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A Woody Understory Survey of Baber Woods, Edgar County, Illinois

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A WOODY UNDERSTORY SURVEY OF

BABER WOODS, EDGAR COUNTY, ILLINOIS

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ABSTRACT

The understory of Baber Woods, located in Edgar County, Illinois, was surveyed to see if sugar maple had increased enough in importance to consider implementing some type of forest management technique. Five 100 meter transects were randomly located in closed canopy areas throughout the woods. Specimens were removed from continuous 1 meter quadrats located along each line. Specimens were also removed from twenty 25 meter transects located in the open canopy areas. Species, age, height, diameter, and quadrat number were recorded for each specimen. The data was analyzed for age-height and age-diameter relationships, plus individuals per hectare, density, frequency, relative density, relative frequency, and importance value.

ACKNOWLEDGEMENTS

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INTRODUCTION

Baber Woods is a Shelbyville Moraine forest remnant located in Edgar County, Illinois. The woods consists of 51 acres located five miles NE of Westfield and five miles SE of Kansas in East-Central Illinois (E 1/2, NW 1/4, NW 1/4 and the NE 1/4, NW 1/4 of Section 18, T12N, R13W). This woodlot was purchased by the Baber family in 1894 as a source of fence rails, lumber and firewood. None of the woods was entirely cleared of trees except for a 3 acre lot in the southwest corner of the timber to provide space for two cabins. At one time, several roads and trails passed through the woods, and evidence of these well travelled roads can still be seen in some parts of the woods. This natural area has a gently rolling topography ranging from 755 - 800 feet above sea level, is well drained except for several small depressions, and contains three small streams which are dry except immediately after a moderate rain.

It was recently determined that sugar maple was increasing in importance from the time of the first study (McClain and Ebinger, 1968), where its importance value (IV) was determined to be 35.7, until the most recent study done by Newman and Ebinger (1985), where the IV of sugar maple had risen to 51.9. This finding supports the results presented by Ebinger (1986), in which sugar maple has been found to be replacing oak and hickory as the dominant forest species in this area.

Another study done by Runkle (1984) examines a different aspect of the *Acer saccharum* Marsh. problem. It seems that this aggressive species is a very significant part of treefall gaps. A gap is an area beneath an opening in the canopy created by the death of a large branch or of one or more trees. He found that *Acer saccharum* is abundant as smaller saplings and so is present in most gaps at the time of their formation. It grows fairly rapidly, even in fairly small gaps, due to its ability to grow and form good root systems at low light levels (Logan, 1965).

The present study was undertaken to determine if sugar maple had increased enough to justify use of some type of forest management technique. After completion of this study, an area of approximately 10 acres will be burned. Another study will be done in the future to determine the effects of the burn on woody understory species.

METHODS AND MATERIALS

Nine - 100 meter transects were randomly located under the closed canopy throughout most of the woods, and twenty - 25 meter transects were located where gaps had occurred in the canopy due to fallen trees or branches. Along each transect, continuous one square meter quadrats were set up on the left side of the transect. All woody plants with a diameter of less than 10 centimeters and a height of more than 40 centimeters were removed. A basal cross section was removed from each specimen and affixed with a label containing the specimen number. The species name, height, and quadrat location were recorded for each specimen. Diameter and ring number were later recorded for each specimen. For closed canopy areas, open canopy areas, and a combination of the two, the following calculations were made for each species:

Density (individuals per hectare) =

$$\frac{\text{total number of individuals of a species}}{\text{total number of plots}} \times 10{,}000$$

Relative Density =

$$\frac{\text{total number of individuals of a species}}{\text{total number of individuals of all species}} \times 100$$

Frequency =

$$\frac{\text{number of plots of occurrence of a species}}{\text{total number of plots}} \times 100$$

Relative Frequency =

$$\frac{\text{total plots of occurrence of a species}}{\text{total plots of occurrence of all species}} \times 100$$

Importance Value =

Relative Density + Relative Frequency

These calculations were done for the dominant species per area as well as for each individual area studied. Nomenclature follows that of Jones (1963).

McClain and Ebinger (1968), determined that three distinct vegetation zones are present in Baber Woods, an oak-maple zone, a disturbed zone, and an oak-hickory zone (Figure 1). The northwest corner and middle west edge of the woods are dominated by an oak-maple overstory. Transects A and B are located in this zone. After surveying the woodlot, it was determined that a larger sample size was needed so quadrats were run on the right side of these transects as well as on the left side. The second vegetational area (disturbed zone) is located in the southwest corner of the woodlot. No samples were collected in this area. The third area is dominated by oak and hickory in the overstory. In this area, three transects C, E, and F were randomly located and quadrats were set up on both the left and right sides of transect E and transect F. Quadrats were only set up on one side of transect C.

Open canopy areas were randomly located, and transects were set up in both the maple-hickory zone and the oak-hickory zone of the woods. These transects were determined on a sunny day and samples were taken later, but in the same manner as in the closed canopy area.

RESULTS AND DISCUSSION

In this understory survey, nine different tree species were recorded. Three species, *Acer saccharum*, *Ulmus rubra* Muhl., and *Asimina triloba* (L.) Dunal, were found to have high enough numbers to constitute individual analysis per species. The other six species are identified hereafter as "other" since they do not constitute a significant part of the understory. These species are *Carya cordiformis* (Wang.) K. Koch, *Carpinus caroliniana* Walt., *Corylus americana* Walt., *Morus rubra* L., *Prunus serotina* Ehrh., and *Fraxinus americana* L.

Ulmus rubra has the highest importance value in the closed canopy area at 97.8 (Table 1), but drops slightly in importance in the open canopy area to 94.0 (Table 2). *Acer saccharum*, on the other hand, has a lower importance value in the closed canopy area, 55.9, but greatly increases in importance, 94.6, in the open canopy area. *Asimina triloba* has been found to grow very well in the closed canopy conditions, with an IV of 35.2, as compared to a decline in the open canopy area to an IV of 3.8. The "other" species analyzed in the closed canopy area are of no great significance with an IV of 11.1. The importance of the "other" species drops to 7.6 in the open canopy area. In the data analysis done on both areas combined, *Ulmus rubra* was found to be a major component of the woodlot, and *Acer saccharum* was increasing in importance (Table 3).

In past studies, it was found that _Acer saccharum_ has increased in importance, from 35.7 (McClain and Ebinger, 1968), to 51.9 (Newman and Ebinger, 1985), to the most recent IV of 67.0, determined in this study. From this data, it has been decided that some type of forest management practices must be put into effect as soon as possible to prevent the complete takeover by _Acer saccharum_.

In addition to the calculation of the IV for the tree species present, an age-height comparison and an age-diameter comparison were completed for only the dominant species per area, as well as for the total number of species present. For each area studied, the average height for the woody understory component (in centimeters) was compared to the number of rings (age) for all species present. The average height of all removed specimens was determined for all areas studied, and the open canopy trees were found to be consistently taller than their closed canopy counterparts of the same age (Figure 2). Sugar maple, when analyzed separately, shows a great variation in height (Figure 3), and, theoretically, the greatest growth occurred after a gap opened in the canopy. This hypothesis is based on the measurement of ring width of sugar maple specimens taken from the same gap, which showed an increase in ring width at approximately the same time in all specimens (Table 4). Sugar maple was determined to be a very aggressive species in treefall gap situations. Therefore, sugar maple is said to have a high gap-phase-replacement-potential as compared to the other species present. Slippery elm has a low gap-phase-replacement-potential because it is easily crowded out by the more aggressive sugar maple. It can be noted, however, that the slippery elm had a very consistent pattern of growth (Figure 4). The diameter data, when compared to the age of the specimens, proved to be increasing in the overall analysis (Figure 5), but was inconclusive as far as an average diameter for sugar maple (Figure 6). There was a general increase in the slippery elm diameter, but the increase was very slight (Figure 7).

CONCLUSION

Baber Woods is, at this time, an oak-hickory dominated forest. The fact that sugar maple has become a very important element in the understory is of concern to some naturalists. Since the objective of this nature preserve is to preserve the vegetation of presettlement times, the domination of sugar maple is of vital importance. Since sugar maple is such an aggressive species, the oak-hickory species of presettlement times are being slowly forced out. From the findings of this, and previous other studies, it has been determined that sugar maple is replacing oak as the dominant overstory species. If this is allowed to continue, Baber Woods has the potential of becoming a sugar maple forest within forty to fifty years. Slippery elm, which has potential canopy status and is certainly dominant in the understory, is prevented from realizing the full height potential due to Dutch-Elm disease. Sugar maple has been proven to dominate treefall gap situations. Management practices, such as fire, may be the only way to keep the oak-hickory dominated forest as it has been for many years.

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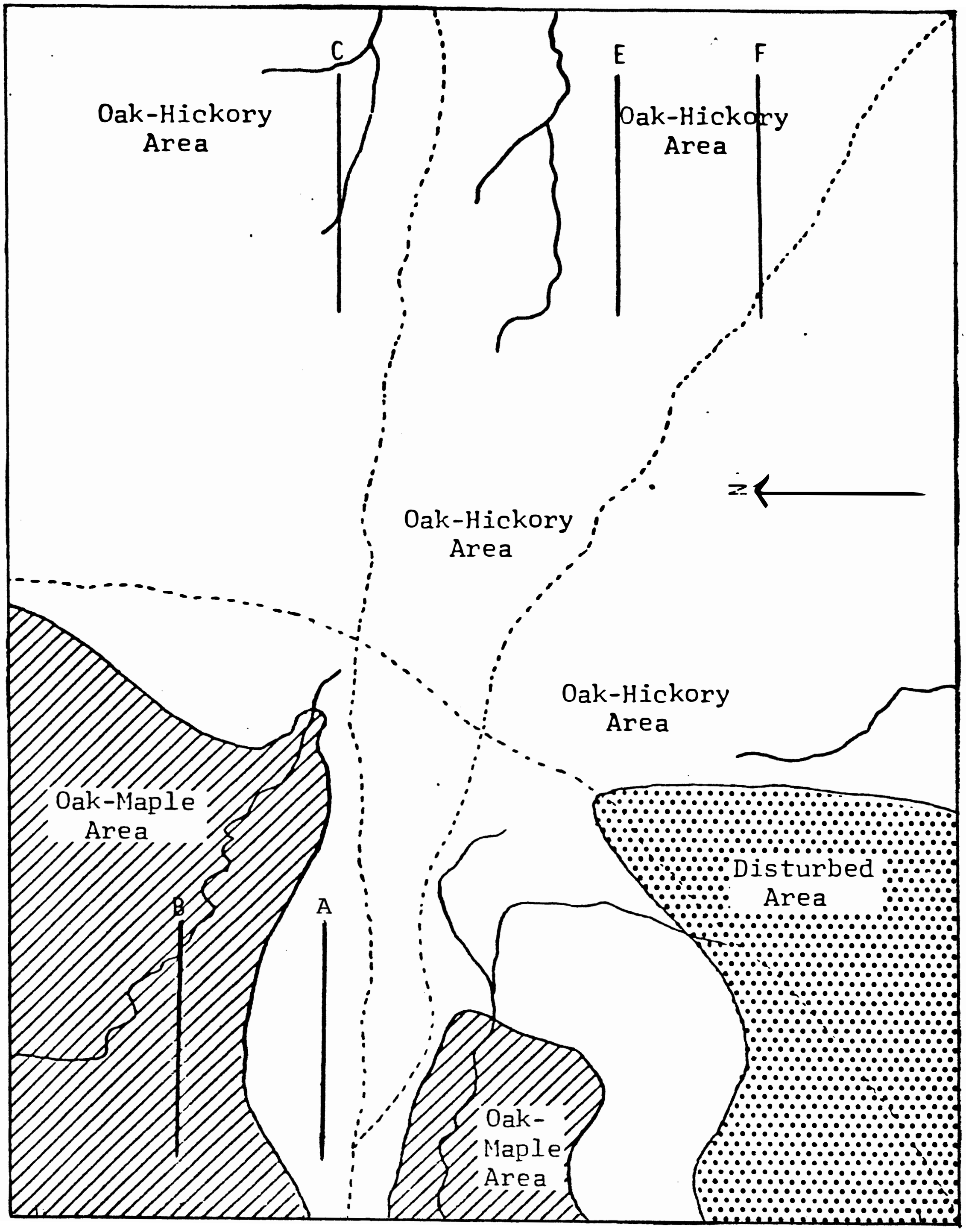

Figure 1. Map of Baber Woods, Edgar County, Illinois, showing intermittent streams, old roads, predominant overstory vegetation, and the five 100m transects (A, B, C, E, and F).

TABLE 1. DATA FOR CLOSED CANOPY AREAS, BABER WOODS, EDGAR COUNTY, IL.

Species	Individuals per hectare	Frequency	Relative Density	Relative Frequency	Importance Value
Acer saccharum	2622	21.7	23.2	32.7	55.9
Ulmus rubra	5856	30.6	51.9	45.9	97.8
Asimina triloba	2311	9.7	20.5	14.7	35.2
Other species	500	---	4.4	6.7	11.1
TOTALS	11,289	---	100.0	100.0	200.0

TABLE 2. DATA FOR OPEN CANOPY AREAS, BABER WOODS, EDGAR COUNTY, IL

Species	Individuals per hectare	Frequency	Relative Density	Relative Frequency	Importance Value
Acer saccharum	3280	27.4	45.1	49.5	94.6
Ulmus rubra	3620	24.6	49.7	44.3	94.0
Asimina triloba	120	1.2	1.6	2.2	3.8
Other species	260	---	3.6	4.0	7.6
TOTALS	7280	---	100.0	100.0	200.0

TABLE 3. DATA FOR ALL AREAS COMBINED, BABER WOODS, EDGAR COUNTY, IL

Species	Individuals per hectare	Frequency	Relative Density	Relative Frequency	Importance Value
Acer saccharum	2857	23.8	29.0	38.0	67.0
Ulmus rubra	5057	28.4	51.3	45.4	96.7
Asimina triloba	1529	6.7	15.5	10.7	26.2
Other species	414	---	4.2	5.9	10.1
TOTALS	9857	---	100.0	100.0	200.0

FIGURE 2

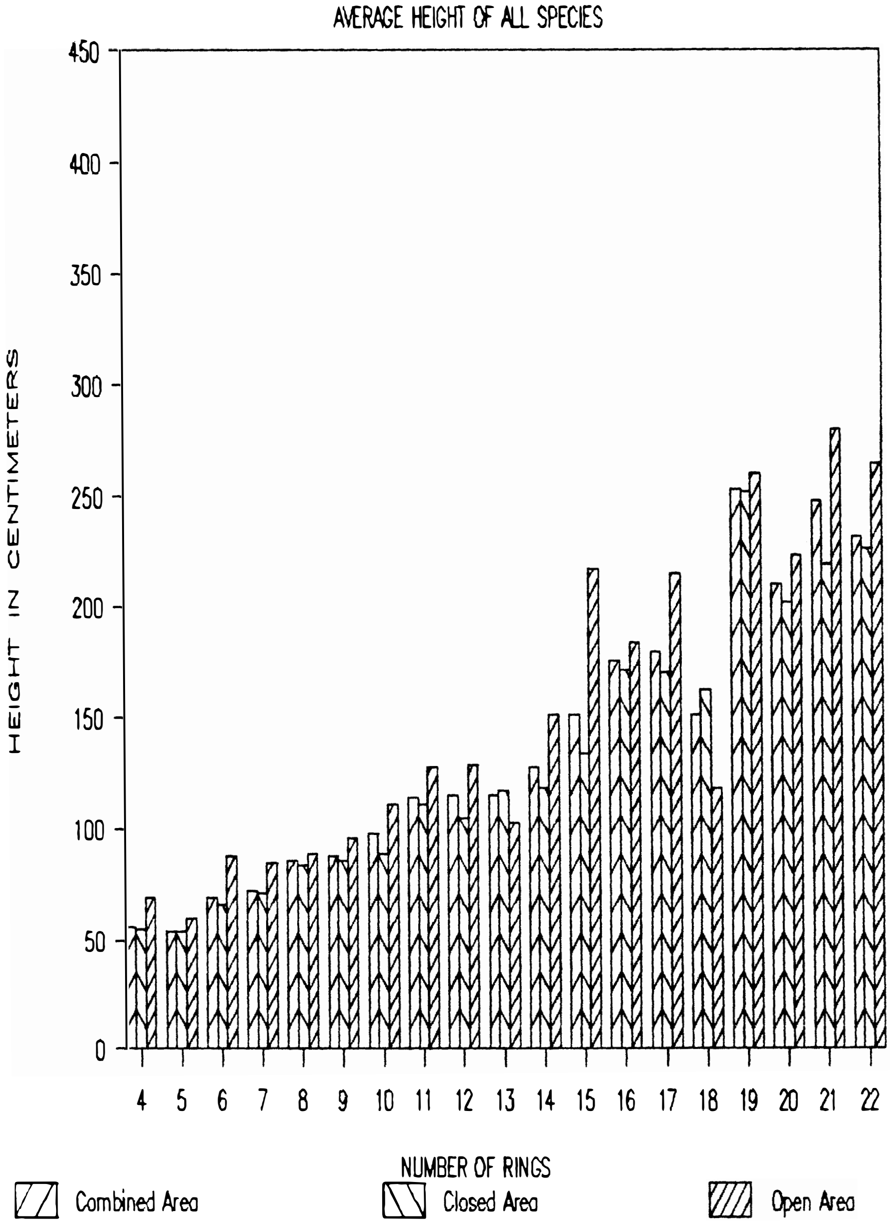
AVERAGE HEIGHT OF ALL SPECIES
HEIGHT IN CENTIMETERS
450
400
350
300
250
200
150
100
50
0
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
NUMBER OF RINGS
Combined Area
Closed Area
Open Area

FIGURE 3

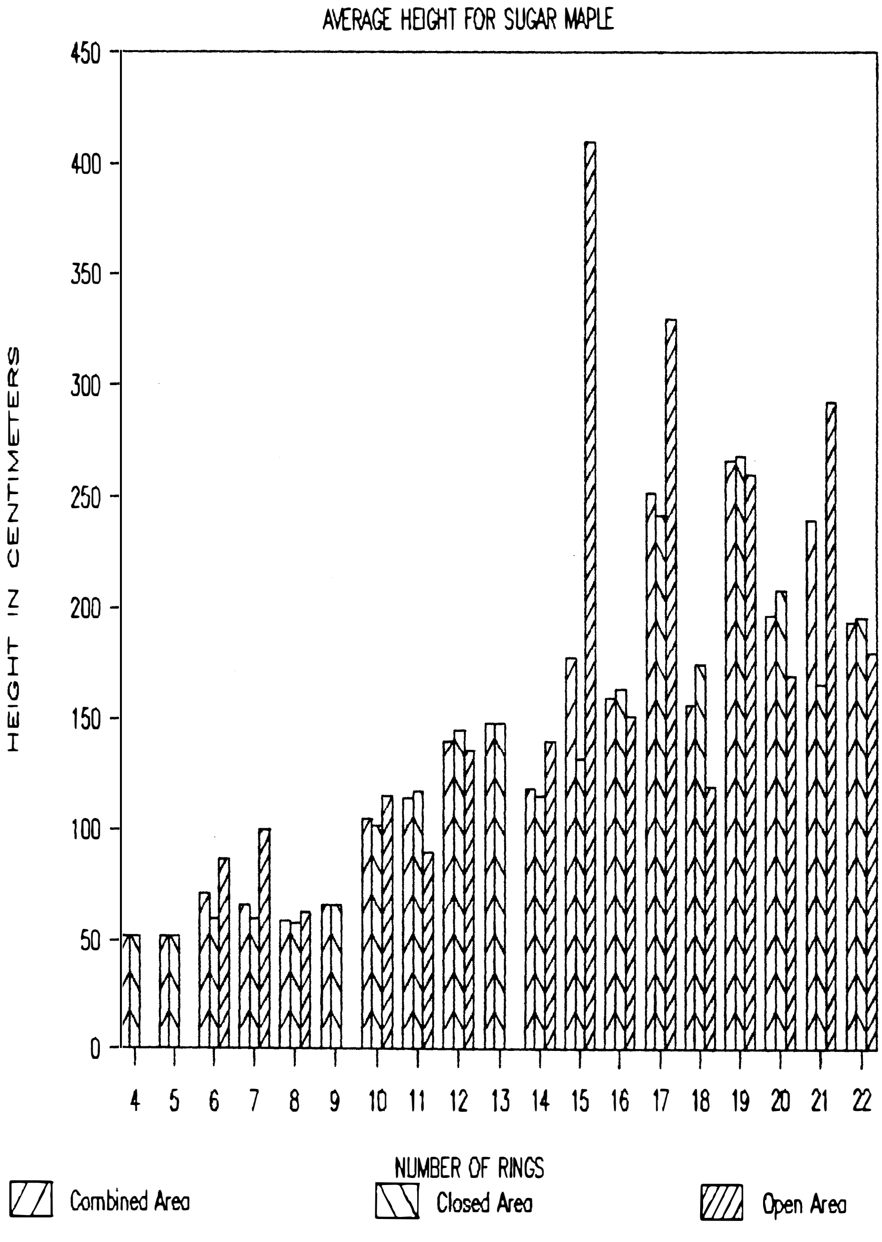
AVERAGE HEIGHT FOR SUGAR MAPLE
HEIGHT IN CENTIMETERS
0
50
100
150
200
250
300
350
400
450
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
NUMBER OF RINGS
Combined Area
Closed Area
Open Area

FIGURE 4

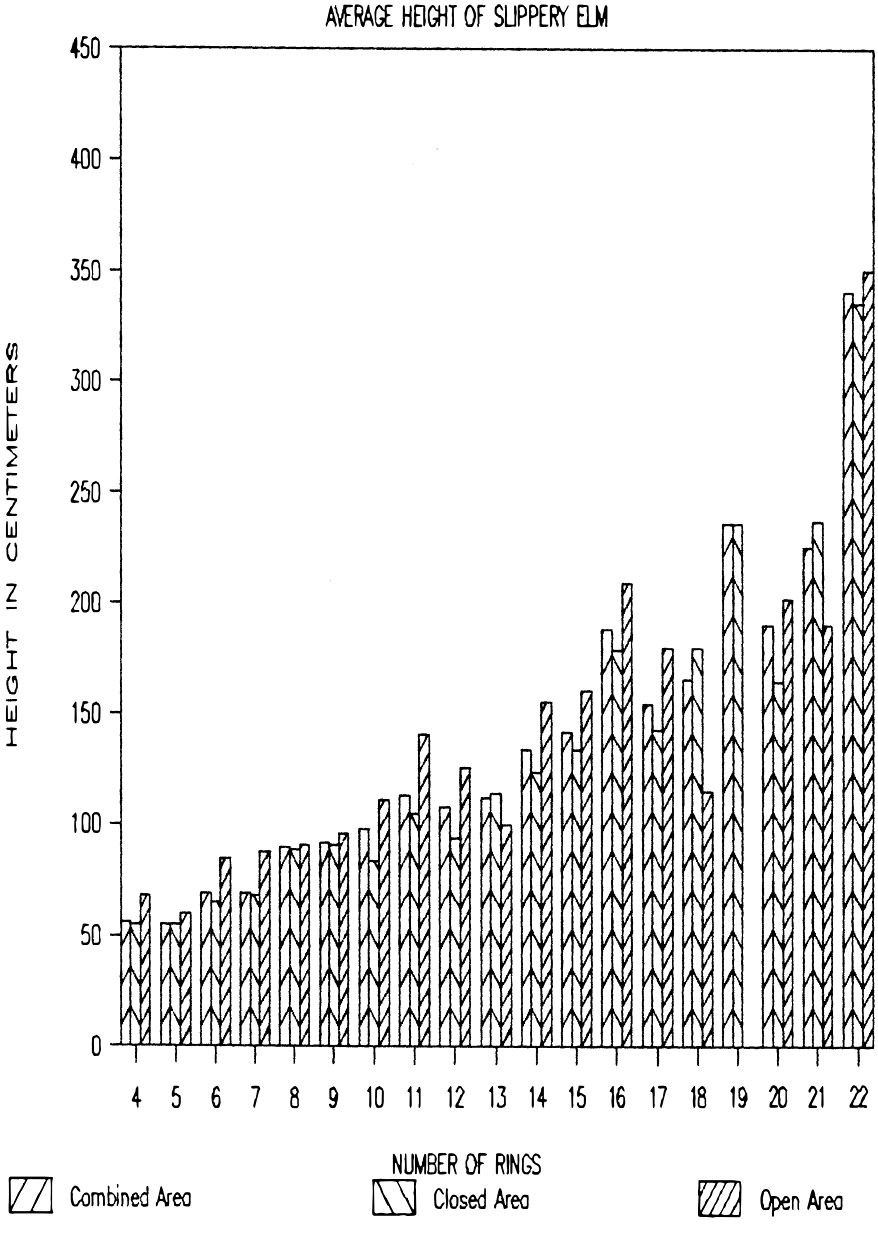
AVERAGE HEIGHT OF SLIPPERY ELM
HEIGHT IN CENTIMETERS
0
50
100
150
200
250
300
350
400
450
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
NUMBER OF RINGS
Combined Area
Closed Area
Open Area

TABLE 4. YEARS SINCE GAP OCCURRENCE IN OPEN CANOPY AREAS OF BABER WOODS

TRANSECT NUMBER	YEARS SINCE GAP OCCURRED	TRANSECT NUMBER	YEARS SINCE GAP OCCURRED
1	17	11	11
2	20	12	20
3	13	13	29
4	21	14	23
5	10	15	30
6	23	16	19
7	19	17	16
8	20	18	21
9	10	19	19
10	13	20	15

FIGURE 5

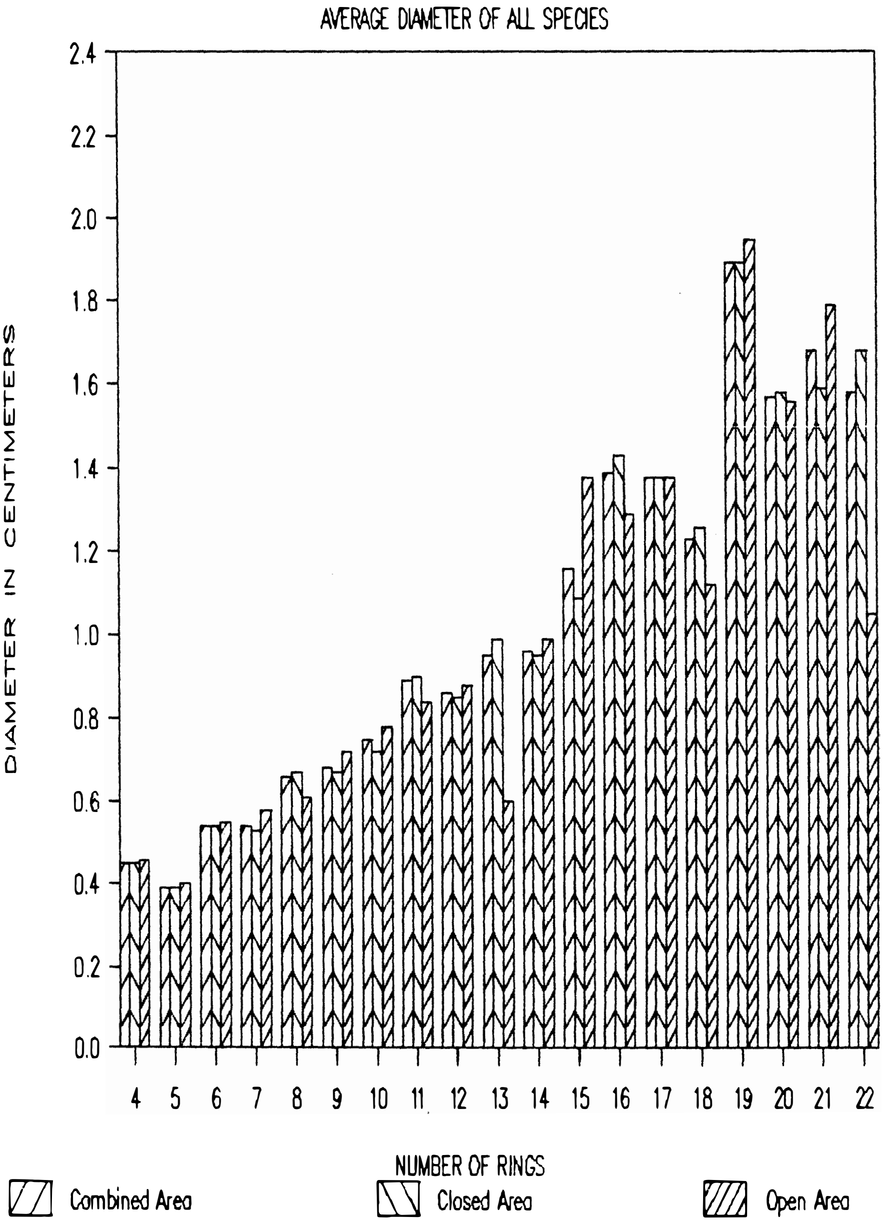
AVERAGE DIAMETER OF ALL SPECIES
DIAMETER IN CENTIMETERS
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
NUMBER OF RINGS
Combined Area
Closed Area
Open Area

FIGURE 6

AVERAGE DIAMETER FOR SUGAR MAPLE