2. Experimental Design

To meet the primary objective of quantifying the change in the behaviour of fire as fuels develop with age, two sites having quite different understorey characteristics were prepared so that each site contained a range of fuels of different age after prescribed burning. The experimental design required that fires be lit simultaneously in each fuel age under conditions that would allow the fires to burn at their potential rate of spread. Fire behaviour characteristics were measured and correlated with fuel and weather variables by regression analysis.

Previous studies on high-intensity forest fire (Project Aquarius – CSIRO unpublished data, Gould *et al.* 1996) indicated that at wind speeds less than 25 kmh^{-1}, fire spreading from a line more than 100 m long and at right angles to the prevailing wind direction would reach its potential rate of spread in less than 100 m from the line and maintain a quasi-steady rate of spread if the mean wind speed remained steady. A 4-ha plot of 200 x 200 m with an experimental fire commenced by instantaneous ignition along a 120 m line oriented at right angles to the prevailing wind was expected to provide a period of quasi-steady potential spread suitable for analysis.

Up to twelve plots were established in each fuel age, and on each burning day an experimental fire was set in each fuel age and burnt simultaneously under the selected conditions.

The experimental design imposed a number of constraints in order to reduce the variation of other factors affecting fire behaviour. These were:

- Fires were burnt in summer under a high drought index, and without the influence of recent rain to ensure the dead fuels were uniformly dry throughout each stratum.
- Fires were burnt under a limited range of surface dead fine fuel moisture. Generally this meant that experimental fires were burnt after 1100 hours when fuel moistures were approaching the minimum for the day (in practice it was necessary to strike a balance between burning at a time when there was a satisfactory moisture content and the wind speed was within the selected range).
- Plots were orientated so that fires burnt on level ground or upslope under the selected wind direction. Previous experiments indicated that even a short pitch of negative slope behind a ridgeline could induce an eddy that would dramatically slow fire spread.
- Fires were burnt simultaneously so that each set of fires on the range of fuel ages experienced a common air mass with associated conditions of temperature, dew point and stability, and a common level of solar insolation.

Half the experiments were scheduled for light winds (<12.5 km h^{-1}) and the other half for moderate winds (12.5–25 km h^{-1}), where wind speed represents the average value over a 10-minute period measured at 10 m height in the open.