MANJIMUP RESEARCH

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MANJIMUP

FIRE RESEARCH REPORT ON GRASSFIRE STUDY BALINGUP HILLS

Objective

The study was undertaken in March 1975 to test the applicability of a metricated version of the "Grassland Fire Danger Meter" designed by A.G. McArthur, to grassland fires in grass fuels of Southern West Australia.

The data from the test fires at Balingup were also to test the fuel density/quantity table developed by R.J. Sneeuwjagt as a refinement to the "Grassland Fire Danger Meter".

Location

The study area was situate on old agricultural land 2½ miles south west of Balingup, and comprised a ridge top running east-west. A block, (Block A) of 8 plots was laid out on the north facing slope, and a block, (Block B) of 4 plots on the south facing slope (the slopes on both blocks ranged from 5° to 12°). The plots in Block A measured 35 metres by 50 metres each and the plots in Block B, 30 metres by 40 metres. In early March, plots were separated by 3 metre-wide breaks, and a 5 metre-wide break was inserted along the top boundary of the blocks on the range top to help in the fire control.

Field Methods

Fuel Assessment. A fuel assessment of each plot was carried out to determine the average grass height. Twenty random measurements were taken in each plot. In order to determine average fuel weight, four quadrats, one foot square, were removed from each plot. These were oven dried and weighed. From the oven dry weight and height, an average bulk density was calculated for each plot, (Appendix 1). On the north facing area (Block A) the average height was 39.7 cm and the average weight was 4.4 tonnes per hectare, giving a bulk density of 1200 grams per cubic metre. On the south facing area (Block B) the heights averaged 27.5 and the weights averaged 3.2 tonnes per hectare giving a bulk density of 1300 grams per cubic metre.

Experimental Fires

Two spot fires were lit on the edge of each plot and the rate of headfire spread noted at fifteen second intervals with metal tags on the headfire only.

The flame height and flame length were recorded at 3o second intervals, as well as any local variations of fuel quantity and density encountered by the headfire.

Weather readings were taken at regular intervals throughout the duration of each fire. The air temperature and relative humidity were recorded at the beginning of each fire using a "Casella" aspirated hygrometer. Wind velocity readings were taken at 30 second intervals at 1.5 metres above the ground using a 'Casella' mechanical anemometer, and at 10 minute intervals 10 metres above ground using a 'Rimco' electrical anemometer. Some trouble was encountered with the electrical anemometer due to faulty connections, and to restrictions in the machine at high wind velocities . Therefore the 1.5 metre readings were used throughout on the calculations of rates of spread.

Fuel moisture content samples were taken at the start of the burning and at the end. Because of the small time interval there was no appreciable change in the moisture content between the two readings.

Results (See Appendix 11).

A range of rates of headfire spread from 0.1 kilometres per hour to 2.0 km/hr was achieved. The two fastest fires were in plot 8 in Block A which had dense fuel, and the highest average wind velocity during the fires. The slow fires were in Block B because these fires were burnt on a day of low winds and the fuel in these plots was light and trampled.

Discussion

The rates of headfire spread measured in the testfires were plotted (Appendix 111) against the headfire rate of spread calculated using the Fire Danger Meter by A.G. McArthur, using the weather data collected during the fire and the headfire slope which was measured when the rate of spread was measured. Using this Fire Danger meter alone was found to underestimate the higher headfire rates of spread, and overestimate the slower fires. This effect was caused by this meter being applicable to only the medium density fuels. The correlation coefficient for this graph was 0.679.

When the density and slope tables developed by R.J. Sneeuwjagt were used, the accuracy in the faster fires and in the slowest fires was considerably increased, giving a correlation coefficient of 0.838.

Conclusion

The Fire Danger Meter when used with the density and slope adjustment tables gives an adequate estimate of the headfire rate of spread for average summer conditions.

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APPENDIX 1

Plot No.	Block	Fuel Weight (Tonnes/ha)	Fuel Height (cm)	Bulk Density gm/cu m
1	(A)	4.6	41.1	1120
2	(A)	4.0	34.9	1150
3	(A)	3.3	48.6	680
4	(A)	5.0	24.6	2030
5	(A)	4.5	48.0	940
6	(A)	4.6	30.5	1510
7	(A)	5.0	46.7	1070
8	(A)	4.0	43.4	920
1	(B)	3.1	19.9	720
2	(B)	2.8	20.8	1570
3	(B)	3.7	23.5	1350
4	(B)	3.3	45.7	

APPENDIX 11

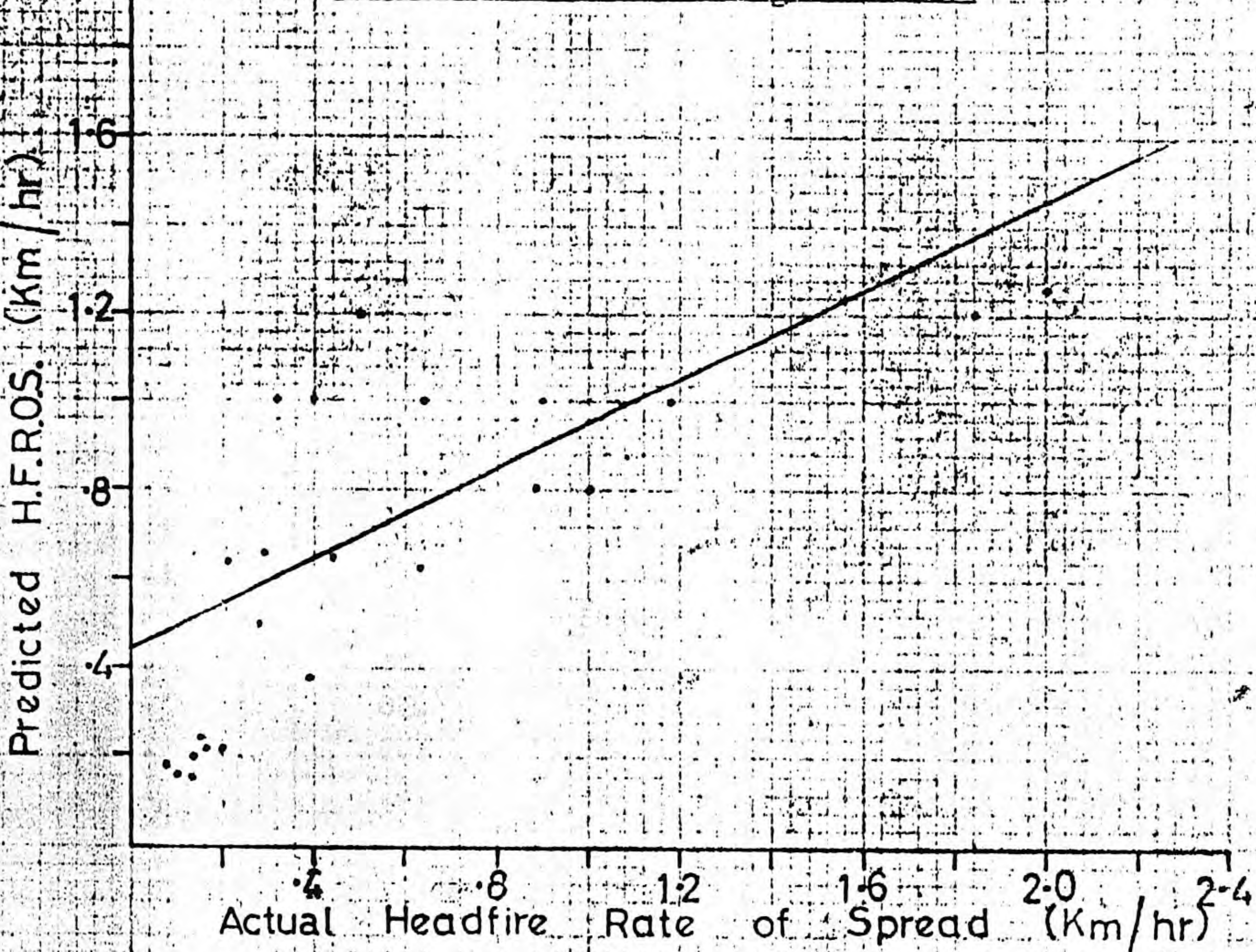
Slope and Weather Factors of Balingup Grass Fires

Fire No.	Fuel Type Rating	Headfire Slope (degrees)	Ave. Wind Speed km/hr	Temp. °C	R.H. %	Moisture Content
1 A	Dense	+ 6	17.7	21	48	13.2
1 B	Dense	+ 5	17.7	21	48	13.2
2 A	Medium	+10	14.3	19.5	47	13.2
2 B	"	+ 8	14.3	19.5	47	13.2
3 A	"	+ 9	12.2	21	52	13.2
3 B	"	+ 7	12.2	21	52	13.2
4 A	"	+12	12.1	22	46	13.2
4 B	"	+11	12.1	22	46	13.2
5 A	"	+ 6	15.5	20	44	12.7
5 B	"	+ 7	15.5	20	44	12.7
6 A	"	+ 4	11.7	19.5	54	12.7
6 B	"	+ 6	11.7	19.5	54	12.7
7 A	"	+ 9	10.7	20.5	51	12.7
7 B	"	+ 9	10.7	20.5	51	12.7
8 A	"	+ 5	9.9	22.5	47	12.7
8 B	"	+11	9.9	22.5	47	12.7
9 A	Sparse	0	5.1	27.5	32	10.4
9 B	"	0	5.1	27.5	32	10.4
10A	"	+ 9	4.4	26.5	44	10.4
10B	"	+ 3	4.4	26.5	44	10.4
11A	"	- 7	9.5	26.5	38	10.4
11B	"	+ 3	9.5	26.5	38	10.4
12	"	+ 9	5.5	29.0	39	10.4

APPENDIX 111

Fire No.	Plot	Av. H/F (metres) Flame Ht	Av. H/F (metres) Flame length	Headfire R.O.S. (km/hr)	McArthurs F.D.M. R.O.S.	R.O.S. F.D.M. + Fuel Adjustment
1 A	8 A	0.25	0.58	2.03	1.25	1.8
1 B	8 A	0.35	0.9	1.84	1.20	1.8
2 A	7 A	0.46	1.6	0.49	1.20	1.2
2 B	7 A	0.17	0.4	0.32	1.02	1.2
3 A	6 A	1.0	1.5	0.88	0.8	0.8
3 B	6 A	0.8	1.25	1.08	0.8	0.8
4 A	5 A	0.6	1.10	0.64	1.03	1.03
4 B	5 A	0.6	1.10	1.18	1.03	1.03
5 A	4 A	0.6	0.9	0.39	1.05	1.05
5 B	4 A	0.4	0.8	0.88	1.05	1.05
6 A	2 A	0.75	1.1	0.36	.49	.49
6 B	2 A	0.20	0.3	0.32	.56	.56
7 A	3 A	0.79	1.2	0.44	.65	.65
7 B	3 A	0.3	0.5	0.31	.65	.65
8 A	1 A	0.47	0.9	0.38	.38	.56
8 B	1 A	0.7	1.1	0.63	.63	.75
9 A	4 B	0.69	0.8	0.20	.23	.12
9 B	4 B	0.6	0.8	0.17	.23	.11
10 A	3 B	0.5	0.8	0.18	.25	.11
10 B	3 B	0.1	0.1	0.09	.18	.09
11 A	2 B	0.3	0.4	0.13	.19	.12
11 B	2 B	0.2	0.3	0.10	.81	.23
12	1 B	0.4	0.6	0.15	.72	.20

H.F.R.O.S. Actual v Predicted from Grassland Fire Danger Meter



H.F.R.O.S. Actual v Predicted from Grassland F.D. Meter + Density + Slope Adjustments