

WOODY VEGETATION OF A DRY—MESIC UPLAND FOREST IN CUMBERLAND COUNTY, ILLINOIS

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ABSTRACT

An inventory was completed of the woody vegetation of a dry-mesic upland forest in Cumberland County, Illinois. This woods, which is located in the Southern Till Plain Division, has a stand composition of 243 stems per hectare (above 10 cm dbh.) and 23.4 sq m of basal area per hectare. Of the 23 woody species present, white oak is the leading dominant, accounting for more than 50 % of the Importance Value in the woods. Black oak, shagbark hickory, mockernut hickory, sugar maple, and red oak follow in order of importance.

INTRODUCTION

The woodlot surveyed represents a remnant of a much larger forest that once occupied upland and sloping sites associated with the Embarrass River drainage in Cumberland County, Illinois. This dry-mesic upland forest is dominated by mature second growth white oak, with some hickories, other oaks, and sugar maple. It is located in the northern part of Effingham Plain Section of the Southern Till Plain Division. (Schwegman, 1973). The present study was undertaken since there are few detailed studies of the forest types of this division.

This 20 acre (8.1 hectare) woodlot is located about 13 miles south of the southern edge of the Shelbyville moraine, the terminal moraine of Wisconsin glaciation (S1/2 NE1/4 SE 1/4 Sec 35 T9N R7E), and about 8 miles SW of Toledo, Cumberland County, Illinois. It is on Illinoian till, and the soils are mostly Bluford silt loam which developed under mixed hardwood forest on undulating ground (Smith and Smith, 1940). The topography is gently rolling with a maximum difference in elevation of about 40 feet. The woodlot is well drained by two small intermittent streams, one across the western part of the tract, and the other near the southern boundary in the eastern part. Between the streams is a relatively

flat to gently rolling upland. The woods is bordered on the east by a county road, on the north and west by pasture, and on the south by a small, heavily disturbed woodlot.

MATERIALS AND METHODS

During the summer of 1983 the woodlot was divided into 126 quadrats 25 m on a side (0.1544 acres). The number, size, and species of all woody plants were recorded in each. Dead-standing trees were also measured and identified when possible. The Importance Value (IV) was then calculated from the data to provide a better basis of comparison of the various species. The determination of the IV follows the procedure outlined by McIntosh (1957), and later Boggess (1964), in which the IV is the sum of the relative frequency, relative density, and relative dominance.

An estimation of the number of seedlings and saplings of the various species was determined by using randomly located 1/10,000 and 1/1,000 hectare, nested circular plots located in each of the 25 m quadrats. The saplings (2.5-10.0 cm dbh.) were recorded on the larger plots, and the seedlings on the smaller. The seedlings were divided into those under 30 cm tall, and those over 30 cm tall but less than 2.5 cm dbh. The nomenclature follows that of Mohlenbrock (1975).

RESULTS AND DISCUSSION

A total of 23 tree species are found in the woodlot. These species along with their density and frequency by height or diameter class appear in Table 1. An additional listing of the 11 leading species encountered, with their relative values, importance values, average diameters, and the number of individuals per hectare broken down into broad diameter classes, is included in Table 2.

Except for along the intermittent stream, in a small swampy area, and in a heavily disturbed lowland area, the overstory of the woods is relatively uniform. Along the two intermittent streams and their slopes sugar maple is extremely common. Associated species include hop hornbeam, red oak, red bud, bitternut hickory, and American elm. In the small swamp, which is less than 1/10 hectare in size and located in the northwest corner of the woods, red maple, black willow, and honey locust are found; while the heavily disturbed lowland located along the east edge of the woods and about 1/2 hectare in size, is dominated by sugar maple, hackberry, chestnut oak, and sycamore.

The remainder of the woodlot is dominated by dry-mesic upland species with white oak being, by far, the leading dominant. This species has an IV of 151 and accounts for more than half of the individuals and two thirds of the basal area in the woods (Table 2). It is not well represented in the seedling and sapling categories (Table 1), but in the other diameter classes exceeds all other species in the woods. Its importance is mainly due to the large size of individual trees, accounting for more than half of all individuals in nearly all of the higher diameter classes.

The importance of black and red oak, second and sixth in IV respectively, is due mostly to the large size of individual trees as indicated by their average diameters of 40 cm. Black oak, which is commonly associated with white oak in the uplands, is fairly well represented in the seedling (fifth) and sapling (third)

categories, but has fairly poor size class distribution with most individuals in the 1-2, 4-5, and 5-6 dm diameter classes. In contrast, red oak is poorly represented in the sapling and seedling categories. This species is commonly found in the narrow valleys associated with the intermittent stream, and also has poor size class distribution (Table 2).

Four species of hickory are found in the woods. Of these, shagbark hickory and mockernut hickory, rank third and fourth in IV respectively, mainly due to the numerous small diameter trees of these species scattered throughout the uplands. Both are fairly well represented in the seedling and sapling categories, and rank very high in the 1 through 4 dm diameter classes. Pignut hickory (ninth in IV) is also an upland species, but is poorly represented in the lower diameter classes. Bitternut hickory (eighth in IV), in contrast, is commonly associated with the intermittent streams. This species has better size class distribution than pignut hickory, and is also better represented in the seedling and sapling categories. The fact that seedlings, saplings, and small diameter trees of most hickory species are fairly common indicates that most of these species will increase in importance in the woods. Similar results were obtained by McClain and Ebinger (1968) and Ebinger (1968) for woodlots located on the Shelbyville moraine.

The importance of sugar maple (fifth in IV) is mainly due to the large number of individuals in the 1-2 dm diameter class (Table 2). It also ranks fourth in seedlings and first in saplings in the woods (Table 1). Though scattered throughout the woodlot, it is particularly abundant along the intermittent stream, and from these areas its size and number of individuals rapidly decreases through the remainder of the woods. The large number of seedlings and saplings of this taxon, as well as its numbers in the lower diameter classes indicates that it will probably increase in importance. Also, sugar maple has a high gap phase replacement potential, and will be able to take advantage of canopy openings as some of the larger oaks die. Commonly associated with sugar maple on the mesic sites is the understory tree hop hornbeam (tenth in IV). A similar association was observed by Ebinger (1968, 1973) for two forests located on the Shelbyville moraine, and by Ebinger and Parker (1969) in the Rocky Branch Nature Preserve located just south of the moraine in Clark County, Illinois.

The other taxa included in the 11 most important species are green ash (seventh in IV) and black walnut (eleventh in IV). Both are poorly distributed in the woods, usually being associated with more mesic sites. Green ash is first in the number of seedlings per hectare (Table 1), but these seedlings appear to have poor survival value as indicated by the small number of saplings and trees per hectare for this species. In contrast, no seedlings or saplings of black walnut were observed (Table 1). Undoubtedly most of the larger walnuts have been cut, and there is no seed source present.

Most of the remaining woody species have extremely low IV's, and are mostly restricted to the more disturbed parts of the woods. A few, however, which are not important components of the overstory, are commonly found in the sapling and seedling layer. Among this group are sassafras and slippery elm which rank second and third in seedlings per hectare. Also, both are well represented in the sapling category (Table 1).

Tree mortality is not an important feature of the woodlot. The total mortality of all species combined is only 10.1 individuals per hectare with nearly 3/4 of these being relatively large white and black oaks. Also, a total of 15 cut stumps were

found, indicating relatively recent cutting. Most of these were white oaks, but a few were black walnut.

The woody composition of this woodlot is similar to many of the forests associated with the Shelbyville moraine, and the northern part of the Southern Till Plain Division in this part of Illinois. The only other woods recently surveyed in this division is located at Rock Cave Natural Area in Effingham County, Illinois (Ebinger, 1982). The composition of the two woodlots is strikingly similar. At Rock Cave, however, the woods is very immature with nearly three times as many individuals per hectare, and with very few trees in the larger diameter classes.

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Table 1. Individuals per hectare and frequency of woody species by height or diameter class in an oak-hickory forest in Cumberland County, Illinois.

Scientific Name	Common Name	Symbol	Height Class				Diameter Class				
			Density		Frequency		Density		Frequency		
			<30 cm tall	>30 cm tall	<30 cm tall	>30 cm tall	<2.5 cm dbh	>2.5 cm dbh	<2.5 cm dbh	>2.5 cm dbh	
<i>Quercus alba</i> L.	White Oak	WO	237	477	714	2.3	3.2	25	2.3	140.4	98.4
<i>Quercus velutina</i> Lam.	Black Oak	BO	1189	872	2061	11.9	8.7	294	23.8	13.1	46.0
<i>Carya ovata</i> (Mill.) K. Koch.	Shagbark	Sh	872	635	1507	7.9	4.8	230	19.8	19.3	54.8
<i>Carya tomentosa</i> (Poir.) Nutt.	Mockernut	Mo	398	477	875	3.2	4.8	430	32.5	14.3	42.9
<i>Acer saccharum</i> Marsh.	Sugar Maple	SM	1033	2540	3573	9.5	21.4	452	16.7	16.3	40.5
<i>Quercus rubra</i> L.	Red Oak	RO	79	316	395	.8	2.4	57	5.6	7.2	28.6
<i>Fraxinus pennsylvanica</i> Marsh.	Green Ash	GA	6032	3731	9763	34.9	27.0	175	15.9	8.9	31.7
<i>Carya cordiformis</i> (Wang.) K. Koch.	Bitternut	Bi	79	237	316	.8	2.4	25	2.4	3.0	15.1
<i>Carya glabra</i> (Mill.) Sweet.	Pignut	Pi	--	79	79	--	.8	7	.8	2.7	12.7
<i>Ostrya virginiana</i> (Mill.) K. Koch.	Hornbeam	Ho	79	237	316	.8	1.6	94	4.8	4.0	11.1
<i>Juglans nigra</i> L.	Black Walnut	BW	--	--	--	--	--	--	--	2.0	10.3
<i>Prunus serotina</i> Ehrh.	Black Cherry	BC	477	793	1270	4.8	7.1	94	7.9	2.7	10.3
<i>Ulmus rubra</i> Muhl.	Slippery Elm	SE	566	4287	4843	5.6	15.1	136	11.1	2.2	7.9
<i>Cercis canadensis</i> L.	Redbud	Rb	316	79	395	3.2	.8	57	4.0	1.2	7.9
<i>Ulmus americana</i> L.	American Elm	AE	--	--	--	--	--	7	.8	1.5	7.1
<i>Sassafras albidum</i> (Nutt.) Ness.	Sassafras	Sa	3254	3731	6985	18.3	23.0	190	11.1	1.5	5.6
<i>Celtis occidentalis</i> L.	Hackberry	Ha	--	--	--	--	--	7	.8	.7	3.2
<i>Quercus muhlenbergii</i> Englem.	Chestnut Oak	CO	--	--	--	--	--	--	--	.7	2.4
<i>Gleditsia triacanthos</i> L.	Honey Locust	HL	--	--	--	--	--	--	--	.7	1.6
<i>Morus rubra</i> L.	Red Mulberry	RM	--	158	158	--	1.6	25	2.4	.2	1.6
<i>Plantanus occidentalis</i> L.	Sycamore	Sy	--	--	--	--	--	--	--	.2	.8
<i>Acer rubrum</i> L.	Red Maple	Rc	--	--	--	--	--	--	--	.2	.8
<i>Salix nigra</i> Marsh.	Black Willow	Bl	--	--	--	--	--	--	--	.2	.8
Totals			14601	18649	33250			2305		243.2	

Table 2. Number of trees and basal areas per hectare, relative values, diameter classes, and average diameters for the leading dominants in an oak-hickory forest in Cumberland County, Illinois.

Species	Basal Area (m ² /ha)	Density (stems/ha)	RELATIVE VALUES				NUMBER OF TREES PER HECTARE BY DIAMETER CLASS (dm)						Av. Diam. (cm)
			Relative Frequency	Relative Density	Relative Dominance	Importance Value	1-2	2-3	3-4	4-5	5-6	6+	
WO	16.7	140.4	22.3	58.0	71.1	151.4	11.0	27.3	47.1	38.1	15.0	1.9	37
BO	1.9	13.1	10.4	5.3	8.1	23.8	2.9	.6	1.5	4.5	3.0	.6	40
Sh	.8	19.3	12.4	7.9	3.3	23.6	9.3	6.9	2.7	.4	--	--	21
Mo	.8	14.3	9.7	5.9	3.6	19.2	5.3	4.1	4.3	.5	.1	--	26
SM	.7	16.3	9.2	6.8	3.0	19.0	10.8	2.0	1.5	1.8	.2	--	20
RO	1.1	7.2	6.4	2.9	4.7	14.0	1.7	1.0	.3	1.3	2.0	.9	40
GA	.6	8.9	7.2	3.7	2.4	13.3	5.2	1.2	.6	1.2	.6	.1	24
Bi	.1	3.0	3.4	1.2	.5	5.1	1.8	.6	.6	--	--	--	21
Pi	.2	2.7	2.9	1.1	.7	4.7	.5	1.3	.8	.1	--	--	28
Ho	.1	4.0	2.5	1.6	.3	4.4	4.0	--	--	--	--	--	14
BW	.1	2.0	2.3	.8	.6	3.7	.2	.9	.9	--	--	--	15
Others	.3	12.0	11.3	4.8	1.7	17.8	9.7	1.6	.4	--	--	.3	--
Totals	23.4	243.2	100.0	100.0	100.0	300.0	62.4	47.5	60.7	47.9	20.9	3.8	--