

WEEK 6. FLATWOOD FORESTS

In the early 1800s the Government Land Office (GLO) surveyors, and soon afterwards, settlers, entered the glaciated lands north of the Shawnee escarpment. Not nearly as rugged as the “Shawnee,” Illinoian glaciation and subsequent erosion during the past 125 thousand years had created an area of flat uplands and broad valleys. Closed and open canopy forest dominated. Prairie openings were also encountered, however, and these prairie openings became more prevalent as the surveyors moved north through this relatively flat region now referred to as the Southern Till Plain Natural Division. Also, a different forest type was occasionally encountered. This forest type, described as flatwood forest, occurred on level to nearly level ground and was usually wet with standing water for part of the year. Not only was the structure of this forest different from the forests of the Shawnee, many of the plant and animal species differed.

Flatwoods are one of the four forest types recognized in the natural community classification system described by the Illinois Natural Areas Inventory (INAI). The other forest types are Upland Forests, Floodplain Forests, and Sand Forests. These flatwood forests characteristically are oak-dominated communities that occur on level uplands of glacial till and former glacial lake plain deposits. Most are associated with surface soils formed from wind-blown silt deposits known as loess. Three different flatwoods community types were recognized as occurring in Illinois based on regional differences in species composition and soil characteristics: Southern Flatwoods, Northern Flatwoods, and Sand Flatwoods. The Sand Flatwoods will be discussed in the chapter concerning Forests and Savannas of Illinois Sand Deposits.

Southern Flatwoods

Flatwood forests were rare throughout the eastern United States, but relatively common in the Midwest. These forests, which were usually dominated by *Quercus stellata* (post oak), were locally common from Ohio, Indiana, Illinois, and Missouri. Presently southern flatwood forests dominated by post oak are primarily restricted to the till plain of Illinois glaciation of Illinois and Indiana. In Illinois this region includes both the Effingham Plain Section and the Mt. Vernon Hill Country Section of the Southern Till Plain Natural Division.

These flatwood forests occur on nearly level soil and are characterized by poorly drained, slowly permeable soils with an abrupt increase in clay in the subsurface layers (hardpan). The clayey subsoil restricts the movement of water as well as plant roots. This impermeable or slowly permeable layer commonly results in a perched water table causing the soils to remain saturated in the spring, often resulting in standing water during much of the winter and spring. After surface water has evaporated during early summer, however, flatwoods soils can become very dry due to water loss by evaporation and transpiration. Also, the subsurface moisture is largely prevented from restoring moisture to the shallow root zone because of the hardpan, creating xeric conditions. For this reason the canopy of these flatwood forests is usually dominated by upland species, but has a ground layer with a mixture of xeric upland and bottomland species.

GLO survey records commonly have notations describing the land as “level, second rate,” or “flat, wet, second rate.” These flat areas of mostly open canopy forests were often wet during the winter and early spring, and the GLO surveyors were amazed at how flat and extensive some were, occasionally covering more than an entire section. The most recent information available suggests that flatwoods, like most Illinois forests in early settlement time, were much more open than at the present time. The distance of the witness to the section and quarter section posts recorded in the GLO survey notes indicates that many flatwoods were probably savannas. Periodic fire maintained these open canopy areas, while the cessation of landscape fires resulted in canopy closure.

Not always restricted to flatwoods, post oak together with *Quercus marilandica* (blackjack oak), are common on drier sites throughout the south-central United States, particularly at the forest-prairie transition. In Missouri these two species account for nearly 70 percent of the density on dry ridges and slopes. In Oklahoma and Texas this species, along the blackjack oak, forms a post oak/blackjack oak savanna commonly referred to as the Cross Timbers, a forest-prairie transition with the prairies to the west. In the Cross Timber Region of Texas these two species accounted for 90 percent of the tree density, while in Oklahoma the importance value percentages for post oak was 39.1 followed by blackjack oak at 30.5 percent, and *Quercus velutina* (black oak) at 6.5 percent. Further to the north in the scrub oak forests of the Chautauqua Hills of Kansas, post oak accounted for 56 percent of the trees, followed by black oak with 22 percent, and blackjack oak with 21 percent.

Presently, southern flatwood forests are uncommon in Illinois, and high quality examples are scarce. The flat topography made it easy to clear and plow the forests for pasture and row crops. Also, most were originally logged, often multiple times, so most remaining flatwood forests are second or third growth forests. Livestock grazing of forests was also a common practice in Illinois until the middle of the twentieth century. This practice, particularly if hogs were involved, usually resulted in the total removal of the ground layer, soil erosion, and the loss of native species diversity. Fragmentation and fire suppression were other factors responsible for the decrease in quality and loss of these flatwood forests.

Dr. Clarence B. Telford, a forester at the Illinois State Natural History Survey, completed one of the first detailed studies of post oak flatwoods in 1926. In this report he mentioned that the soils of this forest type were light gray and very tight (clayey) and “supported a large number of stunted, bushy trees to the acre. At 100 years, post oak averaged 56 feet in height and 14 inches in diameter at the stump.” According to his study, which was based on forest stands in five counties, post oak accounted for 74 percent of the trees in the stands, blackjack oak 12 percent, with various other oaks and hickories totaling 14 percent. Trees up to 300 years old were found but these were mostly defective and gnarled veterans with extensive fire scars. According to this study the very long period required to grow saw logs, the low yield secured, and the inferior quality of the logs, makes saw log production on these post oak sites a very unprofitable undertaking. More recent studies of post oak height in Posen Woods Nature Preserve, Washington County, found that trees 50 cm dbh averaged 23.2 to 26.2 meters tall, while individuals 75 cm dbh averaged 26.5 to 29.5 meters tall.

Presently, only a few of these flatwoods have been studied to determine their plant species composition and structure. One small fragment that is being managed by fire is a 3-hectare flatwoods at the edge of Lake Sara, Effingham County, at the northern edge of the Southern Illinois Till Plain Natural Division. The soils are Wynoose and Bluford silt loams. Both are acidic forest soils, flat, and poorly drained. The surface layer is a dark gray brown silt loam that is about 20 cm thick, while the subsoil is very compact, plastic, almost impervious silty clay. The area is well maintained, and in an attempt to keep the woods open, the understory was burned every spring from 1980 to the late 1990s and three times since 1998.

Twelve tree species were recorded from Lake Sara Flatwoods. On this site, stand composition averaged 280.3 stems/ha with an average basal area of 19.5 m²/ha. Of the species encountered, post oak ranked first with an importance value (IV) of 104.8 (possible 200), having the highest density and relative dominance of all species present, accounting for 56 percent of the individuals, and 49 percent of the basal area (Table 6.1). This species dominated the 10-19, 20-29, 30-39 cm diameter classes (Table 6.2). Its

dominance in these lower diameter classes insures its continued position as first in importance in the flatwoods. This species is also well represented in the seedling layer, but no saplings were encountered, probably the result of management fires. Overall, the oak dominated the flatwoods and accounted for a total importance value of 186.3. Of these species, black oak ranked second with an IV of 51.1, and had more individuals in the 40+ cm diameter class than any other species in the flatwoods. Blackjack oak ranked third with an IV of 14.2, and was usually clumped in very flat depressions where ephemeral ponds were found in the spring. The hickories had a combined IV of 13.1 and accounted for only 9 percent of the trees in the flatwoods.

Table 6.1. Density (#/ha), basal area (m²/ha), relative values, importance values, and average diameters (cm) of the tree species encountered at Lake Sara Flatwoods, Effingham County, Illinois.

Species	Density (#/ha)	Basal Area (m ² /ha)	Rel. Den.	Rel. Dom.	I.V.	Average Diameter (cm)
post oak	157.7	9.5	56.2	48.6	104.8	26.5
black oak	54.0	6.2	19.3	31.8	51.1	37.1
blackjack oak	21.3	1.3	7.6	6.6	14.2	26.6
white oak	12.3	1.1	4.4	5.9	10.3	31.5
black hickory	15.0	0.5	5.4	2.5	7.9	19.4
shingle oak	7.4	0.5	2.6	2.5	5.1	28.4
shagbark hickory	7.3	0.2	2.6	1.1	3.7	18.1
mockernut hickory	3.0	0.1	1.1	0.4	1.5	19.2
pin oak	1.0	0.1	0.4	0.4	0.8	33.3
sassafras	1.0	--	0.3	0.1	0.4	12.6
black walnut	0.3	--	0.1	0.1	0.2	21.3
Totals	280.3	19.5	100.0	100.0	200.0	

The canopy cover of Lake Sara Flatwoods averaged about 75 percent. A few large canopy opens existed, however, resulting in a highly diverse ground layer. Woodland grasses, sedges and forbs were common, and usually dominated the ground layer. The dominant ground layer species were *Helianthus divaricatus* (woodland sunflower) with an importance value of 38.5 (possible 200), followed by *Agrostis perennans* (upland bent grass), *Rubus flagellaris* (common dewberry), *Carex pensylvanica* (Pennsylvania sedge), and *Carex hirsutiella* (hairy-leaved sedge), all forest species (Table 6.3). Prairie grasses and forbs were restricted to the edge of the flatwoods and under larger canopy openings. The most common prairie species encountered were *Baptisia bracteata* (cream wild indigo), *Comandra umbellata* (false toadflax), *Liatris aspera* (rough blazing-star), *Liatris pycnostachya* (prairie blazing-star), *Parthenium integrifolium* (American feverfew), *Orbexilum pedunculatum* (Sampson's snakeroot), *Tradescantia ohioensis* (Ohio spiderwort), and *Veronicastrum virginicum* (Culver's-root).

Table 6.2. Density (stems/ha) of seedlings, saplings, and trees by diameter classes at Lake Sara Flatwoods, Effingham County, Illinois.

Species	Diameter Classes (cm)					
	Seedlings	Saplings	10-19	20-29	30-39	40+
post oak	875	--	34.0	78.0	34.7	11.0
black oak	3417	6	2.3	8.7	22.3	20.7
blackjack oak	1792	--	3.3	11.0	6.7	0.3
white oak	292	6	3.0	3.3	3.0	3.0
black hickory	875	23	9.3	5.0	0.7	--
shingle oak	1229	--	0.3	4.7	1.7	0.7
shagbark hickory	42	6	5.0	2.0	0.3	--
mockernut hickory	--	--	2.0	0.7	0.3	--
pin oak	--	--	--	0.3	0.7	--
sassafras	15895	--	1.0	--	--	--
black walnut	--	--	--	0.3	--	--
wild black cherry	792	--	--	--	--	--
Totals	25209	41	60.2	114.0	70.4	35.7

Presently the finest Southern Flatwoods remaining occur in the Kaskaskia River drainage in Clinton, Washington, and St. Clair counties. Here about 70 percent of all high quality flatwood acreage in Illinois is found. Recently botanists from the Illinois Natural History Survey completed a detailed study of some of these flatwood remnants. In this study six flatwood, including the Lake Sara Flatwoods discussed above, were examined to determine the composition of the forest overstory, woody understory, and ground layer vegetation. Except for the Lake Sara Flatwoods, the woods examined were located in the extreme southwest corner of the Southern Till Plain Natural Division.

In 1995 these botanists recorded 22 tree species in the study sites. Six of the eight most important tree species were oaks, making up 82 percent of the total IV. They found that post oak dominated all of the flatwood forests; blackjack oak was commonly, but not always second in importance, usually followed by black oak and *Carya ovata* (shagbark hickory) (Table 6.4). Overall, post oak accounted for 72 percent of the total basal area (m^2/ha), and an average IV of 57.4, was clearly the most important species. The dominance of post oak was particularly clear in the mid-to-larger size classes. Recruitment of this species, in the smallest size class (6-10 cm dbh), varied between sites from five or fewer trees/ha at four sites (Lake Sara Flatwoods, Posen Woods, Williams Creek Woods, and Jackson Slough Woods) to 35 trees/ha at Chip-O-Will Woods, and 52.5 trees/ha at Recker Woods.

Table 6.3. Frequency (%), average cover, and importance values of the ground layer species encountered on Lake Sara Flatwoods, Effingham County, Illinois. The data was collected in mid-summer of 1996 and only included the herbs and woody vine species. Seedlings of shrubs and trees were not included.

Species	Frequency %	Mean Cover	Importance Value
<i>Helianthus divaricatus</i>	37	3.08	38.5
<i>Agrostis perennans</i>	33	1.97	28.9

<i>Rubus flagellaris</i>	24	1.98	25.1
<i>Carex pensylvanica</i>	26	1.06	18.9
<i>Carex hirsutella</i>	27	0.99	18.5
<i>Carex festucaeae</i>	20	0.78	14.2
<i>Danthonia spicata</i>	13	0.67	10.7
<i>Podophyllum peltatum</i>	3	1.02	8.9
<i>Dichanthelium acuminatum</i>	10	0.25	6.0
<i>Eleocharis verrucosa</i>	13	0.10	5.9
<i>Aster turbinellus</i>	5	0.19	3.7
<i>Carex glaucoidea</i>	6	0.15	3.6
<i>Solidago nemoralis</i>	5	0.22	3.6
<i>Parthenocissus quinquefolia</i>	3	0.15	2.5
<i>Carex blanda</i>	4	0.09	2.3
<i>Hieracium scabrum</i>	3	0.08	1.7
<i>Viola sagittata</i>	3	0.03	1.7
<i>Tradescantia ohiensis</i>	2	0.06	1.3
<i>Rosa carolina</i>	1	0.02	0.7
<i>Lespedeza virginica</i>	1	0.01	0.6
<i>Cinna arundinacea</i>	1	0.02	0.5
<i>Potentilla simplex</i>	1	0.02	0.5
<i>Festuca subverticillata</i>	1	0.02	0.5
<i>Galium circaezans</i>	1	0.01	0.3
<i>Hypericum sp.</i>	1	0.01	0.3
<i>Juncus tenuis</i>	1	0.01	0.3
<i>Sphenopholis obtusata</i>	1	0.01	0.3
Totals		13.00	200.0

Except for Lake Sara Flatwoods, tree density ranged from 465 to 533 stems/ha (Table 6.4). The tree density of 284 stems/ha at Lake Sara Flatwoods is probably the result of nearly annual management fires. Also, the woody understory of most of the flatwoods was high, total stem density ranged from 1900 to 9673 stems/ha, except at Lake Sara Flatwoods with 824 stems/ha (Table 6.4). The ground layer vegetation was also surveyed during the study. As expected forest grasses, forbs, woody vines and shrubs dominated this layer. When the data is combined for all six sites the dominant ground layer species were *Parthenocissus quinquefolia* (Virginia creeper) followed by *Helianthus divaricatus* (woodland sunflower), *Rubus allegheniensis* (common blackberry), and the woodland grasses *Cinna arundinacea* (stout wood reed), and *Agrostis perennans* (upland bent grass)(Table 6.5). The nearly total absence of prairie species reflects the present closed canopies of these flatwoods. Active management, particularly recurring fires, will be necessary to restore the prairie component. All evidence available suggests that fire is important in maintaining the unusual species composition and community structure of post oak flatwoods in southern Illinois and Indiana.

Table 6.4. Importance values of the of the tree species encountered in six southern flatwoods of the Southern Till Plain Natural Division of Illinois and a summary of the overstory and shrub/sapling layer.

Species	Recker Woods	Chip-O-Will Woods	Posen Woods	Williams Creek Woods	Jackson Slough	Lake Sara Flatwoods
post oak	119.9	148.4	85.8	143.5	83.9	110.4
blackjack oak	41.2	30.0	3.5	8.8	9.0	12.8
black oak	1.5	6.0	18.5	10.4	12.6	42.7
shagbark hickory	9.1	10.9	19.7	9.9	10.2	4.3
sassafras	--	--	30.7	2.3	3.6	--
shingle oak	3.7	--	--	10.0	17.3	4.0
white oak	4.1	--	11.7	0.6	1.0	19.2
pin oak	10.8	--	--	0.6	20.5	--
slippery elm	0.6	--	2.2	4.6	9.5	--
mockernut oak	--	--	9.9	1.2	1.3	5.8
wild black cherry	--	--	3.8	--	10.5	0.7
black hickory	--	--	--	5.8	8.5	--
red oak	1.8	--	1.6	--	9.1	--
Overstory summary						
Basal Area (m ² /ha)	19.7	23.4	22.6	30.1	22.3	20.2
Number of tree species	13	5	14	14	17	8
Tree density (stems/ha)	503	475	523	465	533	284
Shrub/Sapling summary						
Total density (stems/ha)	3703	1900	9673	6240	5333	824
Number of sapling species	12	12	26	19	29	7

Of the 170 species recorded in the ground layer of these flatwoods, 56 (33 percent) were recorded from only a single quadrat while 80 percent of the total species occurred at a frequency of less than 1.0 percent. The variability in moisture in these flatwoods tends to support an assemblage of species from a variety of habitats. Many of the species were upland forest species while others were from lowland and transitional habitats. Other species were restricted to micro-depressions where standing water was common into early summer. Species restricted to these depressions were *Isoetes melanopoda* (black quillwort), *Eleocharis compressa* (flat-stemmed spikerush), and *Eleocharis verrucosa* (warty spikerush). One unusual plant encountered was *Trifolium reflexum* (buffalo clover), an Illinois endangered species. It is presently known from two flatwoods where it is common in the openings around cabins where occasional mowing appears to mimic the effects of fire or light grazing by reducing competition and leaf-litter accumulation.

Species diversity and density in these flatwoods is also correlated with canopy cover. Lake Sara Flatwoods was more open and bare ground averaged 32 percent, while bare ground ranged from 67 to 83 percent at the remaining sites. Canopy closure also affected total species richness that varied from 92 species at Lake Sara Flatwoods to 41 to 71

species at the remaining sites. Overall, prairie species were rare in the flatwoods. Only three species typical of dry-mesic tall-grass prairie, *Comandra umbellata* (false toadflax), *Parthenium integrifolium* (American feverfew) and *Pycnanthemum tenuifolium* (slender mountain mint), were recorded in the plots (Table 6.5). Other prairie/savanna forbs were occasionally observed, mostly at Lake Sara Flatwoods. Prairie grasses were not found, and probably were never important in these Southern Flatwoods. Exotic species were uncommon, probably the result of the seasonally harsh conditions. The only exotic sometimes found was *Lonicera japonica* (Japanese honeysuckle).

Table 6.5. Frequency (%), cover (m²), and importance values of the common species encountered in six southern flatwoods of the Southern Till Plain Natural Division of Illinois.

Species	Frequency (%)	Cover (m ²)	Importance Value
<i>Parthenocissus quinquefolia</i>	35.9	23.17	30.60
<i>Helianthus divaricatus</i>	11.9	19.49	18.39
<i>Rubus allegheniensis</i>	16.6	9.89	13.59
<i>Cinna arundinacea</i>	11.8	7.31	9.83
<i>Agrostis perennans</i>	9.4	5.87	7.86
<i>Dichanthelium acuminatum</i>	14.0	3.21	7.84
<i>Rubus flagellaris</i>	7.8	6.30	7.53
<i>Carex pensylvanica</i>	7.0	6.54	7.38
<i>Eleocharis verrucosa</i>	6.6	5.86	6.76
<i>Carex festucacea</i>	5.7	5.71	6.26
<i>Toxicodendron radicans</i>	6.4	3.56	5.04
<i>Carex hirsutella</i>	5.1	4.19	4.99
<i>Sassafras albidum</i>	7.4	2.16	4.45
<i>Quercus stellata</i>	4.9	2.43	3.65
<i>Parthenium integrifolium</i>	3.1	2.66	3.10
<i>Carex albicans</i>	3.1	1.53	2.31
<i>Acalypha gracilens</i>	5.3	0.10	2.19
<i>Carex glaucodea</i>	3.5	0.53	1.79
<i>Amphicarpa bracteata</i>	1.8	1.53	1.78
<i>Prunus serotina</i>	3.0	0.76	1.74
<i>Vitis aestivalis</i>	2.1	1.12	1.64
<i>Paronychia fastigiata</i>	3.6	0.20	1.59
<i>Quercus imbricaria</i>	2.6	0.78	1.57
<i>Pycnanthemum tenuifolium</i>	1.9	1.15	1.55
<i>Danthonia spicata</i>	1.7	1.19	1.51
<i>Carex cf. muhlenbergii</i>	1.2	1.35	1.44
<i>Potentilla simplex</i>	1.9	0.99	1.44
<i>Viola</i> sp.	3.2	0.13	1.37
<i>Vitis riparia</i>	1.9	0.87	1.35
<i>Comandra umbellata</i>	0.9	1.43	1.35
<i>Quercus velutina</i>	2.0	0.77	1.35
<i>Porteranthus stipulatus</i>	1.6	1.02	1.35
<i>Quercus marilandica</i>	1.9	0.80	1.30
<i>Lonicera japonica</i>	1.4	0.96	1.24
<i>Carex caroliniana</i>	1.2	0.86	1.06
<i>Carya ovata</i>	1.5	0.63	1.04

Southern flatwoods also support lowland oak species including *Quercus bicolor* (swamp

white oak), *Quercus imbricaria* (shingle oak), *Quercus palustris* (pin oak) and occasionally *Quercus lyrata* (overcup oak). These four species of oaks are restricted to local depressions in the flatwoods. Usually less than 1 hectare in size, these depressions rarely are more than 4 hectares in size. Usually small irregularly shaped areas, but occasionally covering the entire center of a larger flatwoods, these depressions are very flat and rarely more than 5 to 10 cm deeper than the surrounding flatwoods. One high quality flatwoods with an extensive depression is Eversgerd Post Oak Flatwoods Natural Area located in Clinton County. This 16 hectare flatwoods is part of an extensive band of timber associated with the Kaskaskia River valley in the Southern Till Plain Natural Division. At this site the Kaskaskia River valley is very broad, heavy clay alluvial soils are common, and the soils have a dense claypan at or near the surface. A shallow depression covering about 0.9 hectare occurs in this flatwoods and is dominated by a pin oak/swamp white oak community. This shallow depression is very irregular in outline with the forest type gradually changing from a post oak community to a pin oak/swamp white oak community and back.

Tree density in Eversgerd Flatwoods averaged 265.8 stems/ha with a basal area of 24.8 m²/ha (Table 6.6). Of the 15 species of trees, post oak ranked first with an IV of 171.1 (possible 200). This species averaged 209.5 stems/ha, and accounted for more than 90 percent of the total basal area. Most of the large post oaks had an open-grown appearance with low branches or branch scars and broad open crowns. Even aged and uniform-sized post oaks were common with most individuals in the 20 to 50 cm diameter classes. The largest tree found was a post oak 102 cm dbh. Swamp white oak and pin oak were common species in the shallow depressions, accounting for their second and third ranking in IV. This community type is referred to as the *Quercus palustris-Quercus bicolor* seasonally flooded forest alliance, and is occasionally found along the Kaskaskia River drainage. The remaining woody species were not common and none had an IV greater than 4.0, or a density greater than 8 stems/ha. Of these three were oaks, blackjack and black oaks occurred on drier sites, while shingle oak was scattered throughout the flatwoods.

Table 6.6. Density (#/ha), basal area (m²/ha), relative values, importance values, and average diameters (cm) of the tree species encountered at Eversgerd Post Oak Flatwoods, Clinton County, Illinois.

Species	Density (#/ha)	Basal Area (m ² /ha)	Rel. Den.	Rel. Dom.	I.V.	Average Diameter (cm)
post oak	209.5	22.859	78.9	92.2	171.1	35.2
swamp white oak	13.5	0.697	5.1	2.8	7.9	22.6
pin oak	14.5	0.660	5.4	2.7	8.1	19.8
shagbark hickory	7.3	0.188	2.8	0.8	3.6	17.4
blackjack oak	5.3	0.122	2.0	0.5	2.5	16.0
American elm	5.6	0.067	2.1	0.3	2.4	11.3
shingle oak	4.8	0.068	1.8	0.3	2.1	13.3
black oak	2.9	0.082	1.1	0.3	1.4	16.1

others	2.4	0.050	0.8	0.1	0.9
Totals	265.8	24.793	100.0	100.0	200.0

The woody understory of Eversgerd Flatwoods was very open. Woody seedlings averaged 2,520 stems/ha, small saplings averaged 820 stems/ha, and large saplings only 221 stems/ha. Post oak dominated all categories, but *Sassafras albidum* (sassafras) and pin oak were also relatively common. This open understory along with the relatively open, cathedral-like overstory, gave the flatwood a park-like appearance. Also, the ground layer was open and dominated by woodland grasses and sedges. On dryer sites *Danthonia spicata* (poverty oat grass), and *Dichanthelium acuminatum* (panic grass) were the dominant grasses, whereas *Carex cephalophora* (capitate sedge) was the dominant sedge. Based on the open nature of the flatwoods and the open understory, it is probable that low intensity ground fires had occurred relatively recently in Eversgerd Flatwoods. These fires would tend to decrease the density of the woody undergrowth and increase species richness.

The importance value of the ground layer species of three flatwood depressions were examined: Venedy Flatwoods in Washington County in the Kaskaskia River valley, Eversgerd Flatwoods, and Island Grove Flatwoods in Jasper County. Members of the Cyperaceae dominated the ground layer of the pin oak/swamp white oak community, with *Carex squarrosa* (sguarrose sedge), *Carex tribuloides* Carex(sedge), and *Scirpus georgianus* (dark green bulrush) being among the top five herbaceous species on most sites (Table 6.7). These three species were extremely common, in many areas being the only species present, as indicated by their high relative covers and importance values.

Though 13 *Carex* species were found in the study sites, most were not common, being restricted to a few small clumps on one or two sites, or were found near forest boundaries. The only grass common to all three sites was *Cinna arundinacea* L. (stout wood reed) while *Galium obtusum* (wild madder) was the only forb present in plots at all three sites. Many other forbs were present, but were restricted to localized areas and usually occurred in low numbers. Woody vines were an important component of the ground layer with *Toxicodendron radicans* (poison ivy) and *Parthenocissus quinquefolia* among the top five species at two sites. Tree seedlings were also abundant with pin oak and swamp white oak being fairly common (Table 6.7).

In presettlement times open-grown trees, the general absence of a dense shrub layer, and a grassy ground layer generally characterized these flatwoods. Flatwoods were probably subjected to periodic fires into the late 1950s. Changes in land use patterns, however, particularly fire suppression and the elimination of grazing, resulted in woody plant encroachment into some flatwoods, while others lacked woody invasion and maintained an open understory. The reasons for this difference is not clear, but probably the time since the flatwoods was last grazed, and the time and intensity of past fires or other disturbances, were critical. Presently post oaks dominate these flatwoods, and their importance will probably continue.

The relatively small number of post oaks in the 10-19 cm diameter class in many Southern Flatwoods, however, suggests that conditions may no longer favor the long-term dominance of this species. Occasional fires would probably be sufficient to allow the continued regeneration of post oak. Fire suppression, however, will result in canopy closure, and over the long term, a change in canopy composition. This decrease in oak regeneration is occurring throughout the Midwest due to fire suppression. The resulting canopy closure favors the growth of shade-tolerant, fire-sensitive trees that take advantage of canopy openings as older trees die. Presently it is not clear which tree

species would replace the post oaks, but in other post oak forest types various species of hickory, particularly shagbark hickory and *Carya tomentosa* (mockernut hickory), are common in the understory and lower tree strata.

Table 6.7. Importance values of the ground layer species encountered in three pin oak/swamp white oak flatwood communities in the Southern Till Plain Natural Division of Illinois. Only the species with importance values greater than 1.0 are included.

Species	Venedy	Eversgerd	Island Grove
<i>Carex squarrosa</i>	118.6	79.0	12.5
<i>Carex tribuloides</i>	26.1	27.3	38.3
<i>Galium obtusum</i>	10.3	11.7	0.3
<i>Toxicodendron radicans</i>	9.3	3.5	26.4
<i>Cinna arundinacea</i>	8.4	16.1	1.2
<i>Parthenocissus quinquefolia</i>	8.2	16.1	--
<i>Scirpus georgianus</i>	5.2	5.3	58.4
<i>Impatiens capensis</i>	2.9	--	20.1
<i>Campsis radicans</i>	2.5	--	--
<i>Quercus bicolor</i>	2.5	3.8	1.1
<i>Poa pratensis</i>	1.4	3.1	--
<i>Aster lateriflorus</i>	1.4	--	--
<i>Quercus palustris</i>	1.1	--	19.3
<i>Diospyros virginiana</i>	--	7.3	--
<i>Leersia virginica</i>	--	6.5	--
<i>Eleocharis verrucosa</i>	--	5.9	--
<i>Aster vimineus</i>	--	5.0	--
<i>Persicaria punctatum</i>	--	3.2	0.9
<i>Rubus flagellaris</i>	--	1.7	--
<i>Boehmeria cylindrical</i>	--	1.3	0.9
<i>Bidens vulgata</i>	--	1.1	--
<i>Ranunculus septentrionalis</i>	--	--	10.5
<i>Scutellaria lateriflorus</i>	--	--	8.1
others	2.1	2.1	2.0
Totals	200.0	200.0	200.0

Northern Flatwoods

Northern Flatwoods forests are found in the Moraine Section of the Northeastern Morainal Natural Division, the region most recently subjected to glaciation in Illinois. Moraines and morainic systems are common features and are responsible for the relatively rough, hilly, and rolling topography over most of the region. The Moraine Section contains most of the glacial lakes and true bogs that are found in Illinois along with other unusual glacial features like kames, eskers, drumlins, and kettle-holes.

The forests of the Moraine Section were diverse in presettlement times, ranging from dry upland forests dominated by *Quercus macrocarpa* (bur oak) and *Q. alba* (white oak); to mesic upland forests dominated by *Acer saccharum* (sugar maple), *Tilia americana*

(basswood), *Quercus rubra* (red oak), *Fraxinus americana* (white ash) and rarely *Fagus grandifolia* (American beech); to floodplain forests of *Acer saccharinum* (silver maple) *Fraxinus lanceolata* (green ash), and *Ulmus americana* (American elm); and northern flatwood forests. Also dry, mesic, and wet prairies were common, while tamarack swamps were occasionally encountered along with bogs, marshes, sedge meadows, and fens.

A recent survey of a flatwood forest at the Ryerson Conservation Area in Lake County documented the dominance of swamp white oak with 70 stems/ha, a basal area of 14.46 m²/ha, and an IV of 78.84 (possible 200) followed by white oak, white ash, black ash, American elm, and Hill's oak (Table 6.8). The oak species were mostly in the larger diameter classes, while most other woody species were common in the lower diameter classes. Many of the larger older age-class oaks predate settlement. The large number of mesic species in the lower and mid-sized diameter classes, like ashes, maples, and basswood, were apparently due to canopy closure and increased shading. These changes were probably the result of fire suppression that began after European settlement. As a result of canopy closure in this flatwoods the ground layer vegetation consists entirely of species that were common in forest habitats (Table 6.9). Graminoid species were relatively rare, and sedges (*Carex* spp.), which are usually common components of northern flatwoods, were rare.

Table 6.8. Density (#/ha), basal area (m²/ha), relative values, and importance values of the tree species encountered in a northern flatwoods at Ryerson Conservation Area, Lake County, Illinois.

Species	Density (#/ha)	Basal Area (m ² /ha)	Rel. Den.	Rel. Dom.	I.V.
swamp white oak	70	14.46	24.48	54.36	78.84
white oak	38	4.66	13.29	17.52	30.81
white ash	48	2.26	16.78	8.50	25.28
American elm	36	0.86	12.59	3.22	15.81
black ash	30	0.72	10.49	2.70	13.19
Hill's oak	12	1.94	4.20	7.29	11.49
slippery elm	16	0.85	5.59	3.19	8.78
sugar maple	12	0.21	4.20	0.80	5.00
basswood	10	0.18	3.50	0.66	4.16
shagbark hickory	8	0.14	2.80	0.53	3.33
red oak	4	0.29	1.40	1.09	2.49
hop hornbeam	2	0.04	0.68	0.14	0.82
Totals	286	26.61	100.0	100.0	200.0

These flatwood forests are restricted to the northeastern corner of Illinois in Cook, Kane, and Lake counties. They occur on poorly drained sites within the Valparaiso moraine system located to the west of the Chicago Lake Plain Section. It is estimated that about 35 ha of high-quality flatwoods are protected in just a few dedicated nature preserves. These flatwoods are in slight depressions on seasonally wet impervious glacial till that is somewhat compact. This condition results in the depressions holding water during the spring but often drying out during the summer. Though the soils probably do not have a true claypan there is still a restricting layer sometimes referred to as an aquiclude. Due to this aquiclude, water ponds at the soil surface in depressions and in drainage ways. These

tightly packed clay soils also restrict water movement and limit the depth plant roots can penetrate.

Table 6.9. Frequency (%), mean cover, and importance values of the common species encountered in the understory of a northern flatwoods at Ryerson Conservation Area, Lake County, Illinois. Only species with an importance value ≤ 1.0 are included.

Species	Frequency (%)	Mean Cover	Importance Value
HERBACEOUS SPECIES			
<i>Potentilla simplex</i>	50.0	3.50	6.95
<i>Geum canadense</i>	65.0	2.34	6.35
<i>Galium aparine</i>	15.0	4.35	6.11
<i>Geranium maculatum</i>	40.0	2.25	4.89
<i>Impatiens</i> sp.	35.0	2.45	4.86
<i>Froerkea proserpinacoides</i>	35.0	2.15	4.50
<i>Perscaria punctata</i>	50.0	1.45	4.45
<i>Claytonia virginica</i>	45.0	0.75	3.33
<i>Anemone quinquefolia</i>	20.0	1.80	3.26
<i>Galium</i> sp.	20.0	0.90	2.17
<i>Cardamine bulbosa</i>	30.0	0.35	2.03
<i>Arisaema triphyllum</i>	20.0	0.65	1.87
<i>Aster lateriflorus</i>	25.0	0.35	1.77
<i>Viola cucullata</i>	15.0	0.60	1.54
<i>Antenoron virginianum</i>	20.0	0.20	1.32
<i>Allium canadense</i>	5.0	0.75	1.18
Others (20 species)		2.35	10.11
GRAMINOID SPECIES			
<i>Cinna arundinacea</i>	40.0	0.85	3.18
<i>Carex gracillima</i>	10.0	1.30	2.12
Others (5 species)		0.45	2.97
WOODY SPECIES			
<i>Carpinus caroliniana</i>	30.0	3.45	5.82
<i>Ilex verticillata</i>	5.0	2.00	2.71
<i>Rhus radicans</i>	35.0	0.60	2.61
<i>Lonicera prolifera</i>	25.0	0.80	2.32
<i>Rubus pubescens</i>	15.0	1.05	2.09
<i>Acer saccharum</i>	15.0	0.65	1.60
<i>Viburnum prunifolium</i>	5.0	0.75	1.18
<i>Crataegus</i> sp.	15.0	0.20	1.05
Others (10 species)		4.76	5.66
Totals		44.05	100.00

Hydrology is undoubtedly the most important factor controlling the structure and composition of the plant communities of the northern flatwood ecology. The seasonality and duration of soil saturation can directly affect the vegetation and animal populations of these wet depressions. Also, these communities exist on nearly level ground with small depressions and rises occurring sporadically throughout the flatwoods. This micro topography causes different water depths that can allow for greater biodiversity.

The canopy of northern flatwood forests is dominated by swamp white oak, white oak, and *Quercus ellipsoidalis* (Hill's oak). Many subdominant species are found, the most common being green ash, silver maple, American elm, red oak, bur oak, *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), shagbark hickory, and *Populus grandidentata* (big-toothed aspen). Subcanopy species, that commonly form a distinct layer below the canopy, includes *Acer negundo* (box elder), *Populus tremuloides* (quaking aspen), and *Malus ioensis* (Iowa crab apple), while common shrubs include *Ilex verticillata* (winterberry) and *Rubus flagellaris* (common dewberry).

In a study correlating soil type with plant communities the vegetation of a wooded vernal pond (northern flatwoods) was surveyed at Busse Forest Nature Preserve in Cook County. In this vernal pond swamp white oak dominated with a mean basal area of 15.37 m²/ha followed by shagbark hickory, green ash, bur oak, and American elm with a total stand basal area of 33.78 m²/ha.

The Northern Flatwoods community is very important ecologically since it provides essential habitat for several species of plants, amphibians, reptiles, invertebrates, and birds. The unique ground layer contains many common species as well as a few rare, threatened and endangered plant species, including *Carex tuckrermanii* (Tuckerman's sedge), *Platanthera psycodes* (purple-fringed orchid), *Rubus pubescens* (dwarf raspberry), *Viola conspersa* (American dog violet) and *Viola incognita* (hairy white violet). Also, in the ground layer there is a remarkable diversity of sedges.