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WOODY VEGETATION AT BURGNER ACRES, EAST-CENTRAL ILLINOIS: COMPOSITION AND CHANGES SINCE 1964

Larry Lehnen, Jr. and John Ebinger
Botany Department
Eastern Illinois University
Charleston, IL 61920

ABSTRACT

A comparative study of woody vegetation changes on Burgner Acres over the past 18 years is reported. Presently 30 arborescent species are found in the woodlot with white ash maintaining its position as first in Importance Value, hackberry has increased from fourth to second in importance, while elm, shagbark hickory, and black walnut show little change in relative values. Also, a decrease in elm mortality and a decrease in the importance of red haw has resulted in an increase in the ranking of white oak. Sugar maple has become well established in parts of the woodlot and will undoubtedly increase due to its superior gap phase replacement potential.

INTRODUCTION

Burgner Acres is a 10 acre woodlot located approximately 8 miles northwest of Charleston, Illinois. It was donated to Eastern Illinois University in January 1955 by Mrs. Helen Burgner Douglas as a memorial to her father and grandparents who were pioneer settlers in the county. Since 1955 it has been maintained undisturbed except for a footpath, and has been utilized for research and educational purposes. Shortly after the woodlot was acquired, six permanent quadrats were established (Henderson and Damann, 1966), and in 1962 six line transects were run by an ecology class to determine woody composition. In 1964 a complete survey of the woody vegetation was undertaken (Blackmore and Ebinger, 1967) allowing for the analysis of even the less important tree species. This paper is a follow up to that study to determine woody vegetation changes over the past 18 years.

DESCRIPTION OF THE WOODLOT

Burgner Acres is located in the Grand Prairie Division of Illinois (Schwegman, 1973) three miles north of the Shelbyville Moraine in Coles County, Illinois (SW¼ NE¼ Sec 1 T12N R8E). It is traversed by Sycamore Creek and has a gently rolling

topography with a maximum difference in elevation of about 25 feet. Sycamore Creek divides the woodlot into three well defined study areas (Henderson and Damann, 1966). Area A, at the north edge of the woodlot, slopes gradually toward Sycamore Creek. Prior to acquisition of the woodlot by Eastern Illinois University, this area was frequently mowed. Area B is a somewhat less disturbed moist area which slopes to a second loop of the creek. Area C is a partially disturbed higher and drier area beyond the second loop of the creek. Two soil types are present in the woodlot (Yellow-Gray Silt Loam, Yellow Silt Loam). Both are classified as upland timber soils (Smith, et al., 1929).

MATERIALS AND METHODS

To facilitate direct analysis of vegetation changes the method employed was that of Blackmore and Ebinger (1967). The entire woodlot was staked off into 50 feet square quadrats and the number, size, and species of all trees four inches dbh and over were recorded. Relative density, relative dominance, relative frequency and Importance Value of each species were then calculated using the procedures outlines by Blackmore and Ebinger (1967). These values were calculated not only for the entire woodlot, but also for each of the three areas outlined in the description of the woodlot. Dead standing trees were measured and identified when possible, but only dead elms were used in the calculations because they comprise a relatively large part of the stand.

One set of nested, circular plots 1/100 and 1/1000 or an acre in size was randomly located in each 50 foot square quadrat. Saplings (1-4 inches dbh) were tallied on the larger and seedlings on the smaller plots. The seedlings were separated into those under one foot in height, and those over one foot in height but less than one inch dbh. The nomenclature used follows Jones (1963).

RESULTS

Of the 30 arborescent species encountered on the woodlot, 7 are understory trees. These species, along with their density and frequency by size classes, are shown in Table 1. Also, the 12 leading species, with their relative values, average diameters and number of individuals per acre in broad diameter classes are shown in Table 2.

Of the arborescent species listed in Table 2, white ash ranks first in Importance Value, having the highest relative frequency, relative density, and relative dominance. It predominates in both the 4-6 and 7-12 inch diameter classes, firmly establishing its position as first in importance. Hackberry, which is second in importance, ranks close behind white ash in both relative frequency and relative density but has less basal area. The large number of individuals of this species in the 4-6 and 7-12 inch diameter classes suggests that it will maintain its position of codominance with white ash.

As no attempt was made to distinguish slippery elm and American elm in the previous study (Blackmore and Ebinger, 1967), they were combined in the present study. In the woodlot, elm is third in number of individuals per acre in the 4-6 inch diameter class and in total individuals, as well as third in Importance Value. Presently dead elms account for 14% of all standing elms. This mortality, which is due to phloem necrosis and Dutch elm disease, effectively limits the importance of

this species. If values for living and dead elm are summed, its importance slightly exceeds that of hackberry.

Black walnut, as fourth in importance, only slightly exceeds shagbark hickory which is fifth in importance. This is due mainly to the large size of individual trees. Shagbark hickory ranks higher than walnut in trees per acre in the smaller diameter classes, and will probably surpass walnut in importance as these individuals mature.

White oak and mockernut hickory are sixth and seventh in importance respectively, primarily due to the large size of individual trees. Bitternut hickory and shingle oak are present also in larger diameter classes, but their low density results in a low importance value. Red haw and black cherry are present in the smaller diameter classes, but their low basal area and relative sparseness results in a low importance.

DISCUSSION

Considerable change has taken place in the woodlot since the original survey in 1964 (Blackmore and Ebinger, 1967). A major change is the number of individuals per acre; averaging 143 in 1964 and presently averaging 194 stems per acre (Table 2). Most of this increase occurs in the 4-6 inch diameter class (87.6 in 1964 to 113.1 in 1982), and in the 7-12 inch diameter class (28.6 in 1964 to 54.7 in 1982). Another difference is the change in Importance Value and ranking of some of the species, both in the entire woodlot, as well as in the three separate study areas (Tables 2 & 3).

White ash maintains its position as first in importance in the entire woodlot. It has more than doubled in individuals per acre (22.4 in 1964 to 48.0 in 1982), and while it has increased in all three areas, its major increase has occurred in Area A. In this area it has increased from eighth to a present fourth in importance. This apparent lag in reproduction is possibly due to an inability of ash to germinate and compete in the years subsequent to the area having been mowed and grazed. Adequate germination and growth possibly occurred only after there was an accumulation of nutrients provided by leaf litter (Fowells, 1965).

Hackberry has increased from fourth to second in importance. Its present position as second in individuals per acre suggests that it will continue as second in importance for a long period of time. This substantial increase has displaced elm to third in importance. Elm has increased in all diameter classes, but hackberry has increased at a greater rate, consequently the ranking change. Elm mortality has decreased more than 50%, and the diameter of dead elm has decreased to an average of 6.9 inches (13.5 inches in 1964).

Black walnut, which is fourth in importance, has increased in relative dominance while experiencing a decrease in relative density. This species is not reproducing well in the woodlot and will eventually decrease to a lower importance as the larger individuals die. Hickories will probably exhibit this same pattern, though shagbark hickory will probably remain important as it is exhibiting better recruitment from the seedling and sapling strata. Presently shagbark hickory has increased slightly in stems per acre, but the relative value of this increase is negligable when compared to the increase in the species ranked higher.

White oak has made a slight increase in stems per acre over the past 18 years, primarily in Area C. The increased importance of white oak is primarily due to

the decrease in previously more important species. One of these is red haw, in which the number of stems per acre has decreased to less than half of what was present in the original survey (16.6 in 1964 to 7.4 in 1982). This decrease, as predicted by Blackmore and Ebinger (1967), is largely a response to canopy closure.

Blackmore and Ebinger (1967) reported a large number of sugar maple seedlings and saplings on a portion of the slope to Sycamore Creek in Area C. Presently in Area C, sugar maple is represented by a total of 6.1 individuals per acre in the 4-6 inch and 7-12 inch diameter classes with an average diameter of 6.2 inches (Table 1). Its importance value of 8.0 ranks it as tenth in importance when only Area C is considered. The superior gap phase replacement potential of sugar maple and its rapid establishment in Area C suggests that it will spread throughout Area C, and possibly throughout the entire woodlot, as is occurring in Sargents Woods (Ebinger, 1968) and Baber Woods (McClain and Ebinger, 1968). The far future implications of this suggest that sugar maple could rise to codominance with white ash, hackberry, and elm. The composition of this woodlot would then closely resemble the composition of prairie groves (Boggess, 1964; Boggess and Bailey, 1964).

LITERATURE CITED

Blackmore, B.K. and J.E. Ebinger. 1967. Vegetation survey of Burgner Acres, east-central Illinois. Trans. Ill. St. Acad. Sci. 60:72-79.

Boggess, W.R. 1964. Trelease Woods, Champaign County, Illinois: Woody vegetation and stand composition. Trans. Ill. St. Acad. Sci. 57:261-271.

Boggess, W.R. and L.W. Bailey. 1964. Brownfield Woods, Illinois: Woody vegetation and change since 1925. Amer. Midl. Nat. 71:392-401.

Ebinger, J.E. 1968. Woody vegetation survey of Sargents Woods, Coles County, Illinois. Trans. Ill. St. Acad. Sci. 61:16-25.

Fowells, H.A. 1965. Silvics of forest trees of the United States. U.S. Dept. Agric., Agric. Hand. 271. 762 pp.

Henderson, S. and K.E. Damann. 1966. Burgner Acres Natural Area of Eastern Illinois University. Trans. Ill. St. Acad. Sci. 59:281-286.

Jones, G.N. 1963. Flora of Illinois. Amer. Midl. Nat. Monogr., No. 7:vi + 401 p.

McClain, W.E. and J.E. Ebinger. 1968. Woody vegetation of Baber Woods, Edgar County, Illinois. Amer. Midl. Nat. 79:419-428.

Schwegman, J. 1973. Comprehensive plan for the Illinois Nature Preserves System. Part 2: The natural divisions of Illinois. Illinois Nature Preserves Commission. Rockford, Illinois.

Smith, R.S., E.E. DeTurk, F.C. Bauer, and L.H. Smith. 1929. Coles County soils. Univ. Ill., Agric. Exp. Sta., Soil Report No. 44. 61 pp.

Table 1. Density per acre and frequency of arborescent species by height or diameter class at Burgner Acres. The species symbols will be used to identify species in subsequent tables.

			Height Class					Diameter Class			
			Density			Frequency %		1″-4″		4″ +	
Scientific name	Common name		<1′	>1′<1″ dbh	Total	<1′	>1<1″ dbh	Density	Freq. %	Density	Freq. %
Fraxinus americana	White ash	WA	27	187	214	2.0	14.7	45	32.7	47.96	77
Ulmus sp.	Elm	E	53	660	713	4.7	29.3	150	57.3	37.17	74
Celtis occidentalis	Hackberry	H	40	747	787	2.7	40.7	165	62.0	42.29	69
Carya ovata	Shagbark hickory	SH	7	33	40	.7	2.7	15	11.3	14.51	42
Juglans nigra	Black walnut	BW	--	--	--	--	--	2	1.3	10.92	38
Crataegus mollis	Red haw	RH	7	20	27	.7	2.0	20	15.3	7.43	27
Ulmus sp. (daed)	Dead elm	DE	--	--	--	--	--	--	--	5.81	26
Carya tomentosa	Mockernut hickory	MH	7	20	27	.7	2.0	2	2.0	5.23	22
Quercus alba	White oak	WO	7	13	20	.7	1.3	1	.7	3.83	19
Carya cordiformis	Bitternut hickory	BH	20	80	100	1.3	7.3	10	9.3	4.19	15
Prunus serotina	Black cherry	BC	53	247	300	2.7	13.3	13	8.7	3.61	13
Gleditsia triacanthos	Honey Locust	HL	--	--	--	--	--	--	--	1.51	7
Cercis canadensis	Red bud	RB	--	--	--	--	--	3	3.3	1.63	6
Quercus imbricaria	Shingle oak	SO	--	7	7	--	.7	1	1.3	1.98	5
Maclura pomifera	Osage orange	OO	--	--	--	--	--	--	--	1.16	5
Acer saccharum	Sugar maple	SM	100	53	153	2.7	3.3	33	8.0	1.63	5
Quercus macrocarpa	Bur oak	BO	--	7	7	--	.7	5	4.7	.93	5
Carya glabra	Pignut hickory	PH	--	--	--	--	--	--	--	.24	1
Robinia pseudoacacia	Black locust	BL	--	--	--	--	--	--	--	.93	1
Platanus occidentialis	Sycamore	S	--	--	--	--	--	--	--	.46	1
Salix nigra	Black willow	Bl	--	--	--	--	--	--	--	.12	1
Quercus rubra	Red oak	RO	--	--	--	--	--	--	--	.23	1
Sassafras albidum	Sassafras	Sa	--	7	7	--	.7	--	--	.35	1
Acer negundo	Box elder	BE	--	--	--	--	--	--	--	.12	1
Tilia americana	Linden	L	--	13	13	--	1.3	1	.7	.58	1
Morus rubra	Red mulberry	RM	--	--	--	--	--	1	.7	--	--
Crataegus crusgalli	Cockspur thorn	CT	--	--	--	--	--	2	2.0	--	--
Malus ioensis	Iowa crabapple	IC	--	--	--	--	--	1	1.3	--	--
Viburnum prunifolium	Black haw	B	7	147	154	.7	10.0	11	6.7	--	--
Quercus muhlenbergii	Chinquapin oak	CO	--	7	7	--	.7	2	2.0	--	--
Euonymus atropurpureus	Wahoo	W	--	33	33	--	2.7	--	--	--	--
	Totals		328	2281	2609	--	--	483	--	194.82	--

Table 2. Diameter classes, average diameter, relative values, and importance values for the leading dominants at Burgner Acres. Also included is the importance values for these species from the 1964 survey and the amount of change from the present survey.

Species	Number of Trees per Acre by Diameter Class 4-6	7-12	13-24	25+	Total	Av. Diam.	Rel. Freq.	Rel. Den.	Rel. Dom.	I.V. 1982	I.V 1964	I.V Change
WA	30.4	12.9	3.5	1.2	48.0	7.6	16.6	24.6	20.5	61.7	43.2	+18.5
H	28.8	12.1	1.1	.3	42.3	6.7	14.9	21.7	12.2	48.8	28.3	+20.5
E	27.3	9.6	.2	--	37.1	6.2	16.0	19.1	8.3	43.4	35.5	+ 7.9
BW	1.4	3.1	5.6	.8	10.9	14.2	8.2	5.6	14.2	28.0	27.9	+ .1
SH	3.5	6.4	4.4	.2	14.5	11.1	9.1	7.4	11.4	27.9	32.0	- 4.1
WO	.8	.1	.9	2.0	3.8	21.8	4.1	2.0	11.6	17.7	17.5	+ .2
MH	.3	1.6	3.3	--	5.2	14.0	4.8	2.7	6.0	13.5	13.6	- .1
RH	6.8	.6	--	--	7.4	5.2	5.9	3.8	1.1	10.8	25.4	-14.6
DE	3.9	1.9	--	--	5.8	6.9	5.6	3.0	1.5	10.1	26.7	-16.6
BH	1.5	1.6	1.1	--	4.2	10.0	3.3	2.2	2.8	8.3	7.2	+ 1.1
BC	2.6	1.0	--	--	3.6	6.1	2.8	1.8	.8	5.4	3.9	+ 1.5
SO	1.0	.6	.4	--	2.0	9.0	1.2	1.0	1.1	3.3	2.2	+ 1.1
Others	4.8	3.2	1.3	.6	9.9	12.6	7.5	5.1	8.5	21.1	36.6	-15.5
	113.1	54.7	21.8	5.1	194.7	--	100.0	100.0	100.0	300.0	300.0	--

Table 3. Diameter classes, average diameters, relative values, and importance values for the leaging dominants in the three areas at Burgner Acres. Also included is the importance values for these species from the 1964 survey and the amount of change from the present survey.

Species	Number of Trees per Acre by Diameter Class 4-6	7-12	13-24	25+	Total	Av. Diam.	Rel. Freq.	Rel. Den.	Rel. Dom.	I.V. 1982	I.V 1964	I.V. Change
AREA A												
WA	25.3	7.1	1.2	--	33.6	6.5	15.1	15.9	10.0	41.0	13.2	+27.8
H	56.4	19.1	--	.4	75.9	6.2	20.4	35.8	22.1	78.3	51.2	+27.1
E	31.5	11.2	.8	--	43.5	6.3	19.2	20.6	12.2	52.0	32.1	+19.9
BW	4.6	8.3	7.5	1.2	21.6	11.7	12.2	10.2	23.2	45.7	46.3	- .6
SH	1.7	--	.8	.8	3.3	14.6	4.7	1.6	6.4	12.7	16.3	- 3.6
WO	1.2	--	1.2	--	2.4	14.3	2.3	1.2	4.5	8.0	12.4	- 4.4
MH	.4	--	--	--	.4	6.9	.6	.2	.1	.9	--	+ .9
RH	2.1	--	--	--	2.1	4.7	2.3	1.0	.3	3.6	28.8	-25.2
DE	3.7	4.2	--	--	7.9	7.3	7.6	3.7	2.9	14.2	32.9	-18.7
BH	--	--	--	--	--	--	--	--	--	--	--	--
BC	5.4	2.5	--	--	7.9	6.2	5.8	3.7	2.0	11.5	11.1	+ .4
SO	2.5	.8	--	--	3.3	6.4	2.3	1.6	1.0	4.9	1.2	+ 3.7
Others	3.7	3.7	1.2	1.2	9.8	17.8	7.5	4.5	15.2	27.2	54.5	-27.3
	138.5	56.9	12.7	3.6	211.7	--	100.0	100.0	100.0	300.0	300.0	
AREA B												
WA	14.9	12.6	5.6	2.3	35.4	10.0	15.4	19.3	25.8	60.5	49.4	+11.1
H	19.5	11.0	1.5	.5	32.5	7.1	14.2	17.8	10.4	42.4	25.0	+17.4
E	31.8	11.8	--	--	43.6	6.2	16.6	23.8	9.1	49.5	40.2	+ 9.3
BW	--	1.5	4.4	.8	6.7	17.5	6.9	3.6	11.5	22.0	24.0	- 2.0
SH	5.9	10.0	7.2	--	23.1	10.7	12.1	12.6	16.2	40.9	40.9	--
WO	.3	.3	.5	1.8	2.9	24.2	3.3	1.5	9.5	14.3	15.1	- .8
MH	.3	2.0	1.5	--	3.8	11.2	4.2	2.1	2.7	9.0	9.2	- .2
RH	10.8	.8	--	--	11.6	5.1	7.8	6.3	1.6	15.7	26.0	-10.3
DE	5.4	1.5	--	--	6.9	6.1	6.9	3.8	1.5	12.2	26.3	-14.1
BH	2.8	2.3	.8	--	5.9	8.6	3.3	3.2	2.9	9.4	6.8	+ 2.6
BC	1.3	.8	--	--	2.1	6.5	2.1	1.1	.5	3.7	2.6	+ 1.1
SO	.8	.8	.8	--	2.4	11.2	1.2	1.3	1.8	4.3	3.9	+ .4
Others	3.1	2.3	.8	.5	6.7	12.1	6.0	3.6	6.5	16.1	30.6	-14.5
	96.9	57.7	23.1	5.9	183.6	--	100.0	100.0	100.0	300.0	300.0	

Table 3. continued

Species	Number of Trees per Acre by Diameter Class 4-6	7-12	13-24	25 +	Total	Av. Diam.	Rel. Freq.	Rel. Den.	Rel. Dom.	I.V. 1982	I.V 1964	I.V. Change
AREA C												
WA	62.3	19.6	2.2	.4	84.5	6.4	20.2	43.0	20.7	83.9	55.1	+28.8
H	15.7	6.5	1.3	--	23.5	7.0	11.2	12.0	7.0	30.2	16.5	+13.7
E	15.3	4.4	--	--	19.7	5.9	12.2	10.0	3.6	25.8	29.5	- 3.7
BW	.4	.4	5.7	.4	6.9	17.2	6.9	3.6	11.0	21.5	20.8	+ .7
SH	1.3	7.0	3.5	--	11.8	11.1	8.0	6.0	7.8	21.8	28.0	- 6.2
WO	1.3	--	1.3	4.4	7.0	22.9	6.9	3.6	20.8	31.3	25.9	+ 5.4
MH	.4	2.6	9.6	--	12.6	15.7	9.6	6.4	16.4	32.4	31.8	+ .6
RH	5.2	.9	--	--	6.1	5.5	5.9	3.1	.9	9.9	21.9	-12.0
DE	1.7	--	--	--	1.7	5.1	1.6	.9	.2	2.7	22.8	-20.1
BH	.9	2.2	2.6	--	5.7	12.4	6.4	2.9	5.0	14.3	13.6	+ .7
BC	1.7	--	--	--	1.7	4.8	1.1	.9	.2	2.2	.9	+ 1.3
SO	--	--	--	--	--	--	--	--	--	--	--	--
Others	8.8	4.4	2.2	--	15.4	9.4	10.0	7.6	6.4	24.0	33.2	- 9.2
	115.0	48.0	28.4	5.2	196.6	--	100.0	100.0	100.0	300.0	300.0	