REPORT ON STIRLING RANGE FIRE STUDY

SPRING 1973

PLOT ESTABLISHMENT

Following consultation with Dr. Weston two areas were selected to represent typical vegetation types on Southern and Northern aspects.

The Northern aspect site is situated on the junction of the Twins and Yetemerup Tracks. It incorporates a flat area and a hillside area designated 2B and 2A respectively.

The Southern aspect site consists of two separated areas. The slope plots (1A) are placed in a blind gully at the end of the South Bluff track, and the flat plots (1B) about 2 kilometres east along the Ellen track. (Fig. 2 illustrates the areas on a map).

Using a D4 bulldozer the areas were broken up into twelve plots of approximately 100 metres x 100 metres making twentyfour plots at each location. A further area of approximately the same size not broken into plots, was marked out for future work.

FUEL TYPES

A TWINS TRACK AREA (Sites 2A and 2B)

The bulk of the fuel consisted of proteaceous vegetation between one and two metres high, with varying proportions of dead material hung up in it. The Dryandra species exhibited this to a marked degree often presenting a dense wall of highly inflammable dead leaves.

Throughout the area were scattered Mallee type Eucalypts, however their effect on the fuel was restricted to a small area under the tree where bark and leaves had been able to accumulate.

The ground fuel then was not a significant factor in the burns carried out as all high rates of spread were caused by

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B (i) Ellen track plots (1B)

Once again fuel consisted of proteaceous vegetation of between 1 and 2 metres in height.

Lambertia sp. not found on the Twins track plots formed a very thin upper storey of between 3 and 4 metres in height. The density of the vegetation was greater on these plots than the Twins plots and it appeared that an older age was the reason.

(ii) South Bluff Plots (1A)

These plots presented a completely different situation to any of the previous areas. Rising from a small creek the lower plots have a moderately dense canopy of jarrah ranging to a height of about 10 metres. The understorey species rise to height of 3 to 4 metres and in places is comparable in thickness to karri understorey. As the elevation increases the trees become more widely spaded and their height lessens. The understorey vegetation also lowers in height although its density remains fairly constant.

FUEL QUANTITY

See attached report.

RESULTS

In all 29 fires were conducted during the period 19/9/73 - 23/10/73. The distribution of these fires between the sites was as follows:

1A	4
1B	9
2A	16
2B	-

The average headfire rate of spread varied from 8 to 350 metres/hr, with fairly even representation through the range.

Fires were conducted in temperatures ranging from 11°C to 21°C and Relative humidities from 78% to 40%.

Wind velocities experienced were from 1.0 to 14.8 km/hr and slopes ranged between 0° and 26°.

Backfire and flankfire development was in the main poor. The fastest backfire rate of spread was 24 metres/hr and in all eight fires failed to sustain a backfire.

Only on one occasion did a flankfire fail to sustain itself.

Fire Shape

As an indication of fire shape the long axis of the fire was divided by the short axis, hence the value 1 would indicate a circular fire and numerically increasing numbers a greater elongation.

Factors found to influence the fire shape were rate of spread and slope in direction of headfire therefore -;

$$\text{FIRE SHAPE} \quad \frac{\text{LONG AXIS}}{\text{SHORT AXIS}}$$

HFROS metres/hr	SLOPES	FLATS
0 - 100	2.5	2.0
100 - 200	5.0	2.5
200 +	8.0	3.0

The significance of these for the purposes of prescribed burning is that an estimation of strip width may be made knowing the expected HFROS and topographical situation.

Slope Effect

Due to the limited number of fires it was not possible to isolate an effect of slope on headfire rate of spread. From observation it appears that in the open heath type vegetation (that covered three out of four of the sites) that wind is such a dominating force that it overrides all other influences. On the occasions when a fire was conducted on a substantial slope (14°) and wind speed was relatively low (4.4 k

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was relatively low (4.4 km/hr) the headfire rate of spread was also very low (54 metres/hr).

I feel that the reason for this is tied up in the fuel distribution. Without a continuous fuel bed flames have to jump from bush to bush and to accomplish this wind is required. Slope on its own did not appear strong enough to lean the flame into the next bit of fuel.

This may not be the case on site 1A however. In this situation there is a fuel bed and the canopy of jarrah eliminates a great portion of the wind effect. Because of unfavourable moisture conditions a successful burn was not accomplished in this type so no comment can be made.

Headfire direction was influenced both by slope and wind. In nearly all cases wind direction and slope direction were within 90° of each other and headfire direction was a resultant of these two forces.

From fires conducted it appears that:

(a) Slopes $< 6^\circ$ Headfire direction closely follows wind direction.

(b) Slopes $> 6^\circ$ HF direction more in slope direction if the wind is 5 km/hr or less.

(c) If wind is 5 km/hr and upwards fire more closely follows wind direction.

Moisture Content

The basket trial initiated prior to burning which was to be measured by the Park Rangers failed.

When the Ranger went on annual leave the assistant ranger was forced to neglect the drying trial with his increased duties. The limited information available through the baskets and sampling before the fires however indicates that drying is very swift.

In only two of our fires were a moisture correction considered necessary to explain lowered fire behaviour.

b!

In all other cases no correction was required after one days drying of rainfalls up to 10 mm. The reason for this must be due to the spatial arrangement of the suspended fuel plus the strong winds blowing through the vegetation.

This was not the case however on the Southern aspect gully where increased rainfall and stronger canopy cover lead to a much slower drying rate and in fact during the time we were burning the area it dried out to just marginal burning conditions which never allowed a successful fire.

Flame length

Flame lengths were plotted against headfire rate of spread and a fairly reliable relationship found.

Headfire Rate of Spread (Metres/hr)	Average flame length (Metres)
0 - 50	0.5
51 - 100	1.4
101 - 150	2.2
151 - 200	3.2
201 - 250	4.2
251 - 300	5.0
301 - 350	6.0

Flame length although important as an indicator of fire intensity does not have much relevance to vegetation damage in the absence of high forest.

Correlation of HFROS with Jarrah ROS Index

Rather than attempt to accurately predict headfire rates of spread from specific jarrah rates of spread index on limited data I have set both into classes.

Hence all fires in the range of 0 - 50 metres/hr were listed together and their jarrah Rate of Spread indexes averaged. This was done for corresponding classes 51-100, 101-150, 151-200, 201-250, 251-300 and 301-350.

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The average jarrah rate of spread index was then plotted against the mid point of the class. This resulted in the graph shown in Fig. 2, except that the 0 - 50 class was smoothed over.

In all cases the wind ratio used was 1.1 and a moisture correction factor was not found to be needed except for two cases when burning was washed out. From the graph a table was drawn up showing expected Headfire rate of spread for jarrah rate of spread indexes in 10 unit intervals.

Jarrah R.O.S. Index	Average H.F.R.O.S. Metres/hr
0 - 10	30
11 - 20	75
21 - 30	110
31 - 40	125
41 - 50	150
51 - 60	180
61 - 70	200
71 - 80	240
81 - 90	~~320~~ 270
90 - 100	285
100 - 110	300

The expected variation on these figures could be ± 30 metres/hr.

This could now be used as a useful prediction of headfire rates of spread knowing the jarrah rate of spread index, although it is only applicable to the heath type vegetation. As virtually no work has been done on the woodland vegetation types it is not known what the H.F.R.O.S. relationship with the Jarrah Rate of Spread Index is.

<u>General Comments on Burning</u>

The burning started well with quite a few fast fires on sites 1B and 2A.

However, a lack of fuel on sites 2B and the dampness of 1A prevented a complete programme being accomplished.

As spring progressed conditions deteriorated instead of improving, consequently the last two visits to the Park were cut short by heavy rainfalls.

The range of intensity of fires obtained was quite large, however all fires had the same effect on the heath sites, that is complete destruction of the vegetation.

For these sites it appears fire intensity is not a significant factor in the vegetation ecology. Such would not be the case however for site 1A where a heavy overstorey of woodland type Eucalypts could easily be damaged by high intensity fires.

Such damage has occurred along the Chester Pass Road wouth of the Rangers residence (see attached photo), where defoliation has resulted from a severe fire.

— only one print of photo available

__Future Work__

Completion of burning on the as yet untested sites would be necessary to obtain a more comprehensive picture of fire behaviour.

In particular the 1A site where tree growth and slower drying rates are involved needs to be thoroughly investigated. Included in this work should be some extra burning in woodland fuel types not included as yet in the study sites. This would allow the gathering of information on the most fire susceptible part of the park.

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The drying trials need to be redone to find relationships to fit into the jarrah rate of spread index. Also the moisture differential between Southern and Northern aspects must be of importance to a burning guide hence needs investigation.

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