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WHAT IS THE TIME BETWEEN IGNITION AND DISCOVERY OF LIGHTNING FIRES?

By

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A recent study of fire reports gives some information helpful in planning for discovery and suppression of lightning fires. Reports from national forests during the period 1940-44 show that 46 percent of such fires are discovered in the first hour on Washington forests, but only about 22 percent are discovered in the first hour on southern and eastern Oregon forests.

Several circumstances may delay the discovery of lightning fires. For example, when a bolt of lightning strikes, it may hit dry fuel from which flame or smoke may be visible almost at once. On the other hand, it may hit wet fuel which may smolder for a week or more before becoming dry enough for the fire to gather headway and produce visible flame or smoke. The strike may be in an open forest cover where smoke near the ground can be easily seen or it may be in a tall, dense cover where the smoke is hidden. Knowledge of the proportion of lightning fires visible within 1 hour, 2 hours, 3 hours, etc. after the strike is necessary when estimating either the period during which the fire-suppression force may be overloaded or the period during which extra lookouts and aerial patrols may be needed.

One source of information concerning lightning-fire discovery times is the individual fire report of the national forests. These reports show the time of ignition of each fire as judged from records of the time when the lightning storm passed over the area. They also show the time when the fire was first discovered. Reports for 5,300 lightning fires on the

national forests of Region 6[1/] during the period 1940-44 have recently been tabulated according to the locality and timber type in which each occurred and the interval between ignition and discovery.

The average percent of fires discovered at various time intervals after the storm occurred is shown in figure 1 and table 1 for Region 6 as a whole. If 1-hour rather than 2-hour periods had been illustrated, the chart would show that 31.2 percent of the fires were discovered in the first hour after the storm. The fires remaining to be discovered after 8 days, the limit of the chart, were 3.5 percent of the total number.

Figure 1 shows a decreasing rate of discovery until 8 hours after the storm, then a gradual increase until 16 hours, then a decrease until 32 hours, then an increase until about 42 hours, then a decrease. Both high points occur 8 to 10 hours after the low points. The low points are 24 hours apart, and the high points are at nearly the same interval. No satisfactory explanation of this pattern has so far been found. Since burning conditions and visibility vary with the time of day, the pattern may be related to the proportion of storms beginning at different hours. In such a case, the elapsed discovery times would have to be analyzed according to the hour at which the storm occurred in order to recognize the relationship.

Table 1.--Proportion of lightning fires discovered within various periods of elapsed time after ignition, Region 6, 1940-44

Periods of elapsed time	Percent of total fires
6 hours	50
24 "	78
3 days	90
7 "	96

Effect of Cover Type

To learn what conditions may have contributed to differences in discovery time, the kind of forest cover at the starting point of each fire was classified as either an open canopy or a closed canopy. The discovery times in each class were studied to learn if fires starting in an open forest canopy are usually discovered more quickly than in a closed canopy. The open cover included non-restocked cutovers and old burns, small reproduction and saplings, and the ponderosa and lodgepole pine types. For the two states as a whole, 60 percent of the fires started in the open forest canopy types, and discovery times for these types were less than for the closed types. Within 6 hours after the storms, 52 percent of the fires in the open types, but only 45 percent in the closed types had been discovered. This 7 percent

1/ Washington and Oregon, excepting the Colville National Forest in northeastern Washington which is in another administrative region. The Olympic and Siuslaw National Forests of the Coast Ranges in Region 6 were omitted because they have very few lightning fires.

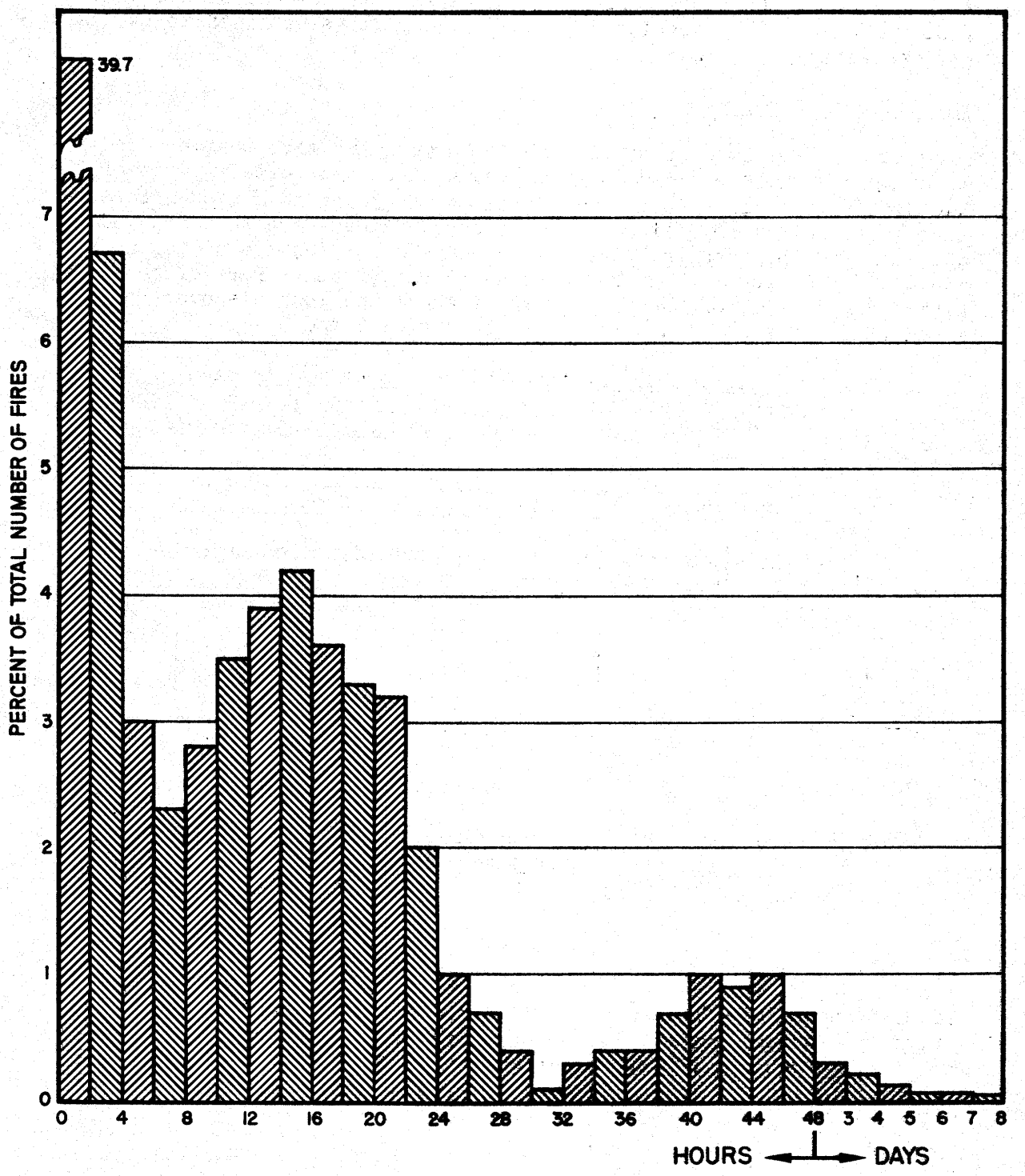

FIGURE 1. - Average rate of lightning-fire discovery at specified periods after storm occurred, for 5,357 fires in Region 6 during 1940-1944.

difference remained nearly the same for any given elapsed time from 6 to 48 hours after the storm passed. As a result, 19 percent of the closed canopy and only 11 percent of the open-canopy fires remained to be discovered after 48 hours.

Variation by Sub-region

Since there is a great difference in fuel and fire weather conditions between northern and southern and eastern and western parts of the two states, the fire reports were grouped according to national forests that have similar conditions. The discovery times were then studied to determine if the results previously discussed for the two states as a whole differed appreciably between the forest groups. Part of the data giving comparisons of the proportion of short and long discovery times in different forest groups are shown in tables 2 and 3.

Table 2.--Proportion of lightning fires discovered in each of the first three hours after ignition in different national forest groups in Oregon and Washington, 1940-44

Hour	Washington		Oregon			
	Mt. Baker Snoqualmie Columbia	Chelan Wenatchee	Mt. Hood Willamette Umpqua	Rogue River Siskiyou	Deschutes Fremont	Blue Mts. forests
	Percent	Percent	Percent	Percent	Percent	Percent
1st	46	46	28	25	23	23
2nd	5	7	9	8	11	10
3rd	3	3	4	7	6	4

Table 3.--Proportion of lightning fires discovered within various periods of elapsed time after ignition in different national forest groups in Oregon and Washington, 1940-44

Periods of elapsed time	Washington		Oregon			
	Mt. Baker Snoqualmie Columbia	Chelan Wenatchee	Mt. Hood Willamette Umpqua	Rogue River Siskiyou	Deschutes Fremont	Blue Mts. forests
	Percent	Percent	Percent	Percent	Percent	Percent
6 hours	59	63	45	44	45	42
24 "	74	83	74	77	82	78
3 days	86	94	87	87	92	91
7 "	92	98	94	95	99	96

Except in the Chelan-Wenatchee group, rate of discovery in each group followed a pattern similar to the regional pattern shown in figure 1. The Mt. Baker-Snoqualmie-Columbia group of western Washington discovered a much larger proportion of its fires than did the Oregon forests in the first six hours. By the end of 24 hours, however, the relationship was reversed and the Oregon forests had discovered as great or a greater proportion of their fires compared to the western Washington forests. The Chelan-Wenatchee group of eastern Washington discovered a greater proportion of its total fires than did any other group during each elapsed time period between one hour and seven days.

The effect of open and closed forest canopy types upon fire discovery time was studied by forest groups, to determine if the effect noticed for the two states as a whole was consistent in all groups. The Washington and western Oregon groups showed the same tendency for earlier discovery in the open-canopy types as discussed on page 3 for all groups combined. But in the eastern-Oregon groups the proportion of discoveries during the first six hours was approximately the same in both closed and open-canopy types. This is reasonable since most forests are somewhat open in eastern Oregon, making less contrast between the open and most dense timber types than in Washington or western Oregon. On the other hand, between 6 and 8 hours after the storm, the proportion of discoveries increased in the open-canopy type in eastern Oregon. As a result, in the eastern Oregon forests, as in the others, a greater percentage of the fires occurring in open-canopy timber types than in closed types was discovered before 8, 24, or 48 hours had elapsed. This left a greater proportion of the fires in closed-canopy types to be discovered after 48 hours or more, in all the forest groups.

Results of the lightning-fire discovery-time tabulations indicate that the peak load of discoveries and reports is in the first hour after the lightning strikes. This should be kept in mind when planning for prompt discovery by emergency lookouts and airplane patrols and prompt attack by suppression crews, although weather and visibility is usually unsafe for flying during the first hour. About 50 percent of the fires are seen within 6 hours, 20 percent remain to be discovered after 24 hours, and 10 percent after 3 days. From this it appears that emergency lookouts, patrols, and suppression help may be needed for at least 3 days. The Washington forests have a greater proportion of their lightning-fire load in the first hour than do the Oregon forests. If all fires are to be suppressed as soon as possible after discovery, regardless of locality, emphasis on action as soon as the storm strikes is then even more important in Washington than in Oregon.