# THREE 1970 FIRES IN GERALDTON FOREST DISTRICT



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FOREST RESEARCH LABORATORY
ONTARIO REGION
SAULT STE. MARIE, ONTARIO
INTERNAL REPORT O-27

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TABLE OF CONTENTS

## INTRODUCTION

In October 1970, three fire researchers[1] from the Canadian Forestry Service had an opportunity provided by the Geraldton District of the Ontario Department of Lands and Forests to visit three fires (one prescribed, two wild) which had occurred in that District during the 1970 fire season. The purpose of the visits was to attempt to further our general knowledge about variation of fire behavior with fuel type.

This report is a summary of observations and impressions gained from the visits, augmented by data and recollections of some of the fire suppression personnel involved in the control of the particular fires.

## 1970 FIRE SEASON IN GERALDTON DISTRICT

The 1970 fire season in Geraldton District was somewhat more severe in terms of number of fires and total acreage burned than recent years. According to preliminary statistics of the Ontario Department of Lands and Forests, 86 fires occurred in Geraldton District burning some 8,650 acres. The total number of fires in the province in 1970, up to the end of October was 1,231 with some 56,000 acres being burned, 39,000 of which burned in June in Sioux Lookout District. Of the 8,650 acres destroyed in Geraldton District, 8,000 acres burned in June.

### *Ogoki Lake Fire, June 1970*

The Ogoki Lake fire, started by lightning and accessible only by air, was located some 80 miles north of the town of Geraldton. It was discovered by aircraft on the afternoon of June 12 but suppression action was not begun until June 14. This was due to a severe fire situation over the whole of the Northwestern Region at the time, and the relatively low timber value due to inaccessibility of the Ogoki Lake area.

There were several fuel types represented in the area, the main ones being 1) mixed spruce and jack pine, well stocked, 50 to 60 ft high with little or no understorey and about 6 in. of moss on the ground; 2) pure black spruce, 45 ft high, fully stocked with 5 in. of moss over mineral soil; 3) areas of aspen, which were observed only from the air.

Weather conditions preceding and during the fire could only be related to those observed at Nakina, some 45 miles south. These observations did not correspond with expected and observed fire behavior at Ogoki and thus will not be related here.

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[1] C. E. Van Wagner, Petawawa Forest Experiment Station and B. J. Stocks, Ontario Region, Canadian Forestry Service, Sault Ste. Marie, as well as the author.

The final size of the fire was mapped at 5,000 acres, and an aerial reconnaissance of the area revealed that the fire burned in at least three different manners. In some areas of black spruce, complete crowning and total destruction occurred, with an estimated rate of spread of 75 to 100 ft per min. These areas appear blackened from the air. Other areas showed up as brown patches--the fire in these cases being sufficiently intense to scorch and kill tree crowns. An estimated rate of spread in these areas would be 20 ft per minute. Still other locations within the burn appeared completely normal from the air; a ground survey, however, revealed the occurrence of a very gentle surface fire with an estimated low rate of spread (2 to 5 fpm) and with occasional evidence of hot smoldering at the base of some trees.

*Stevens Fire, June 1970*

This fire occurred just east of the former village of Stevens, (on the C.N.R. line) about 40 miles southeast of the town of Longlac. Cause of the fire was attributed to hot brake shoe pieces thrown from a westbound heavy freight train which passed at approximately 11:15 a.m. on the morning of June 6, 1970. When an initial suppression force arrived 1 1/2 hrs later, the fire was, in effect, burning uncontrollably. By 4:15 that afternoon, following a substantial increase in the strength of the attack force, the fire had essentially completed its total run of about 2 1/2 miles and burned an estimated 1,075 acres. The fire was roughly elliptical in final shape with an average width of 2/3 of a mile. The topography in the area might be classed as steeply rolling and the fuels consisted of 1) an old cutover area; 2) areas of standing, mature jack pine (with some spruce, aspen, and white birch in the hollows), 50 to 60 ft high, medium stocking and 3 to 4 in. of duff over mineral soil.

Fire weather observations, from Caramat Tower 12 miles away, are presented in Table 1.

Post-fire observations showed that the fire started in grass along the right-of-way, and by the time it had advanced 100 ft was intense enough to kill crowns of standing, 30- to 40-ft jack pine. The fire next reached a jack pine ridge and fanned by a 7- to 10-mph wind spread very quickly, causing severe damage to the stand. The fire then spread into a 15-yr-old cutover with grass and brush vegetation and sparse jack pine regeneration. The rate of spread here was probably quite fast but spotty, with light brush being burned, and being an open area, the fuel was probably quite dry. The fire then encountered another jack pine ridge and again began to increase in intensity and rate of spread, with crowning soon occurring. Fuel consumption both in the crowns and on the ground was very high with much mineral soil exposed (some jack pine regeneration was observed to have started already, 4 months after the fire, and a quantity of seed was observed on the ground).

Knowing that the fire's main advance was about 2 1/2 miles over a period of roughly 5 hours, it is possible to calculate an average rate of

spread of 44 ft per min. The fire burned about one-half of its length in the old cutover and the other half in standing timber. If we assume the rate of spread in the jack pine ridges to be twice that in the cutover, we can calculate an assumed average rate of spread of 33 fpm on the cleared areas and 67 fpm in the standing timber. These figures may be far from actual but indicate what rate of spread might have occurred using these basic assumptions.

Using our assumed rates of spread and guessing the fuel consumption to be around .2 lbs per sq ft in the slower burning area and .5 lbs per sq ft in the standing timber area, then it is possible to make some very rough estimations of fire intensities from the formula:

$I = HWR$ (Byram, 1959) where I is energy output rate per unit length of front, Btu. $sec^{-1}$ $ft^{-1}$

H is heat of combustion, Btu. $lb^{-1}$

W is fuel consumed, lbs $ft^{-2}$

R is rate of advance, ft $sec^{-1}$

If we also assume H to be 8,000 Btu. $lb^{-1}$ then we get total heat output of 880 Btu. $sec^{-1}$ $ft^{-1}$ in the slower burning, open area and 4,400 Btu. $sec^{-1}$ $ft^{-1}$ in the slower burning, open area and 4,400 Btu. $sec^{-1}$ $ft^{-1}$ in the stands.

*Prescribed Burn No. 6*

The purpose of this burn as outlined in the proposed prescribed fire plan was to remove cutover slash and immature balsam fir to permit hand planting of white and black spruce seedlings. Hazard reduction in the area was considered an added benefit of the burn[2].

The area is located about 8 miles south of Longlac in Kimberly-Clark Management Unit and yielded around 2,500 cords of pulp during the winter of 1969-70. The composition of slash remaining was 60% spruce, 30% jack pine and 10% balsam. Numerous pockets of balsam in the understorey were immature and considered unmerchantable. A low cordage of merchantable poplar was cut on the area although to a large extent this species was overmature and left standing.

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[2] Much of this information was obtained from an unpublished report on P.B. No. 6 prepared for the Ontario Department of Lands and Forests by Mr. Allan Johnson, fire boss, and Deputy Chief Ranger at Longlac subdivision.

The initial proposed plan called for the burn to be carried out in August or September under wind conditions 7 to 10 mph from the south or southwest, and a Burning Index (old Canadian system) of 8 to 11.

After a great deal of planning and reconnaissance, and observing weather conditions, August 6, 1970 was chosen as the day to commence the prescribed burn. Wind conditions at first were considered too light, but as the fire progressed, proved to be adequate--in fact higher winds may have presented control difficulties. A weather station was established on the site on August 1 (Table 2) and during the burn, 1/2-hourly readings were maintained.

Ignition began at 9:45 in the morning and by 3:00 p.m. a 1-mile strip of front had been ignited. During this period, the relative humidity dropped from 75% to 40% while winds remained light at 2 to 4 mph (FWI at noon was 12). This initial area was burning somewhat upslope and against the wind with a V-shaped ignition pattern and a rough estimate of rate of spread would be about 5 fpm. In the next two areas ignited, however, the burn maps and communication with the fire boss indicate a rate of spread of about 25 ft per min in clear-cut areas of what was estimated to be 2 ft of fairly continuous slash with some standing balsam and birch which were burned by the fire. Post-fire analysis revealed that 3 to 4 inches of duff was left on the area. This area was said to have burned the "hottest and most impressive" of any during the whole prescribed burn and the convection column supported by all areas burning at this time rose to a height of 5,000 ft, generating its own cloud formation which was reported to have produced some thunder activity.

Using a spread rate of 25 fpm and an estimate of fuel consumption to be 1.0 lbs/sq ft it is then possible to estimate an intensity of 3,320 Btu. $sec^{-1}$ $ft^{-1}$ for this area.

Burning continued until 10:30 p.m. on the first day and included some 580 acres. On August 7 an additional 620 acres were ignited but burning was less intense and somewhat patchy due to higher relative humidities (>55%) and very light winds during most of the day. Some clean-up burning was continued on August 8 and 9 with a final total of 1,375 acres being burned. Patrols were continued on the fire until early September and on October 5, 1970 it was declared officially "out". On the whole, PB-6 is an excellent example of a well planned and well executed prescribed burn which accomplished its prime objectives at a reasonable cost.

## DISCUSSION AND CONCLUSIONS

The original idea behind the visit to these fires was to determine if any useful estimates of fire behavior in varying fuel types could be gathered from visiting past fires and discussing their history with fire control personnel. These visits and

resulting discussions proved that reasonable observations of fuel type, probable rates of advance, and fire weather conditions can be collected in this way. In some cases, if the control officer has maps and related times of a fire's position, an actual visit to the fire may not be necessary. To obtain reliable figures for actual fuel quantities available and consumed, however, would have taken more time than the 1 1/2 days available for this trip. Next field season, with the continuing cooperation of the Ontario Department of Lands and Forests, visits will be made to the site of major fires while burning or as soon as possible after their occurrence to obtain further information. More time will be spent on estimating fuel characteristics and consumption in order to further enhance our ideas on wildfire behavior under a wide range of fuel conditions.

## ACKNOWLEDGMENTS

The author wishes to acknowledge the cooperation and accommodation of the Geraldton District fire staff under the supervision of Mr. John F. Goodman, and also the consultation with his colleagues C. F. Van Wagner and B. J. Stocks.

## REFERENCE

BYRAM, G.M. 1959. Combustion of forest fuels, p. 61-89. *In* K.P. Davis (ed.) Forest fire: control and use. McGraw-Hill, New York.

Table 1. Noon fire weather recorded at Caramat Tower.

| Date | Noon RH | 24-hr rain | Wind vel mph | ADMC[a] | FWI[a] |
|---|---|---|---|---|---|
| June 5 | 39 | - | 2 | 17 | 6 |
| 6 | 33 | - | 7 | 21 | 12 |
| 7 | 39 | .23 | 5 | 15 | 0 |

[a] ADMC and FWI refer to Adjusted Duff Moisture Index and Fire Weather Index, respectively (Canadian Forest Fire Weather Index, 1970. Canadian Forestry Service, Department of Fisheries and Forestry).

Table 2. Noon fire weather recorded on site at Prescribed Burn No. 6

| Date | Relative humidity | 24-hr rain | Wind vel mph | ADMC[a] | FWI[a] |
|---|---|---|---|---|---|
| Aug. 1 | 40 | - | 2 | 48 | 13 |
| 2 | 68 | .50 | 10 | 28 | 1 |
| 3 | 92 | .04 | 9 | 28 | 1 |
| 4 | 42 | - | 7 | 33 | 7 |
| 5 | 50 | - | 4 | 36 | 9 |
| 6 | 44 | - | 4 | 39 | 12 |
| 7 | 59 | - | 4 | 39 | 10 |
| 8 | 52 | - | 5 | 46 | 14 |
| 9 | 60 | - | 6 | 57 | 11 |

[a] ADMC and FWI refer to Adjusted Duff Moisture Index and Fire Weather Index, respectively (Canadian Forest Fire Weather Index, 1970. Canadian Forestry Service, Department of Fisheries and Forestry).