

Fire Management Branch
Department of Conservation & Environment

THE AVOCA FIRE
14 JANUARY
1985

RESEARCH REPORT NO. 23
P BILLING
MARCH 1985

FIRE DEVELOPMENT

At about 1350 hrs on 14 January 1985, a fire started approximately 1 km north of Avoca and just east of the North-Western Highway. (Map 1 shows the origin and subsequent development). Because of the extreme conditions the fire developed very rapidly and it was beyond control within minutes.

By 1430 hrs the fire had burnt south-east through the eastern fringe of Avoca towards the Pyrenees Highway. A desperate attempt to halt the head of the fire at the road failed due to the intense fire behaviour and associated short distance spotting. The rate of spread was close to 3 km/h.

As the spotting process became well established the fire accelerated, so that by 1515 hrs the fire had burnt through the Glenmona Forest, throwing spots more than 0.5 km downwind into grassland. The rate of spread was now close to 7 km/h.

By 1600 hrs the fire had crossed Bet Bet Creek 2 km north-west of Lillicur, while numerous spot fires were burning in the forest area up to 2 km downwind. The rate of spread steadied in the forest and by 1645 hrs the fire front was 1 km north of Peter's Hill.

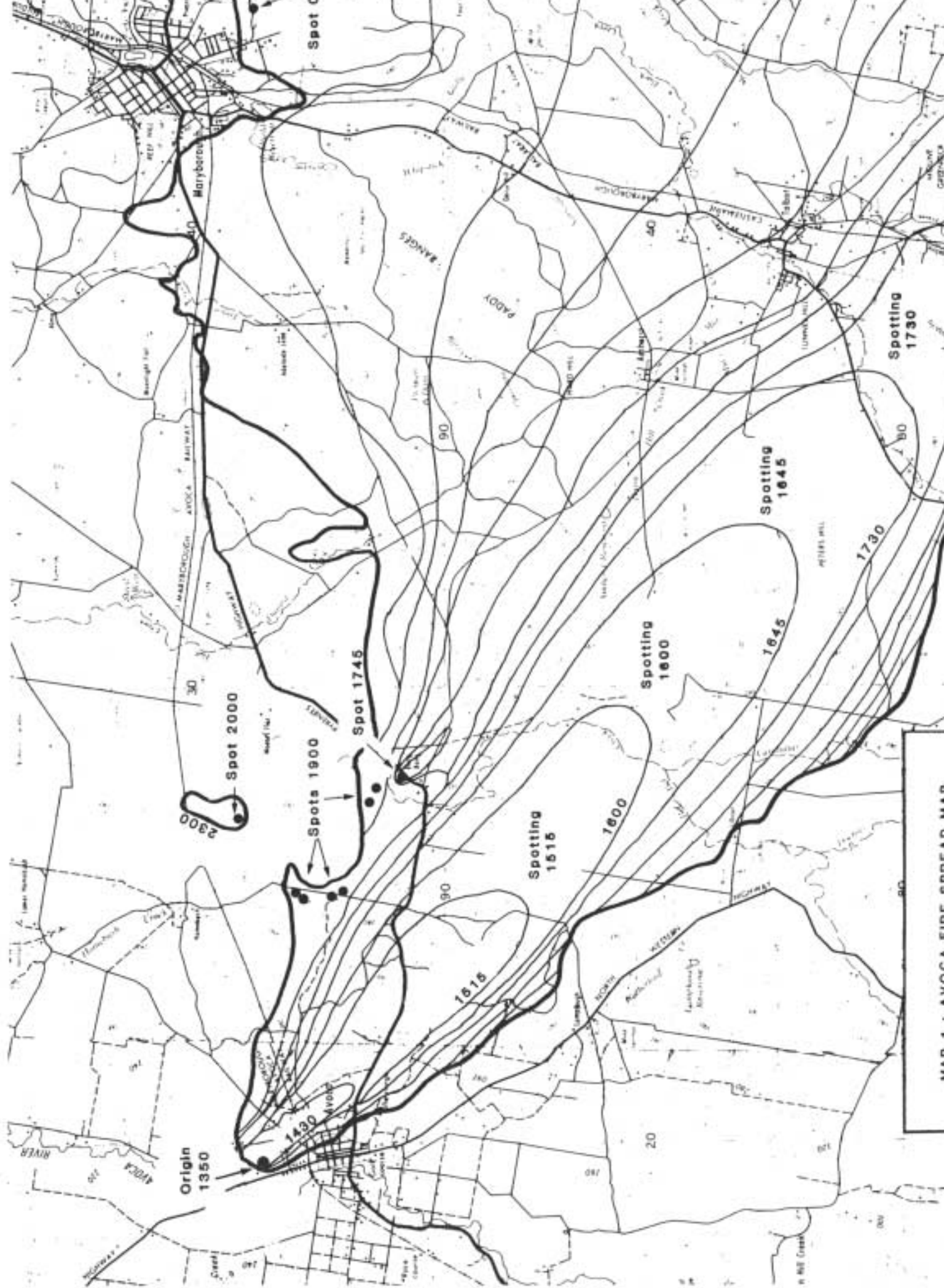
With the rate of spread close to 6 km/h, lower fuel quantities and spotting created a series of fire fronts. The fire crossed Back Creek, south-west of Talbot, at 1730 hrs as the wind began to shift to the west. It spread into grassland causing the rate of spread to increase to more than 12 km/h. A narrow front burnt south of Mt. Greenock, through Dunach at 1800 hrs, then south of Mt. Glasgow along Fell Gully.

By 1830 hrs the front had crossed grassland in a narrow finger to Middle Swamp, while the eastern flank was becoming more active and spreading along a line from Tunnel Hill to Amherst and Bung Bong. A spot fire at Bung Bong was developing parallel with the eastern flank.

Between 1830 hrs and 1900 hrs the wind changed to the south-west and moderated but with spotting more active along the eastern flank, the whole shape of the fire changed as about 28 km of this flank spread rapidly north-east towards Maryborough. Even though the wind change gradually brought in cooler moist air, the fire entered a period of erratic behaviour. The spread rate was around 5 km/h.

By 2000 hrs the eastern front had spread in a line through Hard Hill to Fawcett Hill. The fire spread was much faster in grassland than in the box-ironbark forest, and a long tongue had spread part way along the western edge of Tullaroop Reservoir by 2030 hrs as Daisy Hill was threatened.

The fire reached the outskirts of Maryborough at 2130 hrs after burning through the settlements of Craigie and Majorca. Grassland north of Majorca continued to burn rapidly and by 2330 hrs the fire had crossed the Pyrenees Highway at Mt Moolort, and reached the edge of Carisbrook and spread across the highway just west of Maryborough.



MAP 1. AVOCA SIDE SPOT ELEVATION MAP

A wind changed to the south-east around 2400 hrs brought a new threat to Maryborough as the fire spread through Mosquito Flat but by 0300 hrs 15 January 1985 conditions had moderated and the fire was relatively inactive.

Despite very high fire danger on 15 January, firefighters controlled all edges except for small breakaways at Dunira Creek to the west of Maryborough, and north of Mt. Moolort.

The total area burnt was approximately 50 800 ha.

WEATHER

Temperature, relative humidity, wind speed and direction were recorded automatically at Stawell (Table 2), 60 km west of the fire origin. These records are an accurate indication of the weather conditions in the fire area if a phase difference of approximately 30 minutes in the timing of wind changes and subsequent responses in temperature and relative humidity is allowed.

The most notable weather features were the high temperature (41°C) and low relative humidity (10.5%) combined with a strong north-westerly wind (maximum 68 km/h). The south-westerly wind change, which was critical to fire development occurred between 1830 hrs and 1900 hrs.

The upper atmosphere was very dry and unstable (Figure 1). The wind speed profile is shown in Figure 2.

Prior to the wind change a well structured convection column had developed over the fire to an altitude of more than 6000 metres. Following the south-westerly change this strong convection column persisted (Figure 5) although a low level inversion (Figure 1) tended to trap smoke, so that down wind of the fire visibility was very poor.

FIRE BEHAVIOUR

The FDI (1) is shown in Figure 3. It reached 100 at about 1130 hrs and remained off the scale until 1800 hrs at Stawell, although at Avoca it did not drop until the wind changed between 1830 hrs and 1900 hrs. The FDI's were similar to those recorded on Ash Wednesday, 16 February 1983.

A summary of the fire behaviour is shown in Table 1. Extreme fire danger conditions persisted for 9.5 hours on 14 January, but despite this the fire behaved in a very predictable manner and was another example of how a fire spreading under the influence of a north-west wind is influenced by a south-west wind change.

Forward rates of spread peaked at around 12.4 km/h in grassland which agrees with those predicted by the McArthur Grasslands Fire Danger Meter. A spread rate of around 12 km/h was sustained for an hour between 1730 hrs and 1830 hrs. (Figure 4).

Earlier in the development of the fire, spread rates of 6 to 7 km/h were observed in a mixture of grassland and box-ironbark forest. These rates of spread are consistent with estimates from McArthur's Fire Danger Meters.

(1) Fire Danger Index from the Mark 5 Forest Fire Danger Meter.

In areas of predominantly box-ironbark forest (Figure 6), where fuel quantities were less than 15 t/ha, spread rates were less than 5 km/h. In many instances the absence of fuel in well grazed or cultivated paddocks and forest areas broke up the fire spread so that while some areas were burnt in the path of the main fire, other areas nearby remained unburnt for several hours.

Spread rates following the south-west wind change were 4 to 5 km/h in most areas even though the fire danger eased quickly.

In grassland where fuels were heavier, such as along Back Creek, McCallum Creek and Narragil Creek, spread rates were probably as high as 7 km/h for short periods.

Mass short distance spotting was a major feature of this fire. Under extreme conditions with an unstable atmosphere spot fires were starting up to 2 km downwind, developing very rapidly, initiating further spotting and often creating new fronts.

Spotting increased along the eastern flank as the wind change approached. At Bung Bong spotting was very active and a series of spot fires which started after 1900 hrs in open country were quickly controlled. Figure 7 shows the effect of the wind change on the spread of a spot fire near Talbot.

Table 1 and Figure 8 show that the area rate of spread increased dramatically as the south-westerly wind change affected the fire. In the first 4.5 hours the fire burnt at a rate which increased to about 9000 ha/h, while the forward rate of spread reached more than 12 km/h.

Immediately following the wind change the area rate jumped to a very high 12,000 ha/h even though the forward rate of spread eased to around 5 km/h. About 65% of the total area was burnt following the wind change (Figure 9).

On the north-east sector of the fire, from Avoca to Bung Bong, a flank of more than 10 km was largely held before the wind changed and this had a profound impact on the total area burnt. If this sector had not been held the wind change would have certainly spread the fire in the open grassland along Bet Bet Creek past Wareek and probably as far as Timor. This would have increased the area burnt, property losses would have been higher and no doubt more houses on the fringe of Maryborough would have been destroyed.

ACKNOWLEDGEMENT

This report was compiled with assistance from many people, but in particular staff of Department of Conservation, Forests and Lands at Maryborough and members of the Country Fire Authority.

FIGURE 1 : TEMPERATURE PROFILE-LAVERTON, 14 JAN 1985

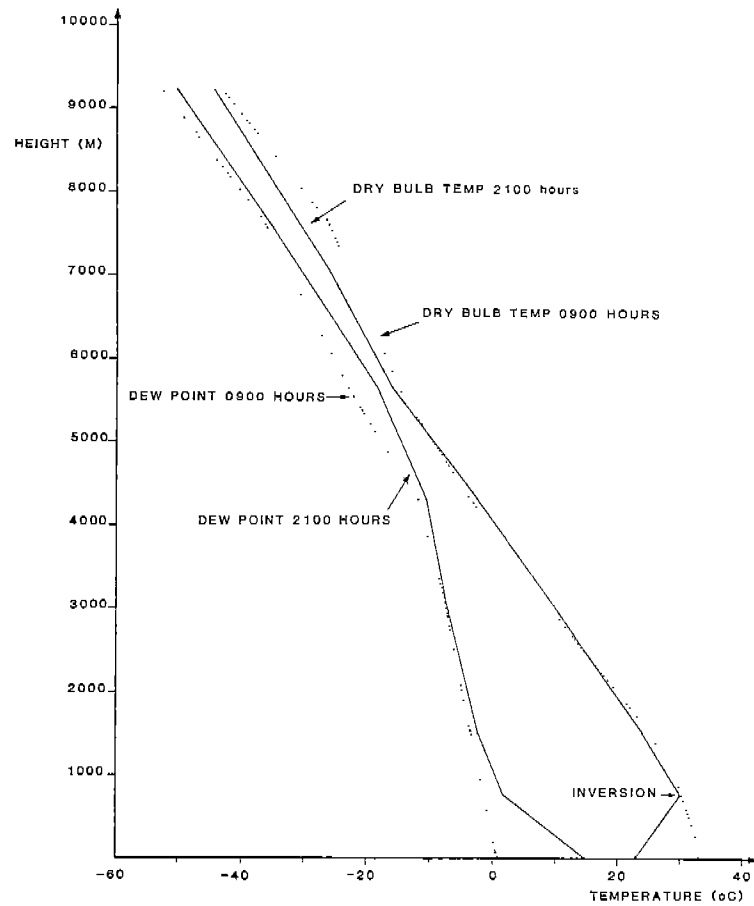


FIGURE 2 : WIND PROFILE - LAVERTON, 14 JAN 1985

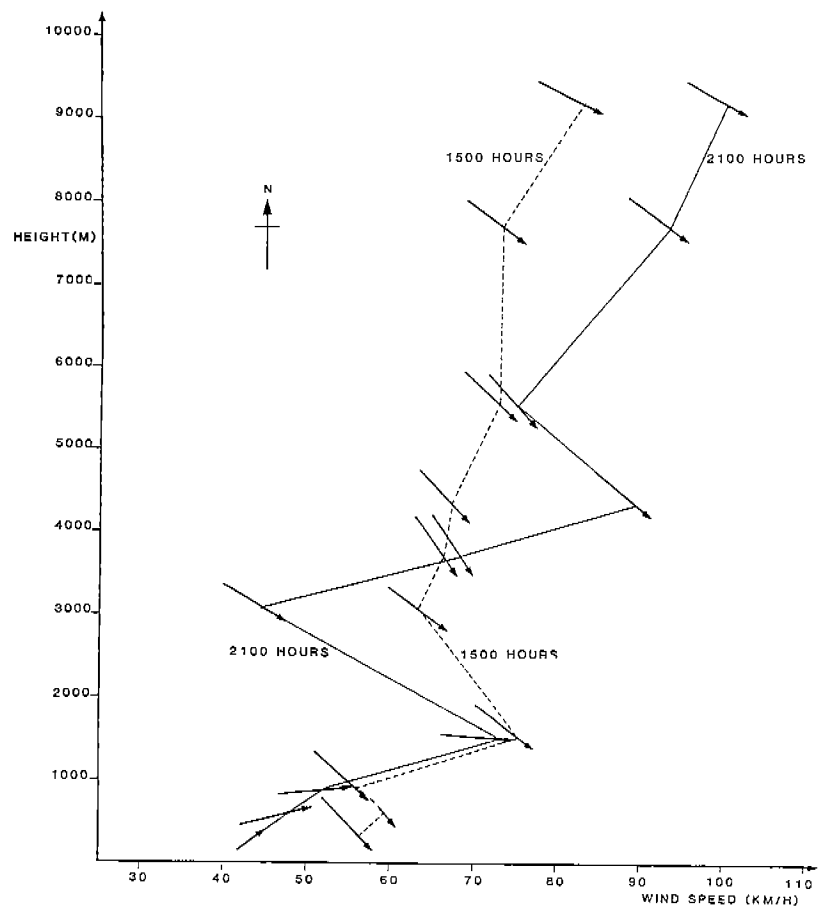




FIGURE 5 : CONVECTION COLUMN SEEN FROM AVOCA - 1930 14/1/85



FIGURE 6 : FIRE IN GLENMONA FOREST - 1915 14/1/85



FIGURE 7 : SPOTFIRE AT TALBOT - 1815 14/1/85

FIGURE 3 : FIRE DANGER INDEX

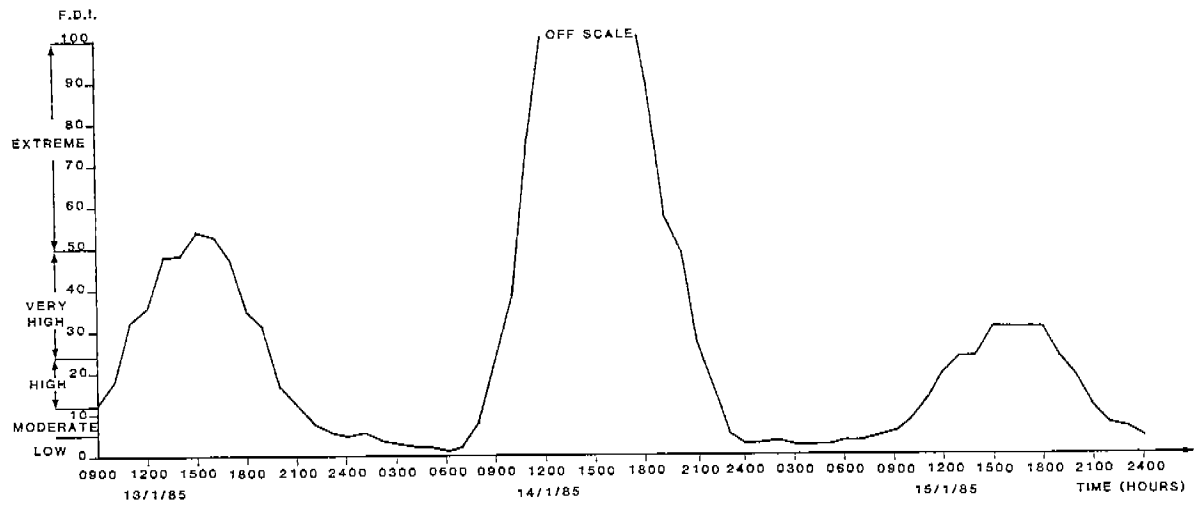


FIGURE 4 : RATE OF FORWARD SPREAD

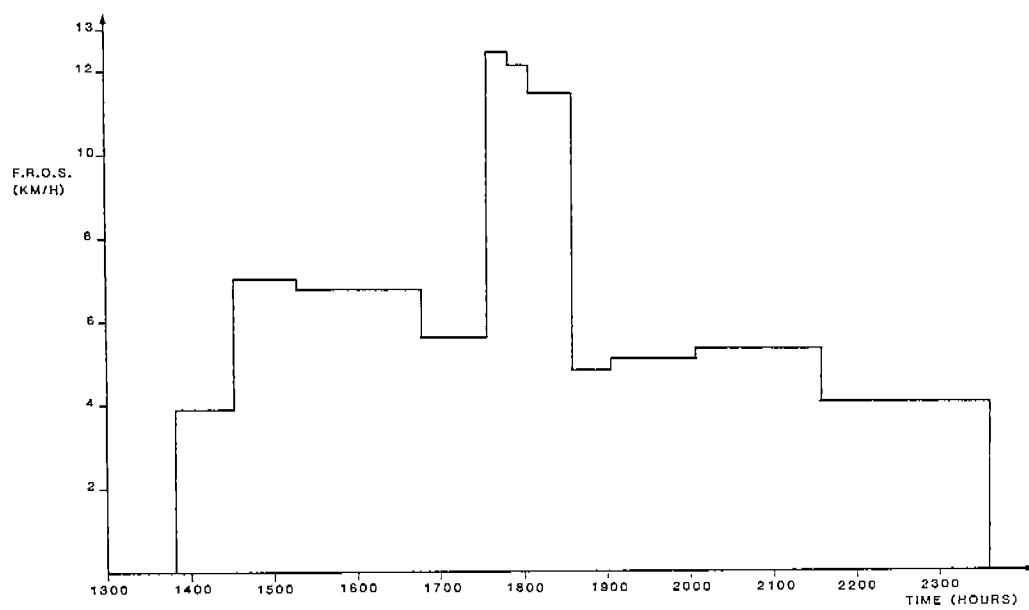


FIGURE 8 : RATE OF AREA SPREAD

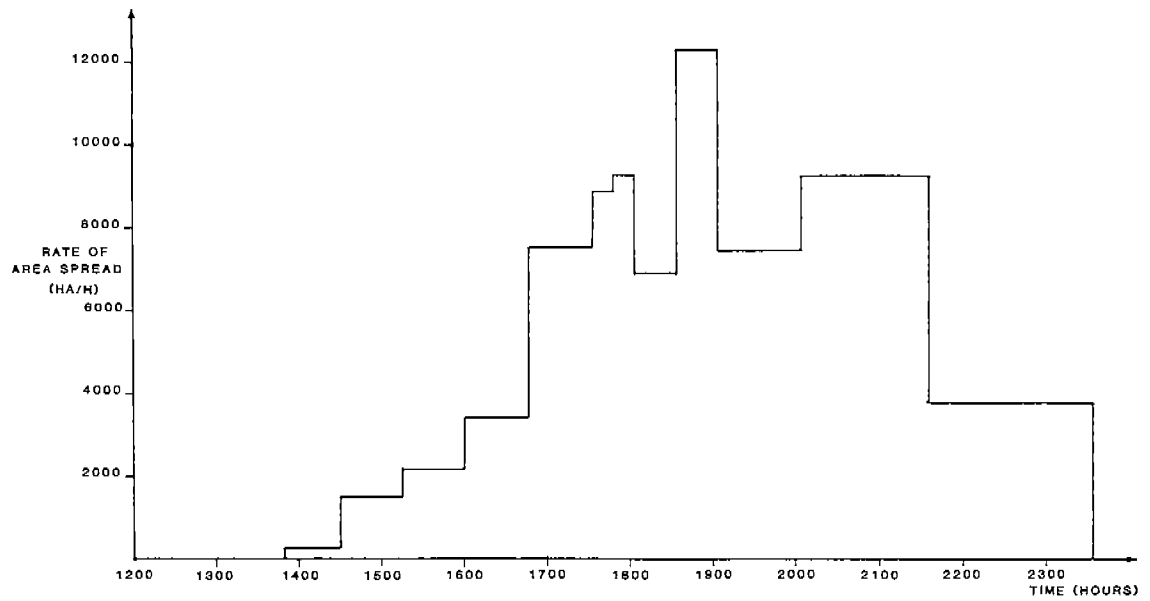


FIGURE 9 : CUMULATIVE FIRE AREA

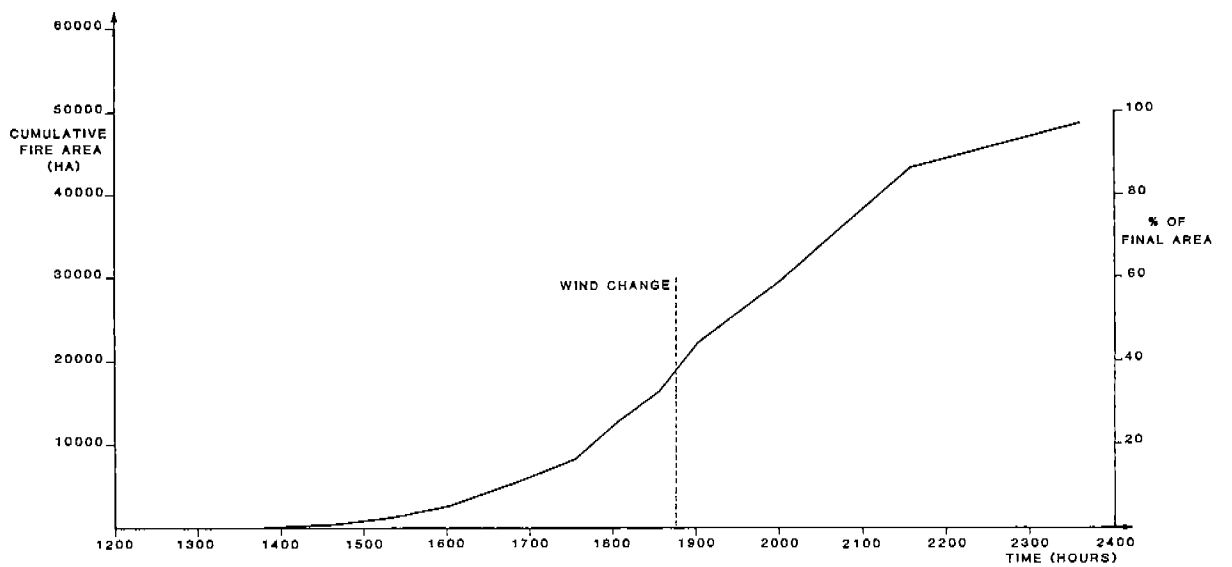


TABLE 1: FIRE BEHAVIOUR

| TIME PERIOD | MIN. | DISTANCE (KM) | FROS (KM/H) | SPOTTING DISTANCE (KM) | RATE OF AREA SPREAD (HA/H) | AREA INCREASE (HA) | CUMULATIVE AREA (HA) | % OF TOTAL |
|-------------|------|---------------|-------------|------------------------|----------------------------|--------------------|----------------------|------------|
| 1350 | 40 | 2.6 | 3.9 | 0.5 | 225 | 150 | 150 | 0.3 |
| 1430 | 45 | 5.3 | 7.0 | 0.8 | 1 467 | 950 | 1 100 | 2.2 |
| 1515 | 45 | 5.0 | 6.7 | 1-2 | 2 133 | 1 600 | 2 700 | 5.3 |
| 1600 | 45 | 5.0 | 6.7 | 1-2 | 3 333 | 2 500 | 5 200 | 10.2 |
| 1645 | 45 | 4.2 | 5.6 | 1-2 | 7 467 | 5 600 | 8 100 | 15.9 |
| 1730 | 15 | 3.1 | 12.4 | 1-2 | 8 800 | 2 200 | 10 300 | 20.3 |
| 1745 | 15 | 3.0 | 12.0 | 1-2 | 9 200 | 2 300 | 12 600 | 24.8 |
| 1800 | 30 | 5.7 | 11.4 | 1-2 | 6 800 | 3 400 | 16 000 | 31.5 |
| 1830 | 30 | 2.4 | 4.8 | 1 | 12 200 | 6 100 | 22 100 | 43.5 |
| 1900 | 60 | 5.1 | 5.1 | 1 | 7 400 | 7 400 | 29 500 | 58.1 |
| 2000 | 90 | 8.0 | 5.3 | 0.8 | 9 167 | 13 750 | 43 250 | 85.1 |
| 2130 | 120 | 8.0 | 4.0 | 0.5 | 3 775 | 7 550 | 50 800 | 100 |
| 2330 | | | | | | | | |

TABLE 2. WEATHER RECORDS (STAWELL)

| TIME/DATE | TEMP(°C) | RH(%) | WIND DIR. (DEG) | WIND SPEED (KM/H) | FDI |
|---------------|----------|-------|--------------------|----------------------|-----|
| 0600 14/1/85 | 14.5 | 75 | 150 | 2 | 1 |
| 0700 | 18 | 77 | 150 | 2 | 2 |
| 0800 | 24 | 35 | 150 | 0 | 8 |
| 0900 | 30 | 25 | 360 | 20 | 24 |
| 1000 | 36 | 20 | 360 | 24 | 38 |
| 1100 | 37 | 15 | 330 | 44 | 76 |
| 1200 | 40 | 12 | 325 | 56 | 100 |
| 1300 | 41 | 11.5 | 330 | 68 | 100 |
| 1400 | 41 | 11 | 330 | 68 | 100 |
| 1500 | 41 | 10.5 | 315 | 60 | 100 |
| 1600 | 41 | 10.5 | 300 | 60 | 100 |
| 1700 | 40 | 10.5 | 300 | 52 | 100 |
| 1800 | 38 | 13 | 225 | 48 | 90 |
| 1900 | 36 | 14 | 235 | 32 | 57 |
| 2000 | 35 | 16 | 225 | 28 | 48 |
| 2100 | 32 | 20 | 210 | 16 | 27 |
| 2200 | 25 | 40 | 150 | 36 | 17 |
| 2300 | 19 | 70 | 160 | 36 | 5 |
| 2400 | 17 | 82 | 170 | 40 | 3 |
| 0100 15/1/85. | 16.5 | 80 | 165 | 32 | 3 |
| 0200 | 15.5 | 83 | 165 | 36 | 3 |
| 0300 | 15 | 85 | 165 | 40 | 2 |
| 0400 | 14.5 | 90 | 165 | 44 | 2 |
| 0500 | 14 | 87 | 180 | 32 | 2 |
| 0600 | 14 | 83 | 180 | 40 | 3 |
| 0700 | 14 | 81 | 165 | 44 | 3 |
| 0800 | 14 | 75 | 180 | 44 | 4 |
| 0900 | 15 | 70 | 165 | 52 | 5 |
| 1000 | 16.5 | 60 | 165 | 44 | 8 |
| 1100 | 19 | 50 | 165 | 48 | 13 |
| 1200 | 21 | 42 | 165 | 48 | 19 |
| 1300 | 23 | 35 | 180 | 44 | 23 |
| 1400 | 25 | 30 | 180 | 32 | 23 |
| 1500 | 26 | 28 | 180 | 40 | 30 |
| 1600 | 27 | 26 | 180 | 36 | 30 |
| 1700 | 27 | 26 | 180 | 36 | 30 |
| 1800 | 26.5 | 26 | 165 | 36 | 30 |
| 1900 | 24.5 | 29 | 165 | 32 | 23 |
| 2000 | 23 | 32 | 150 | 28 | 18 |
| 2100 | 20 | 40 | 165 | 24 | 11 |
| 2200 | 17 | 60 | 180 | 36 | 7 |
| 2300 | 15 | 65 | 180 | 40 | 6 |
| 2400 | 13.5 | 72 | 180 | 32 | 4 |

DROUGHT INDEX STAWELL

14-1-85 306

15-1-85 321