Soil temperatures during autumn prescribed burns:

Are they sufficient to trigger germination in fire responsive species?

T.D. Penman[1,2] and A.L. Towerton[1]

[1] Forest Science Centre, NSW Department of Primary Industries

[2] Bushfire CRC

Introduction

Prescribed burning is a common management tool used in native forests worldwide. These burns are generally used to reduce fuels in an attempt to reduce future fire risk and thereby protect assets and property. Some attempts have been made to burn in order to improve ecological values at a site. However, there has been considerable debate regarding the impacts of prescribed burning on native vegetation.

One aspect of the debate surrounding the impacts of frequent burning is the extent to which species recruit following a prescribed burn. Many species require heat and/or smoke cues from fires to trigger germination. If certain temperatures are not reached, germination will not be triggered in these species and post-fire recruitment will be low or non-existent. These temperatures vary between species, but we define 80ºC as a common trigger point after Auld and O'Connell (1991).

Few studies have examined soil temperatures during prescribed burns. In this study, we tested if standard prescribed burns in dry sclerophyll forests were able to achieve temperatures sufficient to trigger germination in seeds at two and five cm below the soil surface.

Methods

The study was conducted in the dry sclerophyll forests of south-eastern NSW. Soil temperatures were measured in 9 broad area burns along 11 transects and in 7 control transects. Measurements were taken at two and five cm below the soil surface using automatic temperature sensors (i-buttons) (Figure 1).

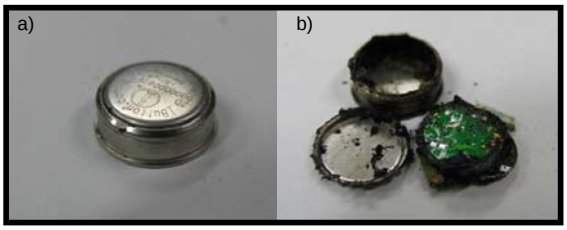

Figure 1: i-buttons after a standard fire (a) and after being superheated under fallen debris (b).

We used a multi-model inference approach with GLMs to determine the factors affecting the maximum temperature reached. The factors considered in the modelling process were:

- the depth of the button;
- the proportion of fuels consumed (measured by pre and post visual assessments); and
- the proportion of the surrounding area burnt (10m radius).

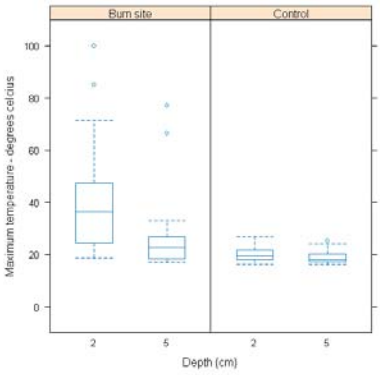

Figure 2: Ranges of values for the maximum temperature reached at the burn sites and the control sites at depths of 2 and 5 cm.

Results

- Soil temperatures were higher at sensors buried at two cm compared with five cm (Figure 2).
- Less than 5% of sensors reached the critical temperatures for germination, i.e. 80º C (Figure 3).
- High temperatures were associated with sites with high fuel consumption and large woody debris.

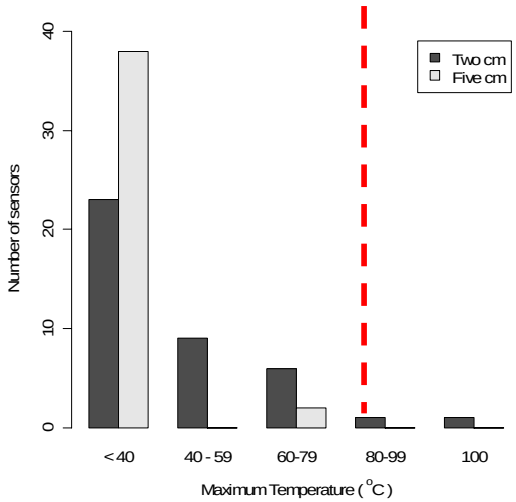

Figure 3: Number of sensors in each temperature category

Discussion

Autumn prescribed burning did not achieve sufficient temperatures to trigger germination in fire responsive species with soil seed banks. If ecological burns in these forests are aimed at promoting populations of obligate seeder species, they need to be hotter than standard practice to achieve their objectives. However, we acknowledge that there are inherent risks associated with hotter burns.