Longevity of Lightning-Struck Trees and Notes on Wildlife Use

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A conspicuous feature of the pine forest on Tall Timbers Research Station, Leon County, Florida is the number of dead pine snags scattered throughout the property. During the "lightning season" (spring-summer) trees with fresh lightning streaks are readily visible and at a later date the death of these trees is often noticed. Lightning plays an apparent important role in this southern pine forest ecosystem.

A major interest in the life history and ecology of the Red-cockaded Woodpecker (*Dendrocopos borealis*) also led to an interest in lightning. Besides the direct effect of lightning striking Red-cockaded Woodpecker cavity trees, it was of interest to determine what effect a lightning struck tree might have on other species of woodpeckers utilizing the same area.

As a consequence of these interests, a limited study of lightning struck trees on Tall Timbers Research Station was initiated in the spring of 1968.

Trees with an obvious lightning streak were numbered and plotted on a map. Basic data recorded for each tree were: species, approximate date the tree was struck, and comments about the strike. As

time permitted, observations were made on the superficial effects of a strike on the tree. If the tree was dying, the amount of browning of needles and flaking of bark, was recorded. Subsequently, observations on the condition of the bark, cones, needles and twigs were noted.

The ground elevation where the trees were hit, and the proximity to fields or open land was also recorded. Height, age, and dbh were not determined for all trees. Older age class timber is a prominent feature of the forest on Tall Timbers Research Station and most of the trees struck were mature.

Periodic checks were made to observe woodpecker utilization of the numbered trees. Lightning struck trees were located and marked during 1968–69 and observations are continuing until the trees no longer remain standing. This paper mainly discusses these trees but some general observations are also noted.

The following discussion is based on data obtained from 77 lightning struck trees. Forty-five of these were found in 1968 and 32 in 1969. Excluding fields, ponds and other open areas on Tall Timbers lightning struck at least one tree per 45 acres annually. This is a minimum figure as undoubtedly a number of trees were missed. In widely spaced mature timber, lightning imposes a substantial effect on a long term basis.

The marked trees are scattered throughout the property with no apparent pattern. Lack of coverage due to less accessibility probably accounts for some omissions e.g. southwest section of property. Some areas such as the border of Lake Iamonia have a high percentage of hardwoods and as a rule these don't show the obvious visible signs as a struck pine does.

Topographic location of lightning struck trees was recorded even though the hilly terrain has no prominent hilltops. Categories used were: level ground; top of slope; top one-third; middle one-third; and lower one-third. Of the 77 trees marked, the number in each category was 21, 4, 13, 16, 23 respectively. Twenty percent of those trees hit were near the edges of fields or other openings.

Ninety-four percent of the lightning struck trees located were pines. A high percentage of pines was to be expected because the

majority of the property and the area best surveyed is predominently annually burned, open pine forest. Also pines when hit, usually show a definite, readily visible streak and are more easily located especially when the needles turn brown.

The species of pine hit reflect the general composition of the dominant species rather than one species being more susceptible to lightning. On Tall Timbers property, which is mostly oldfield land, loblolly pine (*Pinus taeda*) and shortleaf pine (*P. echinata*) are the commonest species. Hence, it is not surprising that these two species made up 97 percent of all pines that were marked.

Only five hardwoods of four species were found. These were black cherry (*Prunus serotina*), southern red oak (*Quercus falcata*), water oak (*Q. nigra*) and two sweetgums (*Liquidambar styraciflua*). The water oak was struck indirectly. The electrical charge came down a large pine, followed out on a branch and then down the smaller adjacent oak.

Three of the five hardwoods (60%) survived even though damage indicated they received a hard strike. Only six, all loblolly, of the 72 marked pines are now living. Of these six, four were hit at a cooler time of the year when insects are less active and the trees were more dormant. In all cases except one these trees were of a younger age class (averaged 55 vs 85 years) and all appear to be in thrifty condition. Most of these tended to be the bushy "wolf type" tree with a large crown.

Some pines lived for a considerable time but most died later. Two trees were hit in January 1969 and died in summer of 1970 (1½ yrs. +). A tree hit in August 1968 died in the spring of 1970 (2 yrs. —), but fire from a controlled burn ignited the old resinous streak and probably caused its death. In one of the other cases mentioned above, fire also ran up the lightning streak for 25 feet.

There is great variation in the length of time a snag remains standing. Some are blown down quickly, while others break off at varying times and heights. Fire can play an important role here. The bases of snags often catch on fire during controlled burns. In some cases during the course of several annual burns the tree will get burned enough at the base that it is weakened and falls over. The

techniques and conditions under which controlled burning is done can also make a big difference in the percent of snags consumed by fire. As an extra precaution to secure particularly desirable snags, it may be necessary to rake the fuel away from their bases.

If 50 percent or more of the tree trunk was erect it was counted as standing. As of March 1973, of the 40 pines marked in 1968 which died, 62 percent are still standing (5 years after death). Of the 26 marked in 1969, 61 percent are still standing. Thirty-two percent broke off leaving stubs of varying heights less than half of the original tree height.

When a pine tree is hit there is usually an obvious double streak (parallel lines) from near the top of the crown to the base. Sometimes it will continue down the trunk and out the roots blowing out the soil in its path. If death occurs the usual events are: browning and dropping of needles, loss of outer limbs and twigs especially in the extreme top of tree, breaking off of part of the top, and eventually the tree falls. The time required for each of these events is extremely variable.

It usually takes at least 2 weeks for noticeable browning of the needles to take place. The completion of this process can occur rather quickly, or, can last several months before all of the foliage turns brown. Once dead, the needles gradually drop off. The cones are more persistent and fall off along with the limbs and twigs after the needles are gone. Usually the extreme top of the trunk will break off. Consequently, if the entire tree does not fall what will be left is the main trunk and a few stubby remnants of the larger branches.

The amount of bark loss is also extremely variable and is very important to the future wildlife value. Generally speaking, there is a gradual loss of bark usually starting on the top half of the trunk; then, sections of bark are lost at various levels, in a few cases coming off in rather large sheets. In cases where most bark is gone there is usually some left on the basal part of the trunk.

The interaction of lightning, insects and disease on a tree is closely woven, especially in older age class timber. The main lightning season coincides with the warmer months of the year. This is a time when trees are physiologically very active and also the time when

insects known to be detrimental are particularly active and abundant.

As mentioned previously, trees can survive a lightning strike even one of obvious severity. However, soon after a tree is struck, especially a pine, the tree is usually invaded by numerous bark beetles (*Ips, Dendroctonus*). These beetles, along with fungus entry, probably are the main cause of the trees death once lightning has weakened the tree. The meager evidence presented that more trees hit in the colder months survive and that younger trees are more likely to survive suggests that often times insects may well determine whether tree mortality occurs.

Sometimes an adjacent tree dies with no apparent visible lightning damage. Here again, lightning may have weakened the tree enough, either directly or through root damage from contact with a struck tree, to allow the insects to invade.

WILDLIFE USE

Of 66 pine trees marked that died, all showed signs of woodpecker utilization. These signs consisted mostly of small holes made while foraging for food. Eighty percent of these same trees were also judged to have holes either complete or to the point that they could be used for roosting and or nesting.

The Yellow-shafted Flicker (*Colaptes a. auratus*), Pileated Woodpecker (*Dryocopus pileatus*) and Red-headed Woodpecker (*Melanerpes erythrocephalus*) all commonly accept snags for roosting and nesting sites and were noted utilizing the marked trees. Wood Ducks (*Aix sponsa*) also use snags for nest sites but none were definitely known to have used the marked trees. The Red-headed Woodpecker is often associated with a snag and also uses it as a territorial perch.

Besides being used as places for nesting, roosting and a source of food, snags are also used as perches. Red-tailed Hawks (*Buteo jamaicensis*) and Turkey and Black Vultures (*Cathartes aura, Coragyps atratus*) often perch on snags.

The stubs left after snags have snapped off are also useful for nesting and roosting sites for such cavity nesting birds as the Downy Woodpecker (*Dendrocopos pubescens*), Carolina Chickadee (*Parus*

carolinensis), Tufted Titmouse (*Parus bicolor*) and Brown-headed Nuthatch (*Sitta pusilla*).

On 27 May 1969 a colony of evening bats (*Nycticeius humeralis*) was found under loose bark of a lightning struck pine (Fig. 1). This was a small nursery colony that was estimated to have 20 adult females.

After finding this nursery roost an attempt was made to find similar situations for more bat roosts. On 25 June 1969, another small colony of *Nycticeius* was found in a very similar situation ½ mile away.

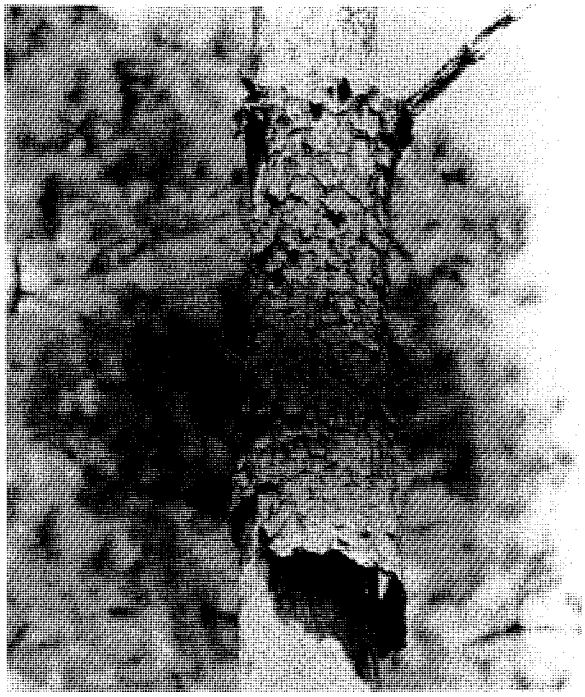

FIG. 1. Loose bark on lightning struck pine which was used as a nursery colony site for the evening bat, *Nycticeius humeralis*. Tall Timbers Research Station, Leon County, Florida. Summer 1969.

Since bark only stays in this condition for a short while this is a very temporary situation for the bats. If roosting sites are a limiting factor for evening bats in this area, loose pine bark from lightning struck trees may play a very important role even though it might be only usable as a roost for one season or less.

Small mammals (*Blarina*, *Cryptotis*, *Peromyscus*) are often associated with burned out root systems of snags. Larger mammals (e.g. *Urocyon*) can then enlarge these holes and use them as dens.

Gray and red ratsnakes (*Elaphe obsoleta*, *E. quttata*), especially the younger age classes, are often under the loose basal bark of snags. Burned out bases and root systems of snags also become den sites for herptiles. The diamondback rattlesnake (*Crotalus adamanteus*) and several lizards (*Eumeces* sp.) are often associated with such sites.

The arthropod succession following death of a tree is a complete subject by itself. Under the basal bark of lightning struck and killed trees one can find numerous arthropods.

In association with W. H. Whitcomb, the basal bark of several dead pines was surveyed for arthropods for 1 year. Several species of Salticid spiders (*Stoides aurata*, *Metacyrba undata*, *Phidippus otiosus*) were commonly found. Indeed, the latter two species seemed to carry out their life history under such bark.

Other insects commonly found under bark belong to the following groups: Orthoptera: Blattidae; Hemiptera: Reduviidae, Pentatomidae; Coleoptera: Carabidae (*Galerita*, *Piesmus*, *Morion*, *Pinacodera*, *Tachys*), Elateridae, Tenebrionidae, Hymenoptera: Formicidae (*Campanotus abdominalis floridanus* Buckley), Vespidae.

In a forest with mature trees any factor that contributes to the death of some of these remaining dominant trees has considerable ecological impact on such a community. Lightning is another mechanism in nature that causes change, variability and diversity. In a forest ecosystem lightning plays a very important role by constantly killing a certain percentage of the living trees. A number of forms of wildlife are associated with these dead snags. In fact, some species may be for the most part dependent on dead trees which in this area, are killed by lightning either directly or indirectly.

While many values to wildlife result from the widely distributed

lightning-struck dead trees, many "old snags" also have a certain character that has high aesthetic value. In the field of wildlife management and especially landscape planning consideration should be given their location before removal. A snag in the middle of a forest for example might have entirely different usage from a wildlife standpoint than an identical snag on the edge of an opening.

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