DISTRIBUTION OF THE WHITE OAK BORER *GOES TIGRINUS* DEGEER (COLEOPTERA: CERAMBYCIDAE) IN A MIXED OAK STAND

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ABSTRACT

The white oak borer *Goes tigrinus* DeGeer is a common pest of white oak *Quercus alba* L. timber quality throughout the natural range of this oak.

Information is presented on the spatial distribution of the white oak borer in a 3.4-acre mixed stand over a 5-year period. Insect location is related to tree size, vigor, and history of pest attack. Changes in insect location are related to changes in tree size, tree mortality, and facets of pest behavior.

INTRODUCTION

The white oak borer *Goes tigrinus* DeGeer is a pest of white oak, *Quercus alba* L., throughout the natural range of this important commercial species. The borer has also been found attacking white oak growing in ornamental nurseries and in urban situations where the tree is highly valued for its aura of strength and beauty. The pest is a long-horned beetle which has a 3- to 4-year life cycle. All of the insects' life, except about 1 month in the adult stage, is spent inside the host tree.

Timber producers are most concerned about this pests' larval-stage activity; the worms cause "pinholes", "bark pockets", and "grub holes", all of which reduce the value of factory grade lumber and often leave the wood unfit for tight cooperage and prime veneer. Tunnels made by the pest act as entry courts for decay organisms that increase the dimensions of each defect. The stain often associated with tunnels produces an extensive defect called "pore streak", which may extend up and down the tree for several feet in one annual ring.

Woodpeckers seek out the larvae for food and in attempting to capture them, produce conical defects larger than the grub tunnel, which serve as entry points for decay and secondary insects.

Insects that gain access to white oak xylem through white oak borer tunnels are the oak timberworm *Arrhenodes minutus* Drury, carpenterworms *Prionoxystus robiniae* (Peck) *P. macmurtrei* (Guer.) and carpenter ants like *Componotus pennsylvanicus* DeGeer.

To reduce losses from the white oak borer we must be able to locate the pest in all stages in natural forest stands. The information in this report will serve as a beginning.

MATERIALS AND METHODS

The study was carried out on a 3.4-acre area of mixed oak forest 45 to 50 years old on the Athens Ranger District of the Wayne National Forest, Athens and Hockings counties, Ohio. Silvicultural treatments in the area consisted of girdling wolf trees some 5 years before our study began. An irregular shaped plot (Fig. 1) was established by creating a 100-foot wide buffer strip from which all white oaks were either removed or killed by girdling 1 year before we began estimating the insect population. All white oaks 12 inches dbh and larger within the study area were killed and left standing. The perimeter was laid out with a transit and the plot subdivided into areas 10 x 50 feet. Each red, black, scarlet, and white oak was located to the nearest foot on a grid and assigned a set of coordinates.

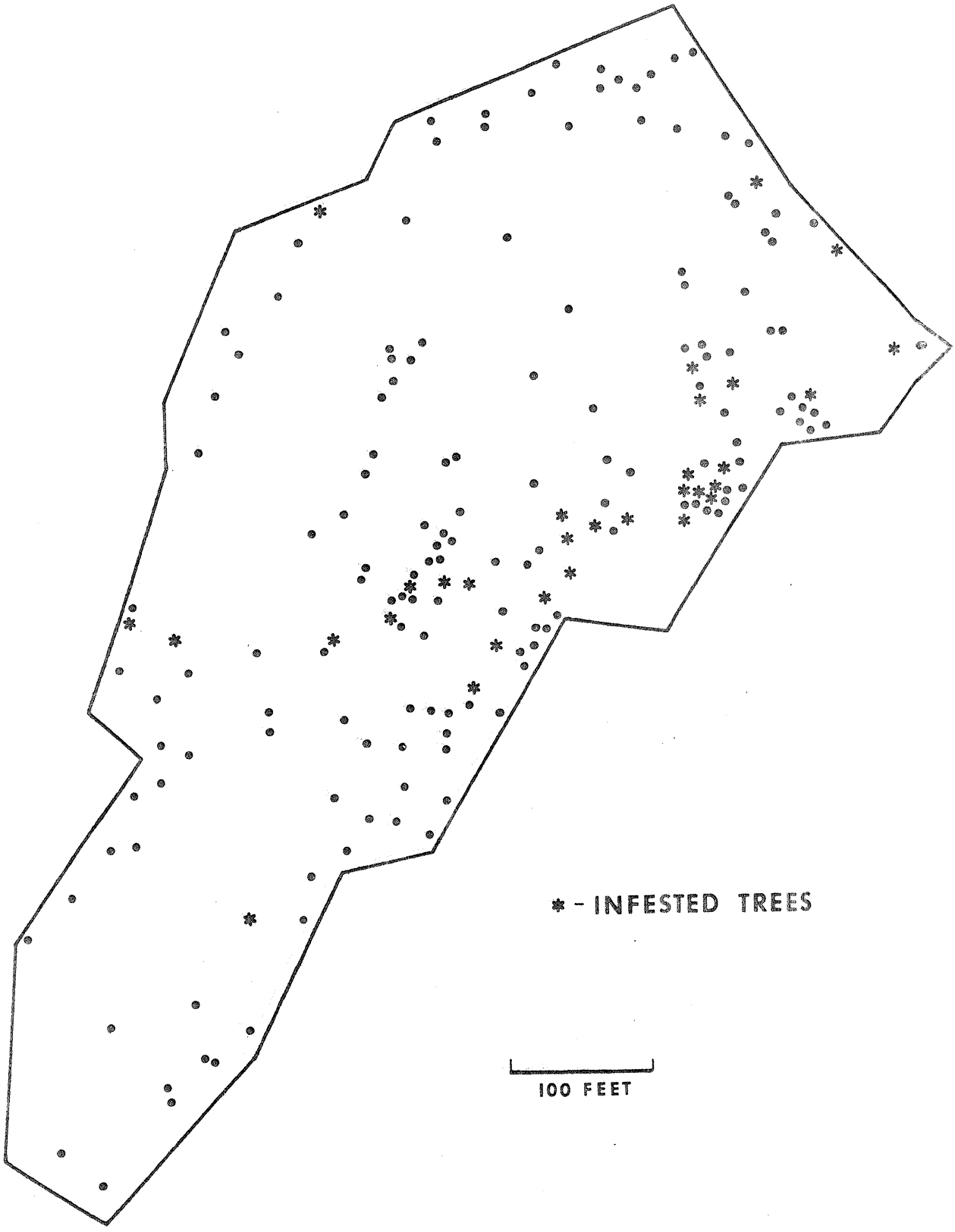
The stump circumference, dbh, and height to a 4-inch top diameter, outside the bark, were recorded in the fall of 1972. Mortality of trees less than 12 inches in dbh was recorded during insect population surveys and surviving trees remeasured in the fall of 1977. Throughout the 5-year period, trees in each size class were cut and ring counts used to determine age.

The bole surface to a 4-inch top of every white oak was examined three times a year (roughly spring, summer, and fall) for borer attacks. An attempt to locate all *G. tigrinus* exits for the years 1970 through 1972 was made during the winter of 1972-73.

When an ongoing attack was first located, its height to the nearest foot, and facing direction, $\pm$ 5°, were recorded. The attack site was marked with a series of color-coded map tacks. The larval sites were reexamined until either the larva died or an adult emerged. If an attack site contained an inactive larva through four consecutive examinations, the larva was considered dead. Ladders were used to examine the second and third log portions of the trees, care being taken to prevent damage to the bark.

The five largest white oaks were felled, sectioned into 1-foot long pieces, and peeled in December of 1977. We used these sections to evaluate our accuracy in finding and recording white oak borer attacks in the standing trees.

Figure 1. WHITE OAK BORER STUDY AREA



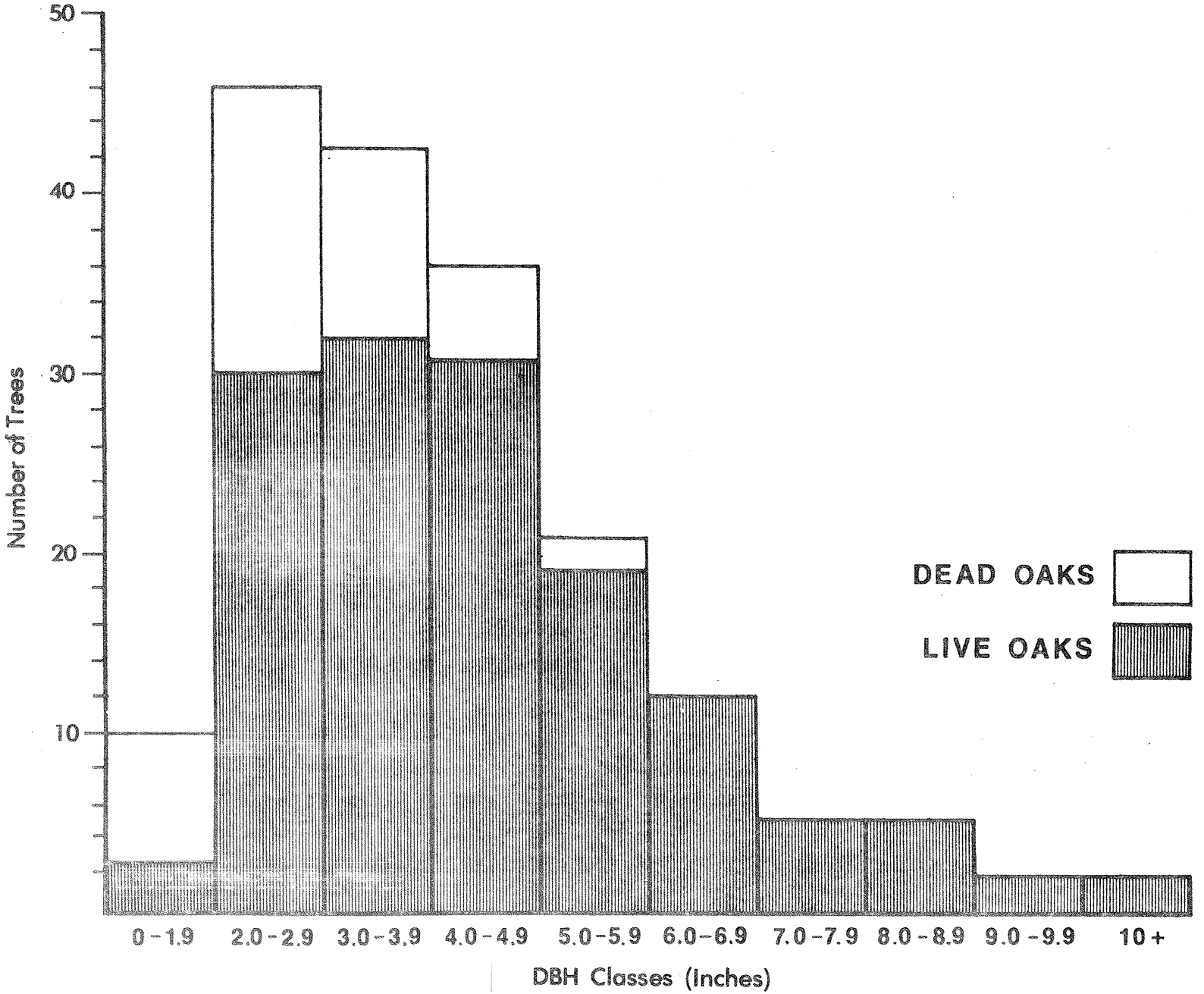


Figure 2. Frequency Distribution of Live and Dead White Oaks

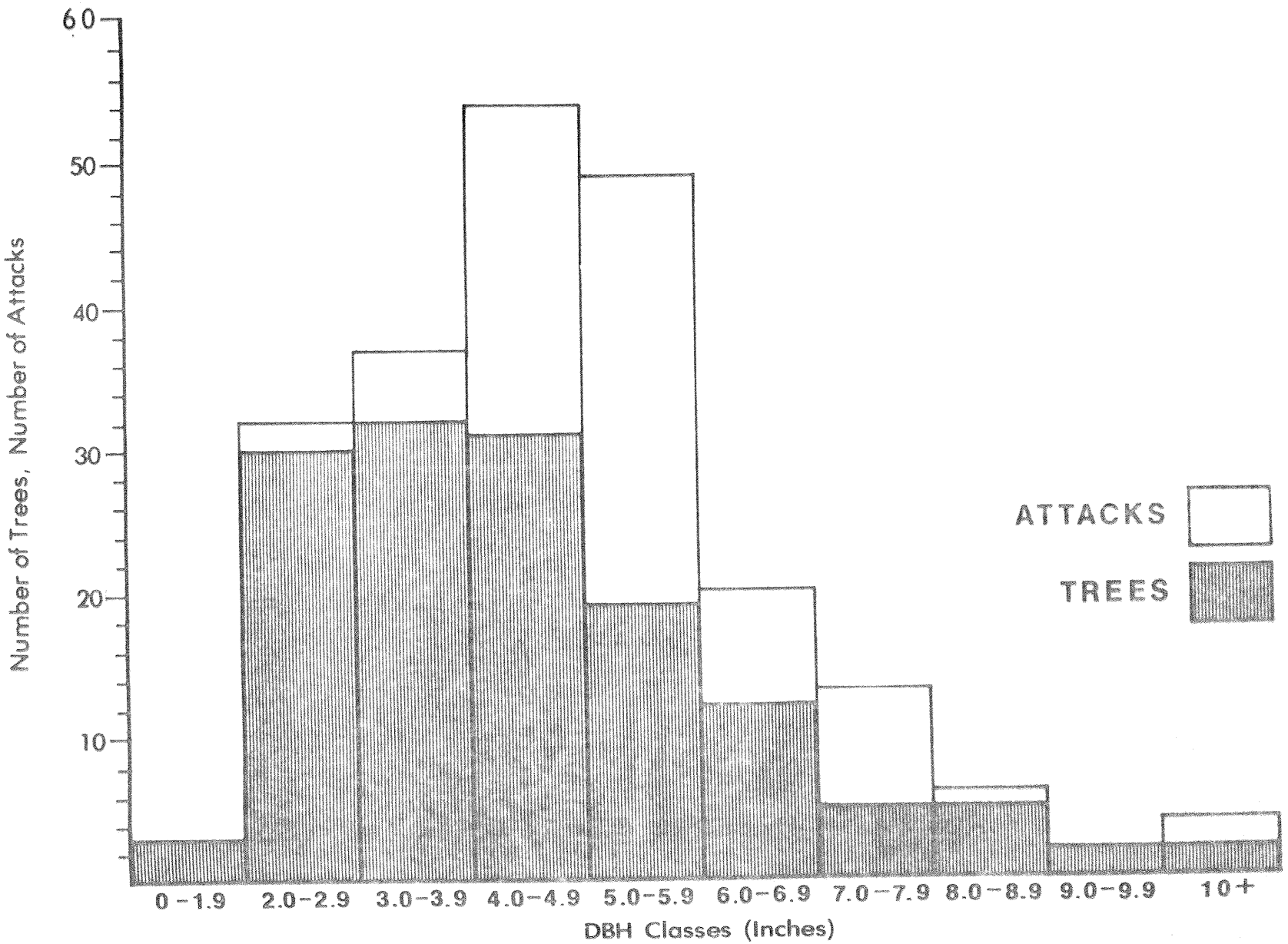


Figure 3. Frequency of White Oak Borer Attacks

RANKING	VIGOR		ATTACK	
	DBH	AREA	ALL	EXITS
	1	2	1	1
	2	3	4	3
	3	1	2	2
	4	4	3	4

Figure 4. **RELATIONSHIP OF TREE VIGOR TO *G. tigrinus* ATTACK.**

RESULTS AND DISCUSSION

The spatial distribution of infested and noninfested white oaks shown in Fig. 1 was obtained by plotting, from a 5-year census of all borer attacks, pest incidence in our stand. Only the trees that survived the entire study period are plotted. The infested portion of the stand appears to be a belt-like strip 50 to 100 feet wide, with only two trees outside this pattern.

A histogram showing the diameter distribution of the trees is presented in Fig. 2. Our diameter distribution looks very much like Schnur's (Schnur 1937) for an even-aged upland oak forest 50 years old on a medium site. A frequency-of-attack histogram (Fig. 3) has been superimposed on the tree-diameter histogram, to relate current borer attack to tree size. Most of the current white oak borer damage took place in the 4- to 9-inch dbh classes. This tree group made up only 48% of the stand but supported 87% of the borers. The average height of attack was 11 feet. This estimate of vertical borer distribution, considering the size classes of attacked trees, makes the white oak borer important to wood quality in the all-important butt logs in our timber stands.

To locate white oak borers in white oak timber stands, we need to know the stem diameter "preferred" by female borers for oviposition. In this study the preferred diameter was 4.3 inches. Thus, attacks on an 8-inch dbh tree were found some 12 to 25 feet above the ground. We found this preference on most study trees.

In our study it appeared that incidence of borer attack was related to tree vigor (growth rate). Two expressions of tree vigor are: (1) dbh increase in the 5-year study period and (2) increase in habitable bole surface. These two growth estimates were calculated for each tree. Individual tree performance was used to develop a 4-class ranking--from best (1) to poorest (4)--for our stand, and borer attacks were expressed as a function of tree vigor in two ways (Fig. 4). I used, first, all borer attacks per tree per vigor class, and second, borer exits per tree by vigor class. Tree diameter growth varied from 0.0 to 0.7 inch over the 5-year study period. Surface area increased from less than 1 square foot to more than 11 square feet.

The white oak borer preferred the fastest growing trees.

During the 5-year study period, more than 20% of the trees less than 12 inches in dbh died. These were mainly in the smaller diameter classes (Fig. 2). However, only 3% of the borer attacks initiated during the study period were on trees that died. Even though white oak mortality was widespread, it had little effect on the borer population. Nor did borer attack have any effect on tree mortality.

Attacks by successive generations of beetles were twice as common on previously attacked trees as they were on trees with no past history of borer attack. Considering the spatial distribution of attacks throughout the stand in both time and space, we could have killed 50% of the resident borer population by removing only 14 trees--less than 5% of the stand's basal area.

If the white oak borer population level remains static over the remainder of the rotation (50 more years) and mortality continues in the smaller size classes, as both my data and Schnur's suggest, the white oak component of our plot will support some 900 additional defects at harvest. These 900 defects constitute a "tax" levied by the white oak borer on our white oak resource. This "tax" is much too high for it will negate our efforts to produce quality white oak timber. We need a Proposition 13!

The results presented here are the beginning of our revolt against the white oak borer. We can now appreciate the damage done by a borer population in a timber production area. In stands selected for timber production, we must locate damage done by the borer in all its life stages. The time span over which forest managers must be concerned about borer damage can be considered as a function of, at least, management objectives, minimum tree size that will support borers, tree growth, maximum size of borer-attacked trees, and changes in location of borers within crop trees.

This study covers only one 5-year portion of the 100 years needed to grow a white oak stand from seedlings to sawlogs. But the data indicate that the white oak borer is a problem in only part of the diameter distribution curve. Trees smaller than 3 inches dbh seldom serve as a reliable host for the pest and trees larger than 10 inches dbh are too big for borers in their butt log portions, or are already too damaged to be counted on as a source of quality lumber.

This study also indicates the potential for silvicultural control of the white oak borer by removal of infested trees.

In short, we know where to look for the white oak borer and how to evaluate its potential impact, and we have at least one possible method of control compatible with current timber stand improvement practices.

LITERATURE REFERENCES

Schnur, G. Luther. 1937. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS. USDA Tech. Bull. No. 560. Washington, D.C. 87pp.