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FOREST FIRE DAMAGE STUDIES IN THE NORTHEAST

I. BARK-BEETLES AND FIRE DAMAGED HARDWOODS

By PAUL W. STICKEL

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In reporting the damage to trees scorched lightly at the base by fire the average fire warden and even the technically trained forester is given to stating that little harm has been done providing the tree crowns remain green. Such a statement is far from being correct, failing as it does to take into account the aftermath of insect and fungus damage which invariably follows even the lightest of surface fires. In the case reported herein, over 50 per cent of the fire-scorched hardwoods showed signs of the presence of ambrosia-beetles, whose work, even if the trees continue to live, causes a serious reduction in quality of the wood of the most valuable part of the tree—the butt log.

DESPITE Hopkins' early statement to the contrary (2), forest entomologists are generally in agreement as to the important relationship between fire-injury in standing timber and insects. In the case of coniferous species and the true bark-beetles, this association has been emphasized by such workers as Craighead (1), Keen (4), Miller and Patterson (5), and Swaine (6). As far as the writer is aware, the relation of fire injury to ambrosia-beetle attack in hardwoods has not received much consideration in the literature. In fact, aside from the brief descriptions found in such standard taxonomic works as Swaine (6), only one comprehensive account of this specialized group of bark-beetles has been published. This is to be found in the long-out-of-print and now very rare paper by Hubbard (3).

Although the presence in the tree of both true bark-beetles and ambrosia-beetles is readily detected on the surface of bark by means of the small round entrance-holes and the fine, whitish boring-dust, a removal of the bark will disclose that, whereas the galleries of the true bark-beetles are superficial and lie within or just under the bark, the galleries of the ambrosia-beetles

penetrate into the wood. Since their borings can penetrate the hardwood in every direction, and thus riddle it with holes, the ambrosia-beetles are capable of largely destroying the value of the wood for the more exacting purposes. Furthermore, since these beetles are always associated with ambrosia fungi, from whence they get their name, the wood in the immediate vicinity of the galleries is usually blackened or stained. This still further reduces the grade of the wood and its value in the market.

FIELD DATA

In the course of establishing permanent sample plots on which to study the mortality and decadence of fire-damaged trees, an excellent opportunity was afforded during the summer of 1933 to observe the relation of fire injury to ambrosia-beetle attack. At Ramapo, Rockland County, New York, a forest fire, covering approximately 150 acres, occurred on April 24, 1933. The forest, second-growth in character, falls within the scarlet oak-black oak (*Quercus coccinea* Muenchhausen—*Q. velutina* La Marck)² cover type,³ although in this case

¹Maintained by the U. S. Department of Agriculture at New Haven, Connecticut, in coöperation with Yale University.

²Botanical nomenclature according to G. B. Sudworth: Check List of Forest Trees of the United States, their names and ranges. U. S. Dept. Agr. Mis. Cir. 92, 295 p. 1927. Entomological nomenclature after Swaine (6).

³Forest cover types of the eastern United States. Jour. For. 30 (4): 451-498, 1932.

black oak is absent. The stand is predominantly scarlet oak, with such associates as red, white, and chestnut oaks (*Q. borealis*, Michaux f., *Q. alba* Linnaeus, and *Q. montana* Willdenow), pignut hickory (*Hicoria glabra* (Miller) Sweet) and occasionally paper, gray, and black birches (*Betula papyrifera* Marshall, *B. populi-folia* Marsh, and *B. lenta* Linnaeus), large-tooth aspen (*Populus grandidentata* Michaux), sugar maple (*Acer saccharum* Marshall), and sassafras (*Sassafras variifolium* (Salisbury) Kuntze).

During August, 1933, or about six months after the fire, a 150-foot square plot was established in the burned-over area. Not all trees on the plot were tagged and measured; only those which were scorched at the base and still alive, were selected for future study. All told, 116 trees over 0.5 inches d.b.h. were selected for observation. Their diameters varied from 1.5 to 12.5 inches d.b.h. with an average of 5.3 inches, while the heights ranged from 18 to 60 feet with an average height of 41 feet. In general, the area can be classed as site 1 for the oaks which formed the major portion of the stand.

Upon examining the individual trees for the purpose of delimiting areas of bark discoloration, it soon became evident that ambrosia-beetles were present in many of them. The final check disclosed that 62 of the 116 trees, or 53 per cent, were infested with these insects.⁴ It is believed that an examination of the trees next year will show that this percentage is even greater. Even during the brief period spent on the area while laying out the plot, it was apparent that the infestation was spreading rapidly. Many trees which on first inspection showed no signs of beetle work had entrance-holes and boring-dust on their bark a few days later.

One point of interest was noted as far as degree of damage and insect attack are concerned. On trees with only one degree of bark discoloration, i.e. scorch, the beetles were usually lacking. Where they did occur on trees having all three degrees of bark discoloration—scorch, char, and burn—their entrance-holes were most numerous in the zone of charred bark. Since in these hardwoods the extent of cambial wounding and subsequent drying out of wood tissue follow very closely the zones of charred and burnt bark, it would seem that these ambrosia-beetles prefer working in the more badly fire-injured trees. In fact, subsequent findings may prove that the presence or absence of these insects is an excellent index not only of the initial degree of injury but also of probable future recovery.

Specimens of the ambrosia-beetles were collected and identified in the laboratory. The species found in each host are given in the following list:—

Scarlet oak—*Pterocyclon fasciatum* Say.

White oak—*Pterocyclon mali* Fitch and *Xyleborus saxesceni* Ratz.

Chestnut oak—*Xyleborus saxesceni* Ratz.

Black birch—*Xyloterinus politus* Say.

Gray birch—*Xyleborus saxesceni* Ratz.

Paper birch—*Anisandrus pyri* Peck, *Pterocyclon mali* Fitch, and *Xyleborus saxesceni* Ratz.

Sugar maple—*Xylaterinus politus* Say and *Xyleborus saxesceni* Ratz.

Large-tooth aspen—*Xyleborus saxesceni* Ratz.

Sassafras—*Xyleborus saxesceni* Ratz.

Aside from illustrating the close relationship between fire-injury and bark-beetle attack in hardwoods, the facts cited above emphasize the need for making more than one inspection of burned-over areas if accurate fire damage appraisals are to be obtained. There is little doubt that in the

⁴In no instance, either on the plot or adjacent to it, were ambrosia-beetles observed working on trees not injured by fire.

case in question an inspection made immediately after the fire would have failed to disclose the presence of ambrosia-beetles. It seems highly essential, therefore, that fire-injured trees be allowed "to season" before attempting to ascertain accurate damage data.

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One of the theories accounting for the prairies, ascribes them to the fires annually set by Indians for driving game, or for favoring the growth of grass that should attract deer and other game to this pasturage; and so far as relates to "oak openings," "barrens," and the prairies east of the Mississippi, this theory has the strongest ground of probability. However this may be, we have these facts before us, that scarcely a year passes without the occurrence of forest fires of sufficient extent to attract public notice; that they are particularly prevalent in seasons of protracted drought, and more frequent from year to year as these droughts become more frequent and more widespread in their effect.—*Report Upon Forestry* by Franklin B. Hough (1877).