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THE EFFECT OF GREEN VEGETATION ON SURFACE FIRE SPREAD IN THE LABORATORY

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INTRODUCTION

It has long been recognized in forestry that minor vegetation leafing out on the forest floor in the early spring retards the advance of surface fires. This experiment was designed to provide some general understanding of this effect. The work was done in the fire research laboratory at the Petawawa Forest Experiment Station at Chalk River, Ontario, during the summer of 1967.

METHODS AND RESULTS

Altogether six fires were burned in still air in a tray 4 feet long and 2½ feet wide, under a smoke hood. The area of the fuel bed was divided lengthwise into two equal sections by a galvanized metal strip. A total of 600 grams of red pine needles was spread over the whole tray, and green vegetation was distributed on one section only. The vegetation was selected randomly from the floor of a white pine stand, and included low shrubs, ferns, herbs and grasses. The amount added varied from 30 to 180 grams, green basis. Just before burning, moisture content samples were taken from both the red pine needles and shrubs. Fire was set simultaneously on each side of the galvanized strip which served to keep the two fires from running together. As the fires moved along the bed their rate of advance was recorded at 6-inch intervals with stop watches. The rate of spread was

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calculated for each side over the last 3½ feet of the fire bed to allow for uneven starting. The rates are listed in Table 1, along with the weighted average moisture contents for the combined fuel bed of green vegetation and pine needles. Rate of spread was then plotted against this moisture content (Figure 1).

Also shown in Figure 1 are data obtained from a previous experiment (Van Wagner 1967) in which rate of spread was plotted against moisture content of red pine needles alone.

In the present experiment, the fires in the part of the bed containing only red pine needles were used as controls. The average rate of spread for all six of these control fires was plotted in Figure 1. This point lies close to the curve obtained with Van Wagner's data.

DISCUSSION AND CONCLUSION

The most obvious result of the experiment is that the green vegetation had surprisingly little effect on the rate of spread. Although most of the flame was suppressed, the fires crept along under the green vegetation. The same amounts of moisture actually distributed within the needles would have had a much greater effect on rate of spread, as can be seen in Figure 1.

A fair conclusion from this experiment is that green vegetation has little effect on fires burning in litter in still air or against the wind, since these fires advance mainly by transferring heat ahead through the fuel layer. However, in head fires driven by wind the flames themselves become

important in transferring heat to ignite the fuel ahead. Large amounts of green vegetation are then perhaps more effective in retarding rate of spread.

The authors wish to acknowledge the helpful advice of C.E. Van Wagner during the writing of this report.

REFERENCE

Van Wagner, C.E. 1967. Fire behavior mechanisms in a red pine plantation: Laboratory and field evidence. Papers of XIVth IUFRO Congress, Munich. Vol. V: 747-781.

Table 1. Fuel moisture content and rate of spread for the six fires in the tray section containing needles plus green vegetation.

	rP needles			Green vegetation				
Fire No.	M.C. (%)	Wet wt. (gms)	Dry wt. (gms)	M.C. (%)	Wet wt. (gms)	Dry wt. (gms)	Weighted av. M.C. (%)	Rate of spread (ft/min.)
1	11.40	300.0	269.3	377.99	30.0	6.3	19.75	0.51
2	12.35	300.0	267.0	242.88	60.0	17.5	26.53	0.47
3	9.18	300.0	274.8	222.68	90.0	27.9	28.85	0.46
4	12.16	300.0	267.5	319.40	120.0	28.6	41.85	0.41
5	11.40	300.0	269.3	377.99	150.0	31.4	49.66	0.39
6	7.69	300.0	278.6	313.98	180.0	43.5	49.04	0.40

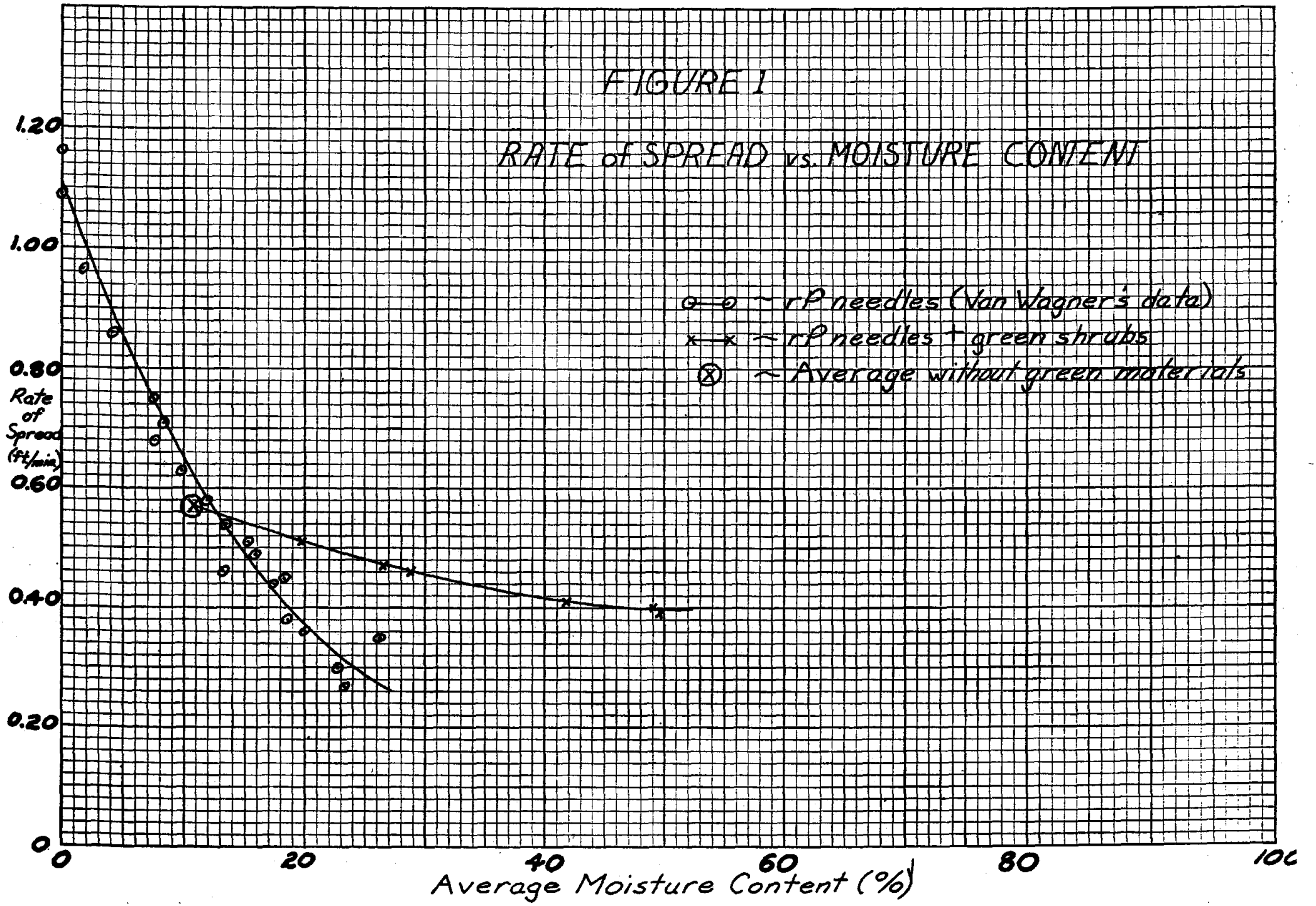
FIGURE 1
RATE of SPREAD vs. MOISTURE CONTENT
o—o ~ rP needles (Van Wagner's data)
x—x ~ rP needles + green shrubs
⊗ ~ Average without green materials
1.20
1.00
0.80
0.60
0.40
0.20
0
Rate of Spread (ft/min)
0
20
40
60
80
100
Average Moisture Content (%)