bottom land woods.

Myosotis Virginica (L.) B. S.P. Dry soil.

Lithospermum officinale L. Dry waste places.

Lithospermum Gmelini (Michx.) A.S. Hitchcock. Dry rocky hillsides.

Lithospermum canescens (Michx.) Lehm. Xerophytic upland woods.

Onosmodium Carolinianum (Lam.) DC. Dry rocky hillsides, Jackson county.

VERBENACEAE

Verbena urticifolia L. Moist shaded soil.

Verbena hastata L. Wet, sunny places.

Verbena stricta Vent. Dry soil.

Verbena bracteosa Michx. Dry sandy soil, especially along rivers.

Lippia lanceolata Michx. . Open wet places and river banks.

LABIATAE

Teucrium Canadense L. . . Moist shaded ground.

- Trichostema dichotomum* L. Rock barrens and ledges of sand stone cliffs, Pope county.
- Scutellaria lateriflora* L. Wet bottom land woods and swamps.
- Scutellaria cordifolia* Muhl. Dry upland woods and xerophytic cliffs.
- Scutellaria campestris* Britton. Dry rocky woods and ledges.
- Scutellaria incana* Muhl. Moist or dry upland woods.
- Marrubium vulgare* L. Naturalized on dry rocky soil, Jackson county.
- Agastache nepetoides* (L.) Kuntze. Rich woods.
- Agastache scrophulariaefolia* (Willd.) Kuntze. Rich, low woods.
- Nepeta Cataria* L. Naturalized in moist waste places.
- Glechoma hederacea* L. Wet low woods.
- Prunella vulgaris* L. Dry upland woods and sassafras barrens.
- Physostegia Virginiana* (L.) Benth. Low wet woods and swamps.
- Leonurus Cardiaca* L. Naturalized in shaded waste places.
- Stachys tenuifolia* Willd. Moist shaded woods.
- Salvia lyrata* L. Dry upland woods. Illinois: the Ozark region.
- Monarda fistulosa* L. Dry upland woods.
- Monarda Bradburiana* Beck. Upland woods, abundant. Illinois: the Ozark region and north along the Mississippi river to Hancock county.
- Blephilia ciliata* (L.) Raf. Moist or dry upland woods.
- Blephilia hirsuta* (Pursh) Torr. Mesophytic wood-lands.
- Hedeoma pulegioides* (L.) Pers. Upland woods.
- Hedeoma hispida* Pursh. Dry ledges of lime stone cliffs, Jackson county. Illinois: the northwestern portion and south along the Mississippi river to Jackson county.
- Koellia flexuosa* (Walt.) MacM. Dry, upland woods and sassafras barrens.

Koellia Virginiana (L.) MacM. Dry upland woods and barrens.

Koellia pilosa (Nutt.) Britton. Upland woods. Illinois: the central and southern portions from Champaign county southward.

Koellia incana (L.) Kuntze. Moist upland woods and thicket, common. Illinois: the Ozark region.

Cunila origanoides (L.) Britton. Dry upland woods, rock barrens and mesophytic cliffs. Illinois: the Ozark region and north to Jersey county.

Lycopus Virginicus L. Swamps and river banks.

Lycopus rubellus Moench. Swamps and wet places.

Lycopus Americanus Muhl. Wet ground.

Mentha piperita L. Escaped or naturalized in wet soil in the Mississippi river bottoms and in the cypress swamps.

Mentha Canadensis L. Wet low woods and swamps.

Perilla frutescens (L.) Britton. Naturalized in waste places and roadsides. Illinois: the Ozark region.

SOLANACEAE

Physalodes physalodes (L.) Britton. Naturalized in gardens and along roadsides.

Physalis pubescens L. Moist sandy soil.

Solanum nigrum L. Damp shaded places.

Solanum Carolinense L. Dry soil.

Datura Stramonium L. In waste places.

Datura Tatula L. With the last.

SCROPHULARIACEAE

Verbascum Thapsus L. Dry upland woods, rock barrens and xerophytic cliffs.

Scrophularia Marylandica L. Mesophytic woodlands.

Pentstemon hirsutus (L.) Willd. Xerophytic upland woods and rock barrens.

Pentstemon canescens Britton. Xerophytic rocky hillsides, in the Pine Hills, Union county. Illinois: the Ozark region. Easily distinguished from the preceding species by the shape of its leaves and the character of the corolla.

Pentstemon Digitallis (Sweet) Nutt. Mesophytic woodlands.

Pentstemon Pentstemon (L.) Britton. Mesophytic upland woods.

Paulownia tomentosa (Thumb.) Baill. Young specimens growing along the roadsides in Pope county may have escaped from cultivation.

Mimulus ringens L. Wet woods, swamps and river banks.

Mimulus alatus Soland. In similar situations. Illinois: the southern portion, north along the rivers to Schuyler county.

Conoclea multifida (Michx.) Benth. Muddy river banks and sand bars. Illinois: the central and southern portions from Kankakee county southward.

Monnina rotundifolia Michx. Swamps. Illinois: the central and southern portions from Hancock and Menard county southward.

Ilysanthes dubia (L.) Barnhart. River banks and sand bars.

Ilysanthes attenuata (Muhl.) Small. In similar situations with the preceding and not easily distinguished in the field.

Veronica peregrina L. Moist ground.

Veronica arvensis L. Dry waste places.

Leptandra Virginica (L.) Nutt. Xerophytic or mesophytic upland woods.

Azalia macrophylla (Nutt.) Kuntze. Mesophytic upland woods.

Dasystoma flava (L.) Wood. Dry upland woods.

Dasystoma Virginica (L.) Britton. Mesophytic woods.

Gerardia tenuifolia Vahl. Upland woods.

Pedicularis Canadensis L. Dry upland woods and hillsides.

BIGNONIACEAE

Bignonia crucigera L. River bottoms. Common in the cypress swamps.

Illinois: southern portion, north along the Wabash to Wabash county and along the Mississippi to Madison county.

Tecoma radicans (L.) DC. River bottoms and mesophytic cliffs.

Illinois: from peoria county southward.

Catalpa speciosa Warder. River bottoms and cypress swamps.

Illinois: extreme southern portion. North along the Wabash river to Wabash county.

MARTYNIACEAE

Martynia Louisiana Mill. Naturalized or native in moist sandy soil.

ACANTHACEAE

Ruellia strepens L. Mesophytic woodlands.

Ruellia ciliosa Pursh. Sassafras barrens. Dry upland woods and rock barrens.

Dianthera Americana L. In slowly flowing water.

PHYRMACEAE

Phryma Leptostachya L. Mesophytic woodlands.

PLANTAGINACEAE

Plantago Rugelli Dec. Waste places and yards.

Plantago lanceolata L. Naturalized along roadsides.

Plantago aristata Michx. Dry upland woods and rock barrens.

Plantago Virginica L. Dry upland woods, rock barrens and xerophytic cliffs.

Plantago elongata Pursh. Dry rock ledges.

RUBIACEAE

Houstonia lanceolata (Poir.) Britton. Mesophytic upland woods.

Houstonia purpurea L. Dry upland woods. Illinois: central and southern portions from Menard county southward.

Houstonia longifolia Gaertn. Dry rocky woods, in the Pine Hills, Union county. Illinois: the Ozark region.

Cephalanthus occidentalis L. Along the margins of ponds and streams.

Spermacoce glabra Michx. Swamps and muddy river banks.

Diodia teres Walt. Dry sandy soil. Illinois: central and southern portions from Hancock to Champaign county and southward.

Diodia Virginiana L. Wet river banks, Massac county. Illinois: from Marion county southward.

Galium Aparine L. Moist woods.

Galium pilosum Ait. Xerophytic upland woods. Illinois: from Menard county southward.

Galium circaeazans Michx. Mesophytic woods.

Galium triflorum Michx. Mesophytic woodlands.

Galium concinnum Torr. & Gray. Mesophytic upland woods.

CAPRIFOLIACEAE

Sambucus Canadensis L. Mesophytic woods.

Viburnum prunifolium L. Upland woods and hillsides.

Viburnum rufotomentosum Small. Dry ledges of lime stone cliffs, Jackson co unty. Illinois: the Ozark region.

Triosteum perfoliatum L. Mesophytic woodlands.

Symphoricarpos *Symphoricarpos* (L.) MacM. Dry upland woods.

Lonicera Sullivantii A. Gray. Mesophytic sand stone cliffs, Jackson county.

VALERIANACEAE

Valerianella radiata (L.) Dufr. Naturalized in moist soil along streams and on mesophytic cliffs.

CUCURBITACEAE

Sicyos angulatus L. Wet river bottoms, Jackson county.

CAMPANULACEAE

Campanula rotundifolia L. Mesophytic sand stone cliffs, Jackson county.

Campanula Americana L. Mesophytic woodlands.

Specularia perfoliata (L.) A. DC. Dry upland woods and rock barrens.

Lobelia cardinalis L. Wet flood-plain woods and swamps.

Lobelia syphilitica L. Moist woods.

Lobelia inflata L. Mesophytic woods.

CICHORIACEAE

Serinia oppositifolia (Raf.) Kuntze. In moist sandy soil along the river and in mesophytic upland woods, Perry county, Missouri, opposite Jackson county Illinois; also collected by E.S. G. Titus in Saline county, Illinois.

Adopogon Virginicum (L.) Kuntze. Mesophytic upland woods.

Adopogon Dandelion (L.) Kuntze. Dry upland woods and rock barrens. Illinois: the extreme southern portion.

Taraxacum Taraxcum (L.) Karst.

Sonchus oleraceus L. Roadsides and waste places.

Lactuca Scariola L. Dry soil.

Lactuca Canadensis L. Moist ground and low woods.

Lactuca sagittifolia Ell. Wet flood-plain woods, especially in the cypress swamps.

Lactuca villosa Jacq. Mesophytic woodlands.

Sitilias Caroliniana (Walt.) Raf. Wet woods, Massac county. Illinois: the extreme southern portion.

Hieracium Gronovii L. Mesophytic upland woods.

AMBROSIACEAE

Ambrosia bidentata Michx. Dry soil. Illinois: the central and southern portions, north to the Shelbyville moraine and to Henderson county.

Ambrosia trifida L. Wet bottom lands and along river banks.

Ambrosia bidentata X *Ambrosia trifida*. Wet river bottoms, Jackson county.

Ambrosia trifida integrifolia (Muhl.) T. & G. Common with the type.

Xanthium commune Britton. Cultivated fields, river banks and sand bars.

COMPOSITAE

Vernonia maxima Small. Mesophytic flood-plain woods. Johnson county.

Vernonia fasciculata Michx. Wet ground.

Vernonia Drummondii Shuttlw. Forms possibly referable to this species are abundant in dry upland soil. They will probably require separation as a distinct species.

Elephantopus Carolinianus Willd. Upland woods. Illinois: the southern portion from St. Clair county southward.

Eupatorium purpureum L. Mesophytic woods.

- Eupatorium serotinum* Michx. Dry upland woods and common on sand bars.
- Eupatorium perfoliatum* L. Wet places.
- Eupatorium ageratoides* L. Mesophytic woods.
- Eupatorium coelestinum* L. Wet woods. Illinois: the central and southern portions from Mason to Champaign counties southward.
- Kuhnia eupatorioides* L. Upland woods and mesophytic cliffs, Johnson county.
- Solidago caesia* L. Mesophytic upland woods and sassafras barrens.
- Solidago flexicaulis* L. Moist upland woods.
- Solidago ulmifolia* Muhl. Upland woods, rock barrens, and mesophytic cliffs.
- Solidago serotina* Ait. Moist ground.
- Solidago Canadensis* L. Dry open places.
- Solidago nemoralis* Ait. Dry upland woods, rock barrens and sassafras barrens.
- Solidago Radula* Nutt. Dry upland woods. Illinois: the western portion from Henderson county southward.
- Solidago Drummondii* T. & G. Dry lime stone cliffs, Jackson and Union counties. Illinois: the bluffs of the Mississippi river from St. Clair county southward.
- Euthamia graminifolia* (L.) Nutt. In wet sunny places. Johnson county.
- Euthamia Caroliniana* (L.) Greene. In similar situations.
- Boltonia asteroides* (L.) L'Her. Wet woods and swamps.
- Aster Shortii* Hook. Mesophytic upland woods.
- Aster sagittifolius* Willd. Upland woods and hill sides.
- Aster patens* Ait. Xerophytic cliffs and rock barrens.

- Aster Novae-Angliae* L. Moist soil.
- Aster ericoides* L. Dry upland woods and sassafras barrens.
- Aster ericoides pilosus* (Willd.) Porter. With the type.
- Erigeron pulchellus* Michx. Mesophytic upland woods and hillsides.
- Erigeron Philadelphicus* L. Moist woods.
- Erigeron annuus* (L.) Pers. Moist sunny places.
- Erigeron ramosus* (Walt.) B.S.P. In fields and along roadsides.
- Leptilon Canadense* (L.) Britton. Waste places.
- Leptilon divaricatum* (Michx.) Raf. Dry upland woods, xerophytic cliffs and rock barrens.
- Pluchea petiolata* Cass. River bottoms and cypress swamps.
- Illinois: the southern portion from Wabash county southward.
- Antennaria plantaginifolia* (L.) Richards. Dry upland woods.
- Antennaria calophylla* Greene. Xerophytic rocky hillsides in the Pine Hills, Union county. Illinois: the Ozark region.
- Gnaphalium purpureum* L. Dry upland woods and hillsides.
- Polynnia Uvedalia* L. Rich moist woods.
- Polynnia Canadensis radiata* A. Gray. Mesophytic woods, Jackson county.
- Silphium perfoliatum* L. Wet places.
- Silphium integrifolium* Michx. Xerophytic upland woods.
- Parthenium integrifolium* L. Dry upland woods.
- Heliopsis helianthoides* (L.) B.S.P. Dry upland woods and hillsides.
- Heliopsis scabra* Dunal. With the preceding.
- Eclipta alba* (L.) Hassk. Muddy river banks.
- Rudbeckia triloba* L. Upland woods. Illinois: from Kankakee county southward.
- Rudbeckia hirta* L. Dry upland woods.

- Rudbeckia fulgida* Ait. Dry upland woods. Illinois: the Ozark region.
- Rudbeckia laciniata* L. Wet low woods.
- Ratibida pinnata* (Vent.) Barnhart. Dry upland woods.
- Brauneria purpurea* (L.) Britton. Dry upland woods. Illinois: the central and southern portions from Stark county southward.
- Helianthus annuus* L. Naturalized in waste places.
- Helianthus microcephalus* T. & G. Mesophytic woodlands. Illinois: the southern portion from Wabash county southward.
- Helianthus divaricatus* L. Dry upland woods.
- Helianthus strumosus* L. Dry upland woods and hillsides.
- Verbesina Virginica* L. Cypress swamps and wet flood-plain woods. Illinois: the extreme southern portion.
- Verbesina alternifolia* (L.) Britton. Mesophytic flood-plains.
- Verbesina helianthoides* Michx. Dry upland woods and sassafras barrens.
- Coreopsis pubescens* Ell. Dry upland woods and sassafras barrens. Illinois: the Ozark region.
- Coreopsis tripteris* L. Dry upland woods.
- Bidens laevis* (L.) B.S.P. Muddy river banks.
- Bidens bipinnata* L. Moist shaded places.
- Bidens aristosa* (Michx.) Wet ground.
- Helenium autumnale* L. Wet ground.
- Helenium tenuifolium* Nutt. Wet river bottoms, Jackson county. Illinois: the extreme southern portion.
- Boebera papposa* (Vent.) Rydb. Dry sandy soil.
- Achillea Millefolium* L. Yarrow. Dry upland woods and in waste places.
- Anthemis Cotula* L. Yards and roadsides.

Chrysanthemum Leucanthemum L. Naturalized along roadsides and in waste places.

Artemisia annua L. Wet river bottoms along the Ohio river. Illinois: the extreme southern portion.

Mesadenia reniformis (Muhl.) Raf. Mesophytic flood-plain woods, Union county. Illinois: the central and southern portions from Peoria county southward.

Mesadenia atriplicifolia (L.) Raf. Dry upland woods.

Senecio Balsamitae Muhl. Mesophytic upland woods, Jackson county.

Senecio lobatus Pers. Wet river bottoms and swamps. Illinois: the extreme southern portion.

Arctium minus Schk. Naturalized in waste places.

Carduus lanceolatus L. Dry woods and pastures.

Carduus altissimus L. Dry upland woods.

Chapter 7.- PHYTOGEOGRAPHY

Before considering in detail the phytogeographical relations of the flora of southern Illinois, it may be well to discuss the general principles of plant distribution. The vegetation of any region is the response to a series of factors, which, though widely varied themselves, exert each some influence on the plant life. The resultant of these different factors determines the vegetation. Since the individual factors are never identical at two different places, the resultant is a variable, and the corresponding plant growth differing for each locality. To determine and correctly to interpret the effect of these ecological factors is the problem of phytogeography.

In the systems of biogeography that have appeared in the past few years, different investigators have selected various ones of the whole set of ecological factors as the principal governing cause of plant and animal distribution. So Schimper, in his *Pflanzengeographie auf physiologischer Grundlage*, has stated that the vegetation is controlled primarily by three sets of forces, heat, rain-fall, and soil; the first governs the flora, or specific composition of vegetation, the second the character of plant growth, whether forest or prairie, chapparal or desert, and the last causes the minor local segmentation into associations. Engler in *Versuch einer Entwicklungsgeschichte der Pflanzenwelt seit der Tertiärperiode*, places especial emphasis on the past history of the vegetation, and would find in the geological fluctuations since the Tertiary period an explanation for the present distribution of plants on the earth. Merriam, applying the results of his field study to biogeography in the United States, concludes that temperature is the chief factor,

and in his Life Zones and Crop Zones in the United States he divides North America into a series of zones, each of which corresponds with a certain type of temperature and includes a characteristic fauna and flora. Cowles has narrowed the historical view of the question to the changes in local physiography, and in them he sees the explanation of the differences in vegetation of upland, flood-plain, and cliff. Warming, in *Oekologische Pflanzengeographie*, has made the available water supply of the soil the chief basis for the separation of plant societies. Adams has explained certain peculiarities of life in the eastern United States by the inter-glacial and post-glacial migrations of species. Graebner, in *Die Heide Norddeutschlands*, takes account of the developmental history of the vegetation, but would classify the societies primarily according to the available food supply in the soil.

There is in each of these systems a nucleus of truth, but not one of them contains the complete explanation of the question. Any one of them is sufficient to separate the plant societies of a region, because the differences are usually obvious, but in that respect they are all like the generic keys in a manual; they serve only to distinguish the societies, not to define them or explain them. In Schimper's already classic work the cause of the forest and prairie of the central and eastern United States is given as the amount and distribution of the rain-fall. No account is taken of the fact that the flora of the prairie is distinctly southwestern in its origin, that of the forest southeastern. Yet the character of the plant associations in the two formations is probably due as much to their origin as to the present conditions of rain-fall, and if the two regions were reversed, the arid portion drawing its

vegetation from a southeastern origin, and the humid portion deriving its species from the southwest, the result would doubtless be strikingly different from the present actuality. Again, the life zones of Merriam do not correspond exactly with a certain type of temperature; southern Illinois, which is placed by him correctly within the Lower Austral zone, does not have a temperature requisite for it, and in arranging his zones to correspond with the facts of plant and animal distribution he has overstepped his own boundaries. Similar flaws could be picked out in the others, but it is not necessary to multiply examples.

Drude was among the first to recognize that to Schimper's three factors heat, rain-fall, and soil there must be added a fourth, history. To the present time, however, no one has offered a classification of vegetation which includes all of the factors regulating plant growth, nor can it be done until ecologists have at hand more exact data on the present physiological requirements and past history of plant species. Ganong, in the conclusion to his recent article on the Vegetation of the Bay of Fundy marshes has commented on this lack of precise knowledge, and has suggested some lines for future ecological investigation. They may well be repeated here. "First, a collection and description of the actual facts as to the kinds of plants which occur in a given region, as to their visible features, and as to the way in which they are grouped. Second, an exact study and a clear expression of the facts as to the physical features of the environment which can affect plant life. Third, there must be made a thorough study not only of the structure and development of the important plants which give character to the different parts of a vegetation but also of ^{their} physiological character quantitatively

expressed. Fourth, a knowledge of the true nature of plant competition and cooperation is essential. "

Certain principles will now be stated, upon which depend the occurrence of any species in a given locality and therefore, collectively, the whole flora of the area:

1. The conditions of temperature and moisture must at all times of the year be within the cardinal points for the species.

2. The chemical and physical nature of the soil must not vary beyond certain limits.

3. The biological environment, including parasites and symbionts, must also be of such nature as to allow the growth of the species.

4. The power of seed production must be sufficient to maintain the number of individuals.

5. Between the locality and the center of distribution of a species there must be, or must have been, a continuous route, along which conditions 1, 2, 3, and 4 were fulfilled, and the species must have some means of dispersal suited to this migration highway.

6. Time must be allowed for the species to reach the locality in question.

When all six of these points are satisfied for one place the plant will be found growing in that locality. It is seldom possible, though, to determine the lack of which condition is responsible for the limitation of a species to a certain geographical range, and even when the boundary of a plant coincides with some change of physical or biological environment, it is not conclusive proof that this change alone prevents further extension of the range in this direction, for it is well known that the physiological requirements of a

plant may be altered by different conditions. Thus to cite a single example, plants require more potassium at a high than at a low temperature.

Many species of plants find in southern Illinois their northern limit, and for some of them there is evidence as to the cause restricting their growth farther northward. Some of them may be mentioned. *Taxodium distichum*, lack of sufficient seed production or of means for seed dispersal. The species extends northward to the glacial boundary, but, with one exception, never crosses it. Since it succeeds well in cultivation much farther north, it seems probable that it is almost incapable of extending its range. *Phoradendron flavescens*, too cold winters. Doctor Schneck¹ states that during two successive mild winters its range in the Wabash valley was extended many miles north, and that it has several times been almost exterminated near Mt. Carmel by cold winters. This species is capable of rapid dispersal by birds, which eat the berries. *Fagus Americana*: the distribution of the beech in Illinois is very peculiar, and seems to indicate some relation to the rainfall. It occurs along Lake Michigan and in southern Illinois south of a line extending from Mt. Carmel southwest to Jackson county. Both of these areas are characterized by heavy winter rainfall and the range of the beech is possible determined by that factor.

For most species, however, the northern limit is not fixed by any one factor but by a resultant of several. Cowles² cites as an example two species of the southern Illinois flora: "Again, in the

¹Bot. Gaz. 15:211.

²Bot. Gaz. 31:83.

Chicago region the tulip tree and buckeye are rare and confined to the floodplain forest, while in Tennessee these trees are found in many other plant societies. We may perhaps summarize these data by saying that each species varies in habitat in different regions, and that in general a species can grow in the largest number of plant societies at its center of distribution, since there the climatic conditions favor it most highly."

To state the matter generally, as one ecological factor approaches an optimum the others may approach minima. So the austro-riparian species which in the southern states are widely distributed on various types of soil become gradually restricted to the northward, until in Illinois they are mostly confined to the optimum edaphic conditions in the floodplains. The cactus which grows in a number of associations in the southwest, is limited in a region of greater rainfall to certain types of soil where the water content is low, and in southern Illinois, with four times the rainfall of the southwest, it occurs only on the rocks, where the available water supply resembles that farther west.

The southern portion of Illinois has long been known as the northern limit for many austro-riparian forms, and its flora has a special interest on that account. There are also small representations of an Appalachian and a Texan flora, which, while they are of little importance in the vegetation, serve to indicate lines of plant migration. A large proportion of species belongs to that large group known as the flora of the Atlantic province, species whose general range is from the Atlantic Ocean west to Minnesota, Nebraska, Kansas, and Texas.

There is but limited evidence as to the origin of the present flora of the Ozarks. The Illinoian glaciers reach the northern boundary of the uplift, but did not cross it. What effect they had on the preglacial flora can only be imagined, unless the presence of certain species in the present flora may be taken as indicative of conditions during glacial times. It is known that plants may live in soil upon the glacial ice itself, as seen in some of the glaciers of Alaska. If the same conditions obtained formerly in Illinois as now in Alaska, the vegetation of the Ozark region during glacial times might have been but little different from that of either the preglacial period or the present time.

In such a country as Greenland, where the cold due to high latitude alone is sufficient to allow the accumulation of ice, a similar arctic climate extends for hundreds of miles south of the edge of the glaciers. But when other factors cause a change in climate, and glacier ice pushes south as far as latitude 38 degrees, the effect of ice upon the local climate can not extend far beyond the glaciers, the annual mean temperature is above the freezing point, and the ice itself melts as rapidly as its slow motion carries it to the south. Under such conditions a temperate flora could persist even within a short distance beyond the glacial boundary, and the arctic and sub-arctic floras would be crowded in a narrow belt along and upon the edge of the glaciers.

Conclusive evidence for this statement is not available. A few species of plants, however, give us some idea of the climate, and therefore of the flora, of extra-glacial southern Illinois during the glacial period. *Taxodium distichum*, the bald cypress, is uni-

formly distributed along the coastal plains from Delaware south, and in the interior along the Mississippi river and its tributaries north into Missouri, Illinois, and Indiana. It succeeds well in cultivation in central Illinois, and according to Sargent in Massachusetts, and the conditions of soil, temperature, and moisture in the river floodplains are suitable for its natural growth much farther north than its present distribution. Yet the northern limit of the cypress never crosses the glacial boundary with the doubtful exception of Knox county, Indiana. If in the thirty thousand years that have elapsed since the retreat of the Illinoian glaciers the cypress has not extended its boundary northward to any appreciable distance, it is highly probable that during the glacial age the tree was growing in or near its present home in southern Illinois. And, unless the physiological requirements of the tree have changed greatly since the close of the glacial period, its associates then probably included many of the species which still grow with it. There are other facts which possibly give evidence concerning the inter-glacial vegetation of the region, but they are far from conclusive and but little weight can be given to them. *Leitneria Floridana* Chapm., the only species of the family Leitneriaceae, has a peculiar distribution in the southern United States, being found in Florida, in Texas and northeastern Arkansas, and in southeastern Missouri. The latter station is not far distant from the glacial boundary in Illinois. There is no paleontological evidence as to the age of the species, but the family is related to old groups, and the three disconnected stations also point to a history extending back through a considerable period of time. If *Leitneria* was forced to migrate to the southward during the glacial period, or has extended its area into Missouri

only since the close of the ice age, it seems probable that there would be other stations in the Mississippi river and coastal plain swamps between its present three stations. The absence of these points, indefinitely to be sure, to a continued existence for a long time in the swamps of southern Missouri, not far from the southern edge of the ice sheet. *Catalpa speciosa* Warde, the hardy catalpas is native in the alluvial bottom lands of southern Indiana, Illinois, and Missouri, eastern Kentucky and Tennessee, and western Arkansas, a range entirely discontinuous from that of the related species *C. Catalpa* (L.) Karst. The distribution of the species and its hardiness argue not only for its origin somewhere near the mouth of the Ohio river, but for its presence there during the glacial period.

It may be assumed therefore for the purposes of this thesis that the vegetation of the Ozark uplift and the lowlands south of it has a continuous history extending back beyond the glacial period; that it has served to some extent as a source of the present flora of central and northern Illinois; and that it consisted of about the same species that now comprise the bulk of the forests in the eastern United States, the oaks, ashes, elms and maples. The Ozark region may be included in the larger area termed by Adams "Southeastern United States" and regarded by him as a center of post-glacial distribution of both plant and animal life to the northeastern states.

The oaks, elms, maples and hickories of the preglacial forests and their associates are still the dominant species over much of the area of the eastern United States, and in southern Illinois they constitute the bulk of the species. Their general range is

north into the dominion of Canada and west to Nebraska and Texas. The members of this group in southern Illinois have nothing peculiar in their distribution. The other floral elements, however, which reach southern Illinois from the south, southwest and southeast, demand special attention.

C.C.Adams¹ has spoken of a southwestern center of post-glacial distribution, and Coulter² has also referred to the presence of numerous endemic species of Umbellifereae in the southwest, denoting a center of distribution or of preservation. Bush,³ in writing on the flora of southeastern Missouri, states " that we now know that we have a Floridian and Georgian flora, which extends up the Mississippi valley in a northwesterly direction to southeastern Missouri, where it meets a Texan flora, which extends southwestward to Texas." A portion of this Texan flora extends across Missouri and reaches Illinois. The natural highway, or line of least resistance, along which this flora has migrated is the Ozark uplift, and representative species are found along it in ever increasing numbers to the southwestward. The number that cross the Mississippi river into Illinois are relatively few in number, but they point definitely and conclusively to their southwestern origin. The principle species of this group, some of which are included in it with doubtful propriety; are the following:

<i>Atheropogon curtispendus</i>	<i>Ptilimnium Nuttallii</i>
<i>Allionia nyctaginea</i>	<i>Verbena bracteosa</i>
<i>Astragalus Mexicanus</i>	<i>Martynia Louisiana</i>
<i>Opuntia humifusa</i>	<i>Vernonia Baldwinii</i>

²Geographical Distribution of North American Umbelliferae.

¹The Southeastern United States as a center of postglacial distribution.

³Notes on a list of plants coll. in S.E.Mo. in 1893.

Solidago Drummondii

Aster turbinellus

Boebera papposa

Hordeum pusillum

Sophia intermedia

Bergia Texana

Megapterium Missouriense

Polytaenia Nuttallii

Hedeoma hispida

Plantago aristata

Solidago Radula

Aster anomalus

Leptilon divaricatum.

Some of these extend so far beyond the limits of the Ozark range that their affinities with the Texan flora are doubtful, and a few even occur so far northward that they may be confused with the flora of the prairie province, which is similarly southwestern in origin, but reaches Illinois by a different route.

Three species of northwestern origin are common along the Mississippi river where they have been introduced in comparatively recent time by the river itself. They are *Parosela dalea*, *Cycloloma atriplicifolium* and *Rumex Persicaria*.

A third group is southeastern in distribution, and has a geographical range coinciding broadly with the limits of glaciation on the north and extending west to Kansas and Texas. A number of factors may be concerned in controlling their northern limits, and no general statement can be made whether the climate or the soil is of chief importance. The evidence at hand however, points to the climate as the deciding factor. As examples of this group may be mentioned:

Pinus echinata,

Uniola latifolia

Agave Virginica

Ulmus alata

<i>Phoradendron flavescens</i>	<i>Clitoria Mariana</i>
<i>Magnolia acuminata</i>	<i>Crotonopsis linearis</i>
<i>Draba brachycarpa</i>	<i>Passiflora lutea</i>
<i>Psoralea pedunculata</i>	<i>Kneiffia linifolia</i>
<i>Stylosanthes biflora</i>	<i>Batodendron arboreum</i>
<i>Viburnum rufotomentum</i>	<i>Pentstemon canescens</i>
<i>Coreopsis pubescens</i>	

The plants in this list are in Illinois almost entirely members of the xerophytic upland association. Owing to inversions of temperature caused by ascending air-currents the hills and ridges upon which this society occurs have a generally higher temperature than the surrounding hillsides and valleys, and especially are less subject to late frosts in spring or to early ones in fall. It may be therefore, that the habitats of these species near their northern limit are regulated to some extent by the temperature, and that they prefer the warmest situations available.

A small group, also southeastern in origin and distribution is distinctively Appalachian and the ranges of the component species extend but little beyond the mountain region of the southeast, except in the case of a few species extending out into Illinois. The hill country of southern Ohio contains many such species, most of which extend no farther west. Some extend into Indiana, as the scrub pine, *Pinus Virginiana* and a few cross Indiana and the highlands of Kentucky into the Ozarks of southern Illinois. In Illinois they grow especially in dry upland woods and on cliffs where the ecological factors most nearly resemble those of the lower Appalachian mountain region, and never in the floodplains.

Some of the species are:

<i>Helianthus microcephalus</i>	<i>Hydrangea arborescens</i>
<i>Rudbeckia fulgida</i>	<i>Heuchera hirsuticaulis</i>
<i>Agrimonia pumila</i>	<i>Heuchera parviflora</i>
<i>Sedum telephioides</i>	<i>Cunila origanoides</i>
<i>Sedum pulchellum</i>	

The range of the bald cypress may be taken as typical of the austro-riparian group. It extends along the coastal plain from Delaware south and west to Mexico, and along the alluvial bottoms of the Mississippi and its tributaries north into Indiana. Other species of the group are not confined so closely to the coastal plain, and some occur even in the lower Appalachian mountains, but generally speaking they all occupy a U-shaped area, with one stem on the Atlantic coast, the other in the Mississippi valley. In the southern states, where the climatic conditions are more favorable, they are found, in accordance with our general rule, in a variety of soils, but in Illinois with temperature approaching a minimum they are mostly confined to the plant associations with optimum soil conditions, namely the flood plains. A few, including *Celtis Mississippensis*, *Planera aquatica*, *Adelia acuminata* and some others, are occasionally found on upland hillsides with a south front, where they have a higher temperature and are consequently able to withstand the unfavorable soil. There is no definite boundary for austro-riparian species in Illinois, but they extend up the rivers various distances, some, like the pecan, as far as Peoria or Keokuk, while others, like *Hymenocallis occidentalis* and *Itea Virginica*, live only in the extreme southern portion.

A partial list of the most typical species of the group follows:

Arundinaria tecta	Triadenum petiolatum
Paspalum mucronatum	Jussiaea diffusa
Taxodium distichum	Styrax Americana
Carex Frankii	Fraxinus profunda
Commelina hirtella	Adelia acuminata
Hymenocallis occidentalis	Asclepias perennis
Populus heterophylla	Bignonia crucigera
Hicoria Pecan	Catalpa speciosa
Planera aquatica	Ludwigia glandulosa
Celtis Mississippensis	Spermacoce glabra
Itea Virginica	Diodia Virginiana
Bradleya macrostachys	Pluchea petiolata
Berchemia scandens	Verbesina Virginica
Rhamnus Caroliniana	Helenium tenuifolium
Ampelopsis cordata	Senecio lobatus.
Hibiscus lasiocarpus	

EXPLANATION OF PHOTOGRAPHS

All photographs were taken in June 1903 in the vicinity of Makanda, Jackson county.

1. General view of the Ozark range from the uplands near Makanda, altitude about 650 feet. The hills in the distance indicate the crest of the uplift, and rise to a height of about 800 feet. The hill tops have been cleared and cultivated, but lines of trees still mark the course of the ravines.

2. General view of Drury creek valley looking south; sassafras barrens on the low hill at the left center, cultivated fields and stream-side vegetation in the lowlands, and upland woods on the hills

3. Pond with *Nymphaea advena*. The margin is occupied with a hydrophytic flora of sycamore, willow, and birch, with undergrowth of alder.

4. The bed of Drury creek grown up with *Dianthera Americana*; on the left a clay hillside with various shrubs, and in the back ground the bluffs covered with upland forests.

5. Xerophytic cliffs bordering a stream valley. Rock-barrens extend along the crest, followed by xerophytic upland forest on the left. On the right the forest has been partially cleared and planted to orchard.

6. Heavily shaded, mesophytic sand-stone cliff, covered with cliff mesophytes, especially *Sedum pulchellum*. At the left a mesophytic forest of oak and maple.

7. Rock barren association; *Agave Virginica* and *Batodendron arboreum*.

8. Rock barrens with a growth of lichens and mosses. The trees in the background are *Quercus Marylandica*, *Ulmus alata*, and *Ratodendron arboreum*.

9. *Opuntia humifusa* on the rock barrens. In the right foreground *Plantago aristata*.

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