

WOODY VEGETATION OF A STREAMSIDE FOREST IN ILLINOIS

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Hart Memorial Woods, an upland streamside forest of 13 hectares was inventoried during 1977. The stand has 415 trees/ha and 27.4 square meters basal area/ha; a sizable increase since the last inventory conducted in 1965. The leading dominants are white oak and black oak. The oaks can be expected to maintain their dominance, but slippery elm, silver maple, and shagbark and mockernut hickory will likely increase their relative importance.

Hart Memorial Woods is located on the east bank of the Sangamon River near Mahomet, Champaign County, Illinois. It is one of the more xerophytic examples of an upland streamside forest in the Prairie Peninsula of east-central Illinois. The University of Illinois acquired it as a natural area in 1965 to complete a wet-to-dry moisture sequence of upland forest sites (Root, et al, 1971). This is a remnant of a larger forest that once extended six miles north along the Sangamon and was about three miles wide. Hart Woods itself is unique in that it includes both moist bottomlands and drier upland areas.

Hart Memorial Woods is located on the N $\frac{1}{2}$ and E 16 acres of the S $\frac{1}{2}$, NE $\frac{1}{4}$, SW $\frac{1}{4}$, S 36, T 21 N, R 7 E, 3rd PM, Champaign County, Illinois. Elevations vary by as much as 30 feet and some slopes approach 30 percent. Two streams pass through the area; one is intermittent while the other has continuous flow.

The soils are Hapludalfs, the Birkbeck and Camden series. Both were developed in loess under the influence of a forest vegetation. Better upland sites are associated with the Birkbeck soils which have higher cation exchange capacities, higher base saturations, and better moisture conditions due to the more fine-textured materials at all depths. Camden soils are associated with stands dominated by black oak (Root, et al, 1971).

PAST WORK

The first inventory on file for Hart Woods was a 100% inventory completed in March of 1965 (Root, et al, 1971). Field procedures established for the 1965 inventory were followed in the reinventory conducted during 1977, but all measurements were taken in metric. For comparison, the results reported by Root, et al, 1971, are converted to metric. This paper is the third in a series reporting results of the reinventory of University of Illinois Natural Areas, results of the inventory of Brown-field Woods were reported by Miceli et al, 1977, and of Trelease Woods by Pelz and Rolfe, 1977.

METHODS

Before the 1966 inventory the woodland was subdivided into 52 permanent blocks of 50 by 50 meters. The blocks were then divided into 4 quadrants for measurement purposes by running diagonals from the 4 corners of each block. All the woody vegetation was measured in one centimeter diameter classes with a minimum diameter of 6.5 cm. Only living trees were included in the inventory.

In each block, two 5 x 5 meter sample plots were used to inventory saplings, which were defined as trees between 1 and 7 cm dbh. These sample plots were located systematically. One 2 x 2 meter sample plot per block was used to inventory seedlings. These were defined as woody plants with a dbh of less than 1 cm. A total of 104 plots of 25 m² each were used for the saplings and 104 plots of 4 m² each were used for the seedlings. This represents 2% and 0.32% of the area, respectively.

RESULTS AND DISCUSSION

A total of 5394 trees or 415.10 trees per hectare were measured in diameter classes of 7 cm or greater (Table 1). This compares to 303.8 trees per hectare (122.95 T/Acre) in 1965, with the majority of the additional trees coming from the 7-15 cm diameter classes. The average basal area in the 1977 inventory was 27.42 square meters per hectare as compared with 23.46 square meters per hectare (102.17 ft²/A) in 1965 (Table 2). The majority of this increase came in the 61-90 cm diameter classes. Figure 1 shows a cover map with major species and basal area densities for the woodland.

The reason for the increase in number of trees per hectare is likely due to dutch elm disease which killed a large number of trees

Table 1 Number of Trees, Basal Area per ha, Importance Value, Average Diameter, and Frequency

Species	Diameter Class										Percent	Ave. Diam.	Frequency		Import. ¹ Values			
	7 - 15		16 - 30		31 - 60		61 - 90		90+							Total		
	No.	BA	No.	BA	No.	BA	No.	BA	No.	BA			No.	BA		blocks	quarters	
White Oak	6.6	0.08	44.2	1.97	48.6	7.20	4.5	1.66	---	---	103.8	10.92	25.0	40.3	33.7	94.23	83.64	65.3
Black Oak	0.3	---	0.5	0.03	20.5	3.77	4.2	1.47	---	0.06	25.4	5.27	6.1	19.4	50.2	73.08	50.96	25.6
Red Oak	0.3	---	2.3	0.12	16.1	2.69	4.4	1.76	0.1	---	23.2	4.64	5.6	17.1	48.0	84.62	54.32	22.7
Slippery Elm	66.1	0.43	4.9	0.17	0.8	0.09	0.2	0.06	---	---	71.9	0.75	17.3	2.8	10.1	96.15	79.32	20.1
Silver Maple	15.8	0.13	6.2	0.21	4.3	0.74	0.8	0.34	0.3	0.29	27.5	1.72	6.6	6.3	20.9	34.62	22.1	13.0
Black Cherry	37.3	0.24	2.8	0.10	1.3	0.16	---	---	---	---	41.5	0.50	10.0	1.8	10.6	78.85	55.76	11.8
American Elm	30.0	0.20	4.6	0.16	0.5	0.06	0.1	0.04	---	---	35.2	0.45	8.5	1.7	11.0	84.62	58.65	10.1
Sassafras	29.0	0.16	1.5	0.05	---	---	---	---	---	---	30.5	0.21	7.3	0.8	8.8	73.08	43.28	8.1
Green ash	2.5	0.02	1.5	0.07	2.0	0.37	0.6	0.20	---	---	6.7	0.66	1.6	2.4	29.5	23.08	16.35	4.0
Shagbark Hickory	7.5	0.05	2.6	0.10	0.7	0.07	0.1	0.03	---	---	10.9	0.25	2.6	0.9	14.0	67.31	35.1	3.6
Hackberry	6.5	0.05	2.2	0.08	1.1	0.13	0.1	0.03	---	---	9.8	0.29	2.4	1.1	16.0	46.15	23.56	3.5
Mockernut Hickory	2.8	0.02	1.8	0.08	1.5	0.22	0.1	0.03	---	---	6.2	0.35	1.5	1.3	22.5	57.69	22.12	2.8
Black Walnut	1.9	0.02	0.6	0.03	2.0	0.26	0.1	0.03	---	---	4.7	0.33	1.1	1.2	25.9	40.38	16.84	2.4
Redbud	5.6	0.03	0.4	0.02	0.1	0.01	---	---	---	---	6.1	0.06	1.5	0.2	9.7	40.38	20.20	1.7
Basswood	2.1	0.02	0.6	0.02	0.5	0.06	---	---	0.1	0.06	3.3	0.17	0.8	0.6	18.7	26.92	7.69	1.4
Honey Locust	0.4	---	0.2	0.01	0.8	0.13	0.1	0.02	---	---	1.5	0.17	0.4	0.6	33.9	15.38	6.7	1.0
Hawthorn	1.6	0.02	0.8	0.02	---	---	---	---	---	---	2.5	0.04	0.6	0.1	14.6	21.15	8.17	0.7
Bur Oak	0.1	---	0.1	---	0.4	0.06	0.2	0.06	---	---	0.7	0.12	0.2	0.4	43.2	11.54	3.36	0.6
Shingle Oak	0.2	---	---	---	0.2	0.03	0.2	0.06	---	---	0.5	0.09	0.1	0.3	41.6	11.54	3.36	0.5
Boxelder	1.2	0.01	0.5	0.01	---	---	---	---	---	---	1.7	0.02	0.4	0.1	12.5	9.62	4.80	0.5
Sycamore	---	---	---	---	0.2	0.04	0.1	0.04	---	---	0.2	0.08	0.1	0.3	63.3	1.92	0.96	0.3
Butternut	0.5	---	0.2	---	---	---	---	---	---	---	0.8	0.01	0.2	---	12.2	3.85	1.44	0.2
Bitternut Hickory	---	---	---	---	0.2	0.02	---	---	---	---	0.2	0.02	---	0.1	40.0	1.92	0.96	0.1
Crataegus	0.1	---	---	---	---	---	---	---	---	---	0.1	---	---	---	8.0	1.92	0.48	---
Blackjack Oak	---	---	---	---	0.1	0.01	---	---	---	---	0.1	0.01	---	---	32.0	1.92	0.48	---
Wahoo	0.1	---	---	---	---	---	---	---	---	---	0.1	---	---	---	8.0	1.92	0.48	---
Total	218.5	1.50	78.7	3.3	101.7	16.11	15.5	5.83	0.6	0.73	415.1	27.13	99.8	99.8				

¹ Importance Value calculated as sum of frequency and basal area percent

Table 2 Number of Trees and Basal Area in 1966 and 1977

Species	1966			1977		
	Number of trees (per ha)	Basal area (m ² /ha)	Average diameter (cm)	Number of trees (per ha)	Basal area (m ² /ha)	Average diameter (cm)
White oak	117.6	9.22	31.8	103.8	10.92	33.7
Black oak	46.6	7.30	44.4	25.4	5.27	50.2
Red oak	11.8	2.43	45.5	23.2	4.64	48.0
Slippery elm	37.8	0.28	9.7	71.9	0.75	10.1
American elm	22.9	0.25	11.9	35.2	0.45	11.0
Silver maple	8.4	0.99	38.6	27.5	1.72	20.9
Black cherry	13.5	0.29	16.5	41.5	0.50	10.6
Green ash	5.2	0.56	36.8	6.7	0.66	29.5

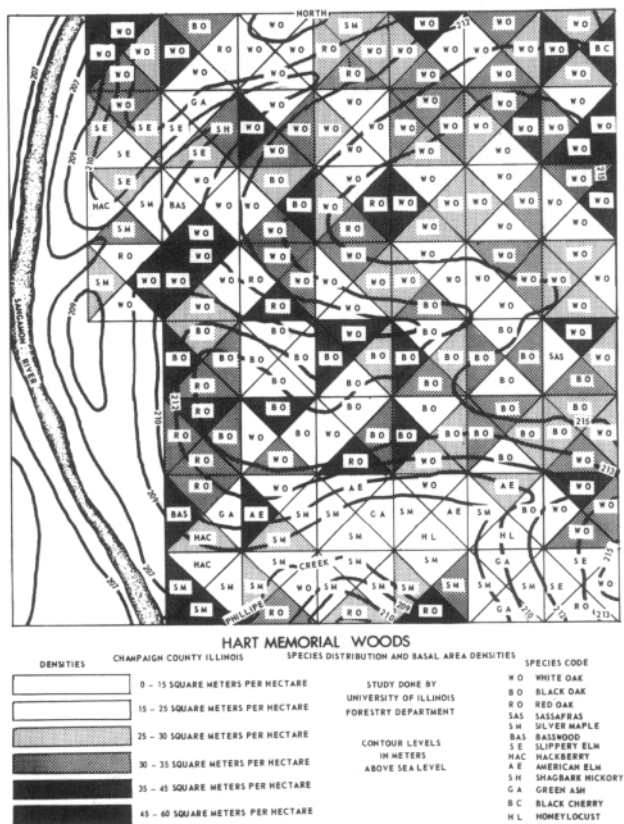


Figure 1. Species distribution and basal area densities for dominant species in Hart Memorial Woods.

several years ago. These open areas were filled by saplings and a large number of seedlings which were recorded in the 1965 inventory. By 1977 many of these seedlings and saplings had grown into the smaller diameter classes (i.e. 7-15 cm). There are several species which seem to have taken advantage of these openings; including slippery elm, American elm, silver maple, black cherry, mockernut hickory, and shagbark hickory (Table 3).

The increase in basal area is concentrated in the larger diameter classes from 61-90 cm. This indicates that from 1965 to 1977 there was little mortality in the larger diameter classes and/or the medium sized trees had extremely good growth over that time span which could be a result of a decrease in competition because of elm mortality.

The largest changes in basal area came from the oaks (white, red, and black), since they have the largest percentage of basal area; 76% in 1977 and 81% in 1965. White oak (Quercus alba L.) was the most abundant species in 1977, having 103.8 trees/ha and 10.92 m²/ha. This is an increase in basal area (from 9.22 m²/ha) but was a decrease in number of trees per hectare. The increase in basal area came from an increase in average diameter of 31.8 to 33.7 cm.

Black oak (Quercus velutina Lamack) has the second largest basal area and is the only species which decreased in basal area, from 7.30 m²/ha to 5.27 m²/ha. The number of trees per hectare decreased for this species for diameter classes of 60 cm and below. This could be due to the fact that black oak tends to be a shorter lived species than red or white oak and does not compete as well (Harlow and Harrar, 1969).

Red oak (Quercus rubra Du Roi) had the third largest basal area in 1977 with 4.64 m²/ha and increased greatly in basal area since 1966 (from .43 m²/ha). This increase reflects an increase in both number of trees per hectare and average diameter.

American elm (Ulmus americana L.), slippery elm (Ulmus rubra Muhl.), silver maple (Acer saccharinum L.) and black cherry (Prunus serotina Ehrh.) all increased substantially in number of trees per hectare and basal area because of an increase in percentage of smaller stems. All four of these species showed a large gain in number of trees per hectare in the 7-15 cm diameter classes. These are individuals that occupy the open spots left by the dead elms. Slippery elm also increased in average diameter.

Slippery elm is gaining in percent of basal area and number of trees; so is American elm to a smaller extent. It will be interesting to see how long it will take dutch elm disease to begin affecting these younger stems and what the ultimate effect will be on the stand.

Five species, black cherry, red osier dogwood, American elm, slippery elm, and sassafras, dominate the seedling class. All but red osier dogwood dominate the sapling class. Black cherry is intolerant

TABLE 3 Density/ha and Frequency of Seedlings and Saplings of Woody Species by Height or Diameter Class in order of importance.

Species	Height Class (<1cm dbh)			Diameter Class		
	<30cm	>30cm	Total	% Freq.	1cm-6cm	% Freq.
Elm Slippery	2524.0	3221.2	5745.2	36.5	742.3	37.5
Elm American	480.8	2115.4	2596.2	25.0	746.1	33.6
Black Cherry	769.2	2764.4	3533.6	32.7	553.8	27.9
Mockernut Hickory	96.2	625.0	721.2	15.4	219.2	25.0
Sassafras	1009.6	889.4	1899.0	19.2	434.6	20.2
Shagbark Hickory	216.35	552.9	769.2	18.3	223.1	19.2
Green Ash	264.4	576.9	841.4	16.4	130.8	10.6
Silver Maple	24.0	312.5	336.5	8.6	176.9	8.6
Crataegus Sp.	216.4	432.7	649.0	5.8	80.8	5.8
Red Osier Dogwood	1634.6	576.9	2211.5	17.3	69.2	5.8
Hackberry	--	24.0	24.0	1.0	30.8	5.8
Prickly Ash	120.2	793.3	913.5	6.7	42.3	4.8
Pignut Hickory	24.0	48.1	72.1	2.9	23.1	4.8
Black Oak	673.1	168.3	841.4	10.6	53.8	4.8
Redbud	--	144.2	144.2	4.8	23.1	4.8
Boxelder	240.4	24.0	264.4	5.8	26.9	3.8
Dogwood	336.5	504.8	841.4	9.6	15.4	2.9
Basswood	--	48.1	48.1	1.0	11.5	1.9
Butternut	--	--	--	--	11.5	1.9
Hazel	24.0	192.3	216.4	3.8	7.7	1.9
Blue Ash	--	--	--	--	3.8	1.0
Black Walnut	--	--	--	--	3.8	1.0
Hawthorn	--	48.1	48.1	1.0	7.7	1.0
Elderberry	--	24.0	24.0	1.0	3.8	1.0
Shellbark Hickory	--	--	--	--	3.8	1.0
Mulberry	--	24.0	24.0	1.0	3.8	1.0
Bur Oak	--	--	--	--	3.8	1.0
Blackjack Oak	--	--	--	--	3.8	1.0
White Oak	336.5	48.1	384.6	7.7	7.7	1.0
Ohio Buckeye	--	--	--	--	3.8	1.0
Wahoo	24.0	144.2	168.3	1.9	11.5	1.0
Choke Cherry	--	24.0	24.0	1.0	--	---
Red Oak	168.3	24.0	192.3	2.9	--	---
Total	9182.7	14350.9	23533.6		3680.6	

and probably will be reduced as the canopy closes. The elms made a large gain in basal area and number of trees, but whether they will become dominant species again remains to be seen. Sassafras, dogwood, and red osier dogwood all have a large number of stems and can be expected to maintain their importance in the understory.

In the overstory, the oaks, white oak in particular, can be expected to continue to dominate in this stand. Silver maple and mockernut and shagbark hickory may gain in importance in future years because of their large number of seedlings and saplings. The silver maple predominates in the wet bottomland area with the hickories becoming more important in the upland area.

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