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SUGAR MAPLE, A MANAGEMENT PROBLEM IN ILLINOIS FORESTS?

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ABSTRACT

Based on the General Land Office Survey notes that were completed in the 1820's in central Illinois, sugar maple was a minor forest component. Present surveys, however, indicate that some of these forests are changing from a prevailing oak-hickory cover type to one in which sugar maple is the dominant species. The large number of seedling, saplings, and small diameter trees of this species indicates that it is an extremely aggressive taxon that will continue to increase in importance.

INTRODUCTION

Present indications are that sugar maple (*Acer saccharum* Marsh.) is increasing in importance in many Illinois forests. If this trend continues, many of the oak-hickory forests and the wildlife that depends upon them will be in serious trouble in the near future. This problem has become an increasing concern to some natural area ecologists and managers. It appears, that in many areas, even the best quality oak-hickory communities are undergoing an apparent irreversible change as sugar maple, and other shade tolerant species, replace many of the original forest components. Though this change seems fairly obvious, few detailed studies have been undertaken. Also, almost no work has been done concerning the possible methods that can be used to reverse this trend.

METHODS

The presettlement vegetation of Kane, Lake, Coles and Douglas Counties was determined. For Kane and Lake Counties the information was taken from the studies of Kilburn (1959) and Moran (1976), while for Coles and Douglas Counties the vegetation was reconstructed using the General Land Office Survey notes. From this data it is possible to determine the importance of sugar maple, as well as all other tree species, at or near the time of pioneer settlement. This information was then

compared with that obtained from recent vegetation surveys of a number of forest areas in east-central Illinois.

RESULTS AND DISCUSSION

Presettlement forest vegetation: A large amount of vegetation information can be obtained from the General Land Office Survey notes (Bourdo, 1956). The job of the surveyors was to establish a grid system of township, range, and section lines by the placement of section and quarter section corner posts. In prairie and marsh areas only posts were used, while in timbered areas two (or four) witness trees were blazed and the distance and direction of these trees from the corner posts, the species, and dbh recorded. Since the placement of the corner posts, and the selection of witness trees is essentially random, it is possible, by using the random-pairs method or the quarter method to calculate the density and importance value of sugar maple, as well as all other recorded species, in the pre-settlement forest (Phillips, 1959).

In Lake County, Illinois Morain (1976) reported that only nine sugar maples were listed as witness trees out of the 2340 recorded by the surveyors. In general, savanna, which was dominated by bur oak, accounted for most of the timbered area in Lake County. However, sugar maple-basswood forests did occur on the east side of the Des Plaines River on glacial valley trains or alluvial deposits, but did not extend up onto the moraines. In Kane County the situation was similar. Kilburn (1959) reported that the density of sugar maple was extremely low with only 59 individuals being recorded out of the total of 2103 witness trees. Overall, sugar maples had an importance value of 5.1 (out of a possible 200). In the bur oak cover type, which includes most of the forested part of the county, sugar maple was rarely encountered. However, in an area referred to as "Big Woods", which covers several thousand acres with heterogeneous topography and drainage located just east of Aurora, Illinois, a more mesophytic sugar maple-white oak cover type existed. Here sugar maple made up 22.2% of the stand.

Recently the author has examined the General Land Office Survey notes for Coles and Douglas Counties. In Douglas County only seven sugar maples, out of a total of 377 witness trees, were recorded, giving sugar maple an importance value of 3.7 (out of a possible 200). In Coles County sixteen sugar maples were recorded among the 1252 witness trees for an importance value of 2.3. In both counties the sugar maples were listed for corners located in rough topography, usually associated with streams or rivers, and not on the flat uplands.

Present forest vegetation: In Table 1 the occurence of sugar maple is recorded for some of the forests of east-central Illinois that have been surveyed by the author and his students during the past twenty years. In this table the number of sugar maple seedlings, saplings, and trees by broad diameter classes are listed for each study area, as well as its relative values, importance value, and importance value ranking.

In a few of these areas sugar maple is not an important stand component. At Walnut Point State Park (Ebinger, et al, 1977) this species is rarely encountered. Also, at Burgner Acres (Blackmore and Ebinger, 1967) it is not common. During a later survey, however, it showed a slight increase in importance and this trend will probably continue (Lehnen and Ebinger, 1984).

In the other areas listed in Table 1, sugar maple is a relatively important stand component, ranking in importance value from first to ninth. In these areas it is well represented in the seedling and sapling categories as well as in the smaller diameter classes. In most of these forests it ranks first or second in seedlings and saplings per acre.

Probably the best example of the increasing importance of sugar maple is at Baber Woods, Edgar county, Illinois. McClain and Ebinger (1968) reported that sugar maple ranked second in importance, ranked first in relative density, and dominated the seedling, sapling, 4-6 and 7-12 inch diameter classes. In a more recent survey of the same area (Newman and Ebinger, 1985), this trend was continued with sugar maple increasing to first in importance value, and almost doubling in the number of trees per acre. Also, it continues to dominate the seedling and sapling categories, and now accounts for nearly half of the individuals in both the 4-6 and 7-12 inch diameter classes. In this woods maple and oak represent two distinct age classes. This is emphasized in Figure 1 where smoothed curves of basal area by diameter class are shown for sugar maple, all oak species combined, and all species combined. The biomodal characters of these curves show that the oaks predominate the higher diameter classes, and suggests that these species have been an important forest component for an extended period of time. Sugar maple, in contrast, predominates the lower diameter classes, and has probably been increasing steadily during the past century. The large number of seedlings and saplings of this species suggests a continuation of this trend.

Other forests studied in central Illinois also indicates a trend in the importance of sugar maple. Two "prairie grove forests" in Champaign County have been surveyed at various times in the past, and in both, sugar maple is an important component. In Trelease Woods (Boggess, 1964; Pelz and Rolfe, 1977), sugar maple dominates the seedling and sapling categories as well as most of the diameter classes. This species also has the highest relative values and importance value of all species in the woods. Similar results were obtained for Brownfield Wods by Boggess and Bailey (1964) and Miceli, Rolfe, Pelz, and Edgington (1977).

An inventory of the woody vegetation of Funk Forest Natural Area was conducted by Boggess and Geis (1966). This forest is an example of a mesophytic forest that is transitional between the upland oak-hickory cover type and the "prairie grove forest". Presently sugar maple is the dominant species (IV of 57.9) followed closely by white oak and elm. According to Boggess and Geis (1966) sugar maple and white oak represent two distinct age classes when basal area is plotted against diameter. The results show that white oak, which predominates in the thirty inch diameter class, is a "pioneer" species; and that sugar maple, which predominates in the sixteen inch diameter class, has perhaps been increasing steadily in importance during the past century.

Present forest surveys, when compared with presettlement vegetation, indicate that most of the forest in central Illinois are changing from a prevailing oak-hickory-dominated cover type to one in which sugar maple is the most important constituent. The large number of seedlings and saplings of this species, as well as its importance in the smaller diameter classes, indicates that it is an extremely aggressive taxon that will probably continue to increase in importance. Also, its high gap-phase-replacement-potential will enable it to take advantage of canopy openings that occur when the veteran trees die.

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Table 1. Seedlings, saplings, and trees (by diameter classes) per acre, relative values, importance values, and importance value ranking for sugar maple in some east-central Illinois forests. The number in parenthesis is the percent of the total stand for that category represented by sugar maple.

Forest	Seedlings <1" dbh	Saplings 1-4" dbh	Number of trees per acre by diameter class 4"-6"	7"-12"	13" +	Rel. Dom.	Rel. Den.	I.V.	I.V. Rank
Walnut Point State Park — Douglas Co., IL (Ebinger, et al, 1977)	20 (.1)	22 (4.6)	.2 (.5)	—	—	.1	.2	.3	20
Burgner Acres — Coles Co., IL (Blackmore & Ebinger, 1967)	285 (2.5)	16 (2.1)	.7 (.8)	—	—	.5	.5	1.0	22
Burgner Acres — Coles Co., IL (Lehnen & Ebinger, 1984)	153 (5.8)	33 (6.8)	1.2 (1.2)	.4 (.7)	—	.4	.9	1.3	22
Sargent Woods — Coles Co., IL (Ebinger, 1968)	443 (2.2)	142 (27.2)	6.3 (10.3)	2.2 (4.7)	.5 (1.7)	2.8	6.5	9.3	9
Rocky Branch — Clark Co., IL (Ebinger & Parker, 1969)	4453 (30.9)	131 (31.6)	6.1 (11.9)	3.2 (6.7)	1.6 (4.2)	5.0	7.9	12.9	5
Dry-mesic Upland Forest — Cumberland Co., IL (Ebinger & Newman, 1984)	1446 (10.7)	183 (19.6)	4.0 (19.3)	1.5 (5.1)	1.1 (2.3)	3.0	6.8	9.8	5
Coppice Forest — Coles Co., IL (Ebinger, 1973)	6127 (29.7)	150 (29.5)	5.8 (4.2)	4.4 (5.6)	2.6 (23.4)	9.8	5.6	15.4	3
Baber Woods — Edgar Co., IL (McClain & Ebinger, 1968)	5369 (25.1)	143 (41.8)	13.2 (36.1)	10.8 (35.5)	2.9 (7.3)	10.6	25.1	35.7	2
Baber Woods — Edgar Co., IL (Newman & Ebinger, 1985)	2421 (25.2)	294 (70.7)	20.5 (46.9)	14.5 (49.0)	5.5 (13.9)	15.8	36.1	51.9	1

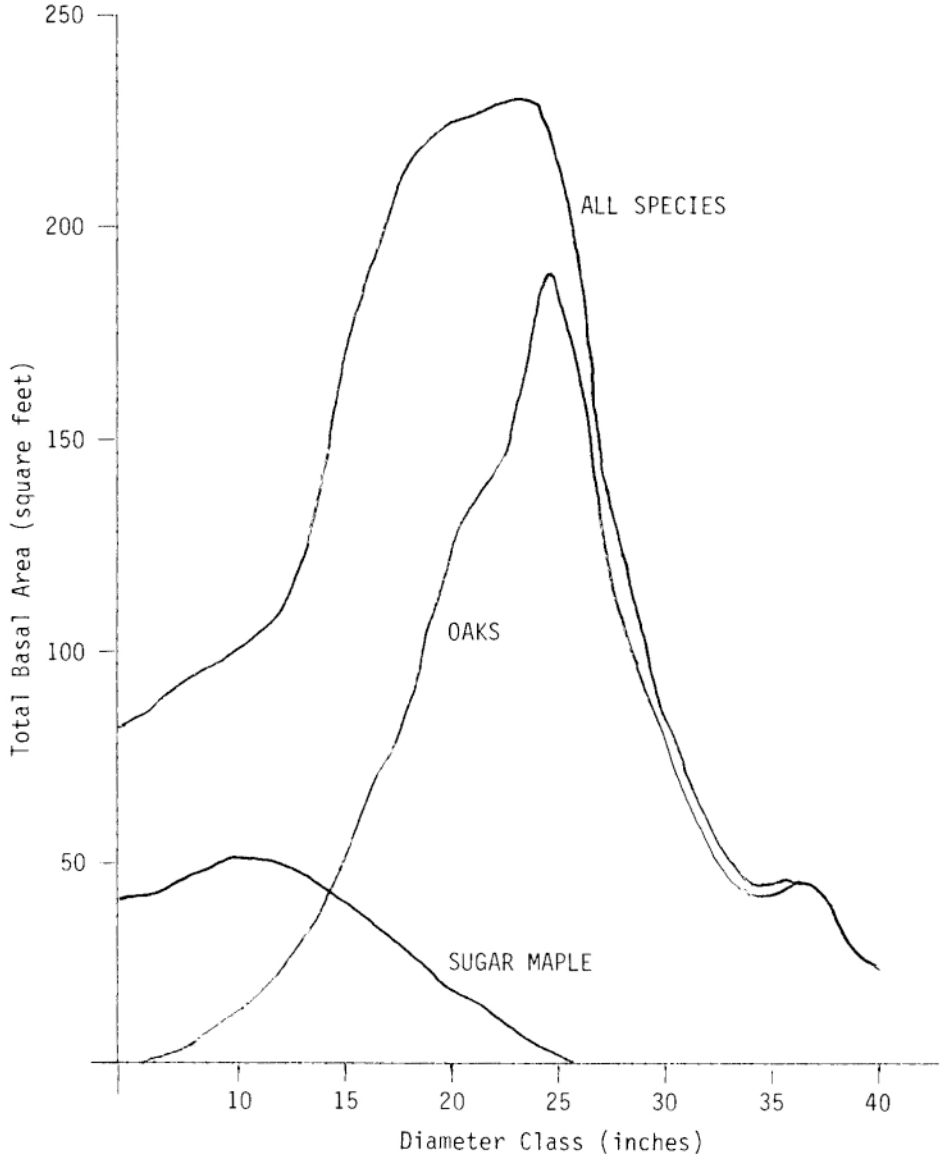

Fig. 1 Smooth curves of basal area by diameter class for sugar maple, all oak species combined, and all species combined at Baber Woods, Edgar County, Illinois.