Comparison of measured surface fuel moisture content with predicted values from the Forest Fire Behaviour Tables, WA

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Introduction

Fire is a major type of disturbance in the Australian environment, with thousands of fires occurring each year. Fire authorities need to predict fire behaviour not only to assess fire danger and protect lives and properties but to be able to effectively use fire as a tool, as in hazard reduction burns. In most prescribed burning guides, one of the major variables addressed is fuel moisture (Peet 1965, McArthur 1962).

The moisture of the fuel affects the probability of ignition and the rate of spread of a fire. If fuel is very moist, it simply will not burn, or will take a lot of energy to dry out, making the fire less intense, and spread more slowly. Very dry fuel on the other hand, can aid the rapid spread of a fire, as it requires little preheating and will ignite readily.

There are various categories of fuels, living and dead, coarse and fine, and these respond differently to changes in atmospheric moisture depending on how the moisture is held within the fuel structure. The moisture content of live fuel is usually well over 100% of the oven-dried weight of the fuel, because the water is held within the living cells. This means that live fuel moisture does not respond rapidly to changes in atmospheric moisture. However, in some plants it does respond to the effects of seasonal drought and reduces when the plant is subjected to significant drought stress.

Dead fuels hold moisture both within the cellular structure as free water and within the cell walls as hygroscopic water. The fibre saturation point is around 35% in many cellulose materials and beyond this level additional water is held within the cellular structure or between the fuel particles as free water (Schroeder and Buck 1970). The rate of moisture exchange between the fuel and the atmosphere strongly depends on the size and compaction of the fuel particles (Schroeder and Buck 1970).

Large fuel articles exchange moisture slowly. Often they become saturated in the wet season and their drying is related to seasonal drought.

Fine dead fuel exchanges moisture rapidly with the atmosphere and depending on the change in atmospheric moisture fuel moisture content can vary on an hour-to-hour basis.

The fine dead fuel contributes strongly to the rate of spread of a fire because it burns out first and is mainly responsible for the high flames at the leading edge of the fire front. Combustion of large fuel occurs after the fire front has passed. Usually fine fuel is necessary to sufficiently