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Progress Report on:  
"ANALYSIS OF THE EFFECT OF THE INTERVAL OF TIME  
ELAPSING BETWEEN FIRE ORIGIN  
AND COMMENCEMENT OF ORGANIZED ATTACK"

It is generally recognized that successful fire protection hinges to a marked extent upon the period of time which is permitted to elapse between the origin of a fire and the commencement of organized attack. This factor has been the subject of extensive studies by the United States Forest Service, who have given it the term "Hour Control," and includes four distinct steps: 1. Discovery time. 2. Report time. 3. Get-away time. 4. Travel time. In the United States hour control requirements have been determined for each forest type, and the Protection Scheme organized to comply with these criteria. A knowledge of the standards of hour control required in each type is an indispensable factor in planning an adequate protection scheme for British Columbia in order that burned acreage may be held to a minimum.

The preparation for adequate hour control requires:-

- (a) An analysis of past action in the various hazard types to determine how closely our present Protection System approaches the Hour Control necessary to hold burned acreage to a reasonable minimum.
- (b) The determination of the defects in our present system, and the remedies required.

The opportunity to make a statistical analysis of suppression action had not presented itself until recently, when it was possible to make a start with that section of the Province which includes the south-eastern portion of Vancouver Island and the adjacent mainland, commonly called the Douglas fir belt. Ultimately the study will be extended to include the other forest types but in the meantime it is felt that the results of our preliminary investigations are of sufficient interest to warrant reporting.

### Limitations of Data

The study dealt only with man-caused fires and was further limited by omitting fires allowed to become slash burns, fires not fought, fires with obviously unreliable or inadequate information, and escaped permit fires. Lightning fires were omitted from the analysis in conformity with similar studies by the United States Forest Service. Their conclusion is that (in a given season) the rate of spread of man-caused fires is many times that of lightning fires; therefore adequate hour control for man-caused fires in a given type will readily take care of lightning fires in the same type.

The period studied was 1935-1937. It was considered undesirable to go any further back since the information for the years previous is less complete.

### Method of Classification

Fires were grouped by their occurrence in the following fuel types:-

Extreme - Fresh slash, or logged and burned with an accumulation of dead herbaceous cover.

High - Old slash with deciduous or immature stands commencing to be established.

Moderate- Established brush or young immature stands.

Low - Mature timber or older immature stands.

In each type the total elapsed time until attack commenced was grouped by hour classes (1 hour class: 0-60 minutes; 2 hour class: 61-120 minutes, etc.). Elapsed time was then correlated with the final size of fire, and the results are graphically presented on the following charts.

### Results

#### A. Effect of elapsed time on acreage burned and cost of suppression .

Referring to graph No. 1, it is illustrated that time is not such an important factor in the low and moderate types where the average final sizes, even when attacked at 3 hours, are 6 and 10 acres respectively. However, this acreage increases sharply with greater hazard, as noted by the high and extreme types where, after the same interval of time, their final sizes have become 28 and 150 acres respectively.

Suppression costs have not been shown graphically, but they also vary with the hazard, being \$80, \$100, \$250, and \$800 at 3 hours for the low, moderate, high, and extreme types respectively.

Continuing our perusal further, we find that at 45 minutes we have final sizes of 1, 1, 2 and 20 acres, and costs of \$10, \$30, \$50 and \$200 for the low, moderate, high and extreme types. In brief, this indicates that fires in areas of extreme hazard will spread 20 times as fast as low or moderate, and may cost 20 times more to suppress. This shows the necessity for immediate action on fires in the extreme hazard zones; and it further suggests that our Protection system be adequate to deal effectively with this type.

The curve for extreme type and extreme hazard indicates the result of fires in fresh slash under extraordinarily severe weather conditions. These fires, in direct range of the logging crews, were attacked in an average time of 18 minutes; yet rapid control was not effected. The average final size became 120 acres, and average suppression cost reached \$2,000. This shows the necessity for logging companies to be aware of such conditions, and to plan for emergencies accordingly.

The second graph indicates the result of delay in suppression action. This delay, in the case of fires reviewed, was due to three main causes: first, where, due to lack of detection facilities, the fires were not discovered for several hours; second, where fires were discovered in the early evening and attack delayed until next day; and third, where fires were discovered early but, due to poor judgment, were allowed several hours start.

It will be noted from the curves that fires in the extreme type, on which attack is delayed 14 hours, average 1,100 acres in size and cost \$1,900 to suppress; in comparison with 20 acres and \$200 had attack been made within 45 minutes of origin. The high type at 14 hours averages 300 acres and \$400; as compared to 4 acres and \$50 for 45 minute attack. In the moderate and low types, although the time factor is not of such great importance, 45 minute attack will give significant results, as shown by acreages of 40 and 20 at 14 hours reduced to 1 acre each; and costs reduced from \$150 each to \$30 and \$10 respectively.

B. Analysis of elapsed time in areas of extreme hazard.

Considering only the 84 extreme type fires which occurred during the period under study, we derive the following table:

Attack Time Group	No. in Group	Av. Discovery & Report Time	Get-away Time	Travel Time	Av. Total elapsed Time	Av. Cost	Av. Final Size
1 hour	37	11 min.		14 min.	32 min.	\$ 78.00	5½ ac.
2 hours	22	40 min.		20 min.	92 min.	480.00	75 ac.
3 hours	12	75 min.		42 min.	150 min.	116.00	16 ac.
Delayed Action	13	6 hours			14½ hours	1,870.00	1,120 ac.

The above classification by "attack time" further emphasizes the desirability of early action. The average value saved in extreme hazard types by quick action on the part of the Forest Officer is approximately \$130 per hour in costs of fire fighting. The 3 hour group shows a false final acreage since these fires occurred in the evening, or under very favourable conditions, and were controlled the same night. They were included to show the elapsed time spread.

In an attempt to determine the reason for the elapsed time previous to attack having exceeded one hour, the inadequacy of our present detection system was brought forcibly to the foreground. The average detection and report time for the 71 fires attacked within 3 hours was 27 minutes, while the average travel time was only 17 minutes.

### Conclusions

As it is impossible for this Service to plan for extraordinarily severe conditions, hour control should be planned on the basis of the average bad conditions found in the extreme type, and this would automatically give adequate control to the lower hazards.

Earlier in this paper the advantages to be derived from immediate action are emphasized, and while re-organization of our protection system is in the embryonic stage, it would appear that within this South coast area studied such changes as are made during the next year or so should aim to give a maximum of 45 minute total elapsed time in the extreme type. This means that personnel and equipment should be of such standard, and in such numbers, that where fires start in areas of extreme hazard, it will be less than 45 minutes from the start of the fire until suppression action is taken. Elapsed time standards should be established in the remaining Forest Districts as soon as possible.

Our present organization will require less change than one might at first consider necessary to meet the above-mentioned standard. Records show that although the majority of fires are reached within 30 minutes, we have a most serious deficiency in report time. It is imperative that we have direct coverage of hazardous areas by lookouts; this will necessitate establishment of a number of new stations, and the shifting of some previously in use. Furthermore, the opening up of lookouts must precede the commencement of the fire season as determined by fire danger rating rather than by the calendar. This fact is emphasized by the 1937 season when dangerous fire weather occurred during the first week in June (2 weeks prior to the organization of the detection system) and was responsible for 40% of the season's damage.

The frequency of delayed action is a serious problem and even this brief preliminary study indicates clearly that in future there must be no delay in attacking fires in the extreme and high hazard types, regardless of the time of day or year. Every fire must be attacked and treated as though tomorrow's conditions will give a greater hazard than today's.

I. C. MacQueen.

ACRES BURNED PER FIRE

200

400

600

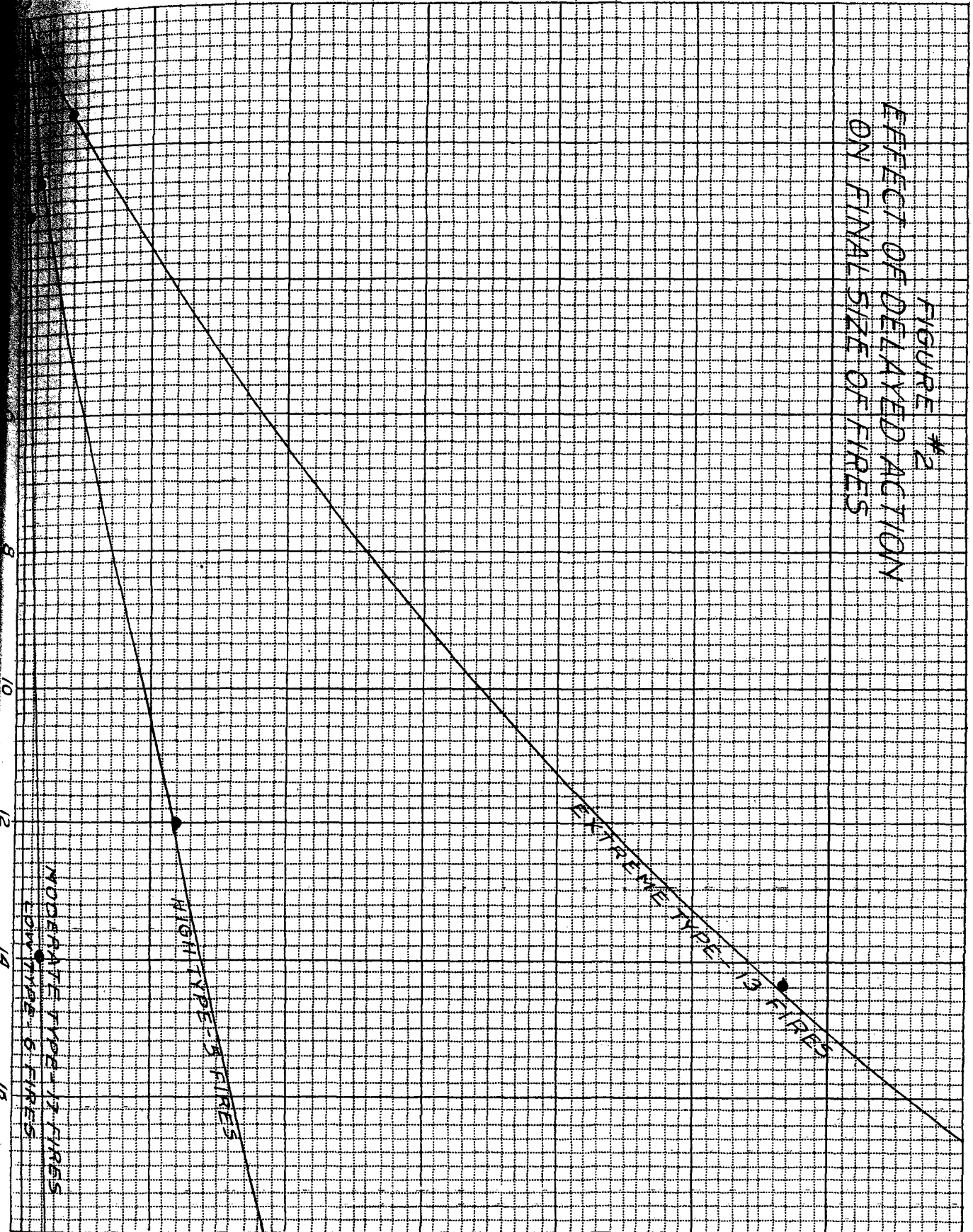
800

1000

1200

1400

FIGURE #2  
EFFECT OF DELAYED ACTION  
ON FINAL SIZE OF FIRES



EXTREME TYPE - 15 FIRES

HIGH TYPE - 5 FIRES

MODERATE TYPE - 12 FIRES

8

10

12

14

16

FIGURE #2  
EFFECT OF DELAYED ACTION  
ON FINAL SIZE OF FIRES

