PROGRAM B

WHAT DIFFERENCE DO PLANTS MAKE TO FIRE BEHAVIOUR?

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INTRODUCTION

Burning 4 years after the 2003 bushfires in Kosciuszko National Park, fires of the 2006-2007 fire season burnt in a fuel bed of regrowing vegetation. A traditional view of fuels suggested that under the weather conditions experienced, fire behaviour would be more controllable due to the younger fuel age class.

In many areas of the Park however, regrowing vegetation had produced an 'extreme' Overall Fuel Hazard (*figures 1 & 2*). The result across the mountains was varied; at times the dense vegetation acted to keep ground fuels shaded and moist, damping fire behaviour. In other instances, fires such as the October 2006 Tooma Dam fire spread in massive sudden runs with no observable change in weather conditions[1]. Rates of spread in such instances were up to 10 times greater than those calculated using McArthur's equations.

This project, begun in 2004, is an attempt to quantify the way fire will behave in different species and arrangements of vegetation. Due to the way fire changes the forest understorey (*figure 3*), this knowledge is essential for effective planning of prescribed burns

OVERVIEW OF THE PROJECT

In order to build such a fire behaviour model, flammability must be quantified at several levels. The ignitability, combustibility and sustainability of flame in burning fuels needs to be understood at the level of individual leaves, branches of a plant, the whole plant and the arrangement of plants and dead fuels in a forest and landscape. Some of these factors have already been studied in the work of others, and this work along with the existing work on the physics of flame behaviour has been incorporated with a varied experimental component. Some of the work and results so far follow:

1. *Leaf ignitability* – Ignition Delay Time at different temperatures studied in a muffle furnace (after Gill & Moore 1996[2]) and related to leaf moisture and surface area : volume ratio. Temperature of the endotherm calculated from the silica-free ash content.[3]

Figure 1. **4 year old regrowth vegetation in a dry sclerophyll forest**

Figure 2. **4 year old regrowth vegetation in Sub alpine woodland.**

Figure 3. Oxylobium **seedlings sprouting following low intensity burning of sub-alpine country burnt 4 years previously. Note these are new seedlings, not re-sprouting stems.**

2. *Combustibility & sustainability of flame in a leaf* – found experimentally to be determined by leaf dimensions[4].

3. *Flame length from a burning branch or plant* – a result of the flame lengths from individual leaves[4] merged into 1 or more discreet flames. Flame merging has been described in a theoretical sense[5], these models are being tested in small-scale experimental fires.

4. *Ignitability of a branch or plant* – an interaction between the plant architecture, the flammability of the leaves and the merged flame lengths of individual branches.

5. *Forest flammability* – studies have found that plant moisture varies seasonally and with weather and soil conditions[6]; this is being confirmed in this project with empirical models. Changing plant moisture, flame tilt due to wind or slope, and the flammability and 3-dimensional spacing of plants interact to define forest flammability.

SUMMARY

Fire behaviour is determined not only by terrain, weather conditions and the quantity of dead fuels present; but by the species of plants, their size, spacing and arrangement in the forest. The introduction or exclusion of fire alters these factors.

Effective prescribed burning programs require knowledge of the forest's ecological response to fire, and of how this will translate into fire behaviour. This project will provide a model to understand and predict that behaviour.

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