Short Communication

Monitoring eucalypt germination in Victorian native forest logging coupes: a comparison of methods

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Summary

Germination monitoring is an important aspect of native forest silviculture, but the method currently used in Victoria is seen to be time consuming and difficult to employ. This study reports the development and preliminary testing of an alternative method for field-based germination monitoring. The method meets the objectives of germination monitoring, reduces on-plot time by about half, and may increase motivation to implement the process.

Keywords: forests; forest management; regeneration; forest inventories; sampling; monitoring

Introduction

Management of forest ecosystems has changed markedly in recent times, with concepts such as 'ecological sustainability' and 'biodiversity maintenance' becoming important principles (Spence 2001). In Australia, recent developments in forest policy have included the formulation of Regional Forest Agreements, which aim to incorporate economic, environmental and social considerations into the process of forest management (Slee 2001). Nevertheless, less newsworthy aspects of forest management, such as the regeneration of tree species after logging, are still important and legally binding aspects of forestry practices (DNRE 1996a).

In Victoria, a number of monitoring processes (including monitoring of seed fall, seed-bed quality, seed viability, seedling germination and seedling distribution) have been developed to help meet regeneration objectives in harvested areas. Much of the monitoring is conducted by regional staff who have many constraints placed on their time. Consequently, changes to monitoring systems that save time without loss of data quality are important (DNRE 1996b).

Post-harvest germination monitoring is designed to identify the timing of germination on different seedbeds, detect the effect of natural events such as frost, drought or high temperatures, and provide an early indication of possible regeneration failure (Dignan and Fagg 1997). Experience with the current method, however, suggests that time savings could be made and data presented more effectively. In this study, we present an alternative method for post-harvest germination monitoring with the aim of developing a simpler and more time-efficient procedure. The alternative and current methods are compared.

Methods

The two monitoring techniques were compared on a recently-harvested native forest coupe near Creswick, Victoria (37°29'S, 143°54'E, altitude 550 m a.s.l.). Prior to harvesting, 80% of the basal area was attributable to messmate (*Eucalyptus obliqua*) with manna gum (*E. viminalis*) and narrow-leaved peppermint (*E. radiata*) also present. The coupe was harvested during February 2001 using the seed tree silvicultural system, but logging residue had not yet been burnt at the time of data collection (spring/summer 2001).

The current method for post-harvest germination monitoring (Dignan and Fagg 1997) involves selecting a number of representative logging coupes within each district and establishing three to five monitoring plots (2 m x 1 m) on each. Plots are not designed as replicates, but are subjectively positioned to sample different micro-environments. Seed is sown at three times the recommended sowing rate, and germinants are monitored with the aid of bamboo skewers. Colour-coded skewers are inserted next to new germinants and removed when that germinant has died, enabling the collection of exact data describing both new germination and mortality. For each coupe progressive germination, mortality and survival may be presented graphically using mean values from each plot at each monitoring.

The alternative method was based on plots 1 m x 1 m, as plots of this size are more convenient to set up and quicker to measure. Plots were sown at 25 times the recommended sowing rate to ensure a greater number of germinants so that changes in the number of germinants over time could be easily detected. At each monitoring the live germinants in each quarter of each plot (0.25 m^2) were given a germination abundance score using the following six categories:

Score	0	1	2	3	4	5
No. of germinants	0	1–5	6–10	11–20	21–50	>50

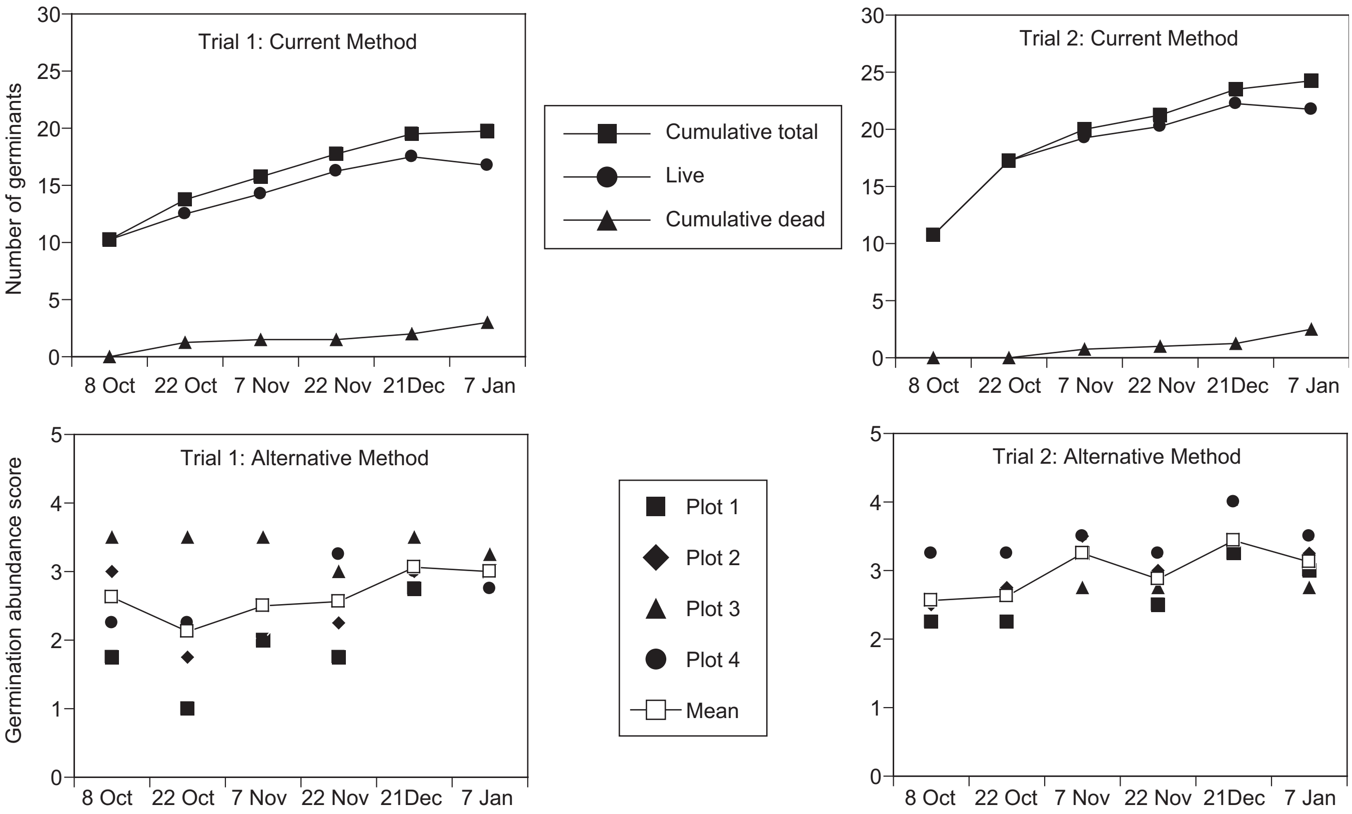

Figure 1. Germination monitoring results using the current method (top) and the alternative method (bottom). Graphs on the left are from Trial 1 and graphs on the right are from Trial 2.

Abundance scores for each quarter were then averaged to generate a total plot score.

The two methods were compared using paired plots sited at four different elevations and aspects within the study coupe. At each location, a 1 m x 1 m plot for the alternative method, and a 2 m x 1 m plot for the current method, were placed side by side. The soil was disturbed with a rake-hoe to create a viable seedbed and *E. obliqua* seed from a local source was hand sown on 21 August 2001. Monitoring was first conducted on 8 October 2001, and then every two weeks for the next three months. At each monitoring, the time taken to assess each plot was recorded. A replicate trial was conducted concurrently, using paired plots at four other locations on the same coupe. The first set of plots is referred to as Trial 1 and the second as Trial 2.

Results and discussion

The data (Fig. 1) collected using the current method are displayed as recommended by Dignan and Fagg (1997), and show average values for the number of live germinants, dead germinants and the cumulative total. In contrast, the graphs based on the alternative method only show the number of live germinants (represented as a germination abundance score), but display data from each plot. For both trials and methods, the number of live germinants increased gradually with time.

The current method enables the timing of both new germination and mortality to be identified while the alternative method does not. Although this additional information may be valuable for understanding the patterns and processes influencing eucalypt germination, we argue that these data are not necessary to meet the objectives of field-based germination monitoring. The primary aim of the monitoring is to identify initial germination and any major mortality events, and this objective is adequately achieved with the alternative method.

Under the current method, plot averages are used to represent germination trends. However, these may not be meaningful because plots are neither randomly positioned nor numerous enough to provide a representative sample. Using the alternative method, the presentation of individual plot data provides information that is much more useful. For example, the relatively low germination abundance score for Plot 1, Trial 1 (Fig. 1) may prompt further reconnaissance on the parts of the coupe that Plot 1 represents. We believe that the data display associated with the alternative method is more appropriate for a small number of subjectively positioned plots, and more useful for showing the results of germination monitoring.

The time taken to monitor plots using the current and alternative methods is shown in Table 1. On average, the alternative method was 54% faster than the current method. The time difference

Table 1. The mean time taken to monitor plots using the current and alternative methods for Trials 1 and 2. Numbers in parentheses are standard errors of the mean.

Monitoring date	Mean monitoring time (seconds plot^{-1})			
	Trial 1		Trial 2	
	Current method	Alternative method	Current method	Alternative method
08 Oct	153 (15)	70 (2)	148 (8)	72 (3)
22 Oct	201 (24)	69 (5)	212 (8)	88 (9)
07 Nov	142 (17)	61 (5)	158 (11)	75 (9)
22 Nov	171 (23)	78 (6)	174 (7)	89 (2)
21 Dec	173 (22)	70 (9)	169 (32)	82 (9)
07 Jan	177 (18)	76 (5)	169 (23)	79 (4)

between the methods was similar at each monitoring and each trial, and was due mainly to the time-consuming use of skewers associated with the current method. Based on data from both trials the average time difference between the methods was 95 seconds per plot. This corresponds to 48 minutes saved if five plots were each monitored on six occasions.

Use of the alternative method could reduce on-plot monitoring time by about 50%, and thus translate into substantial time-savings across the State. This potential time saving is likely to be modest, however, if other time-consuming activities (e.g. travel to coupes and time spent walking between plots) are taken into account. Nevertheless, we believe that the combination of speed and ease of use afforded by the alternative method may increase the motivation of field staff and thus facilitate more thorough germination monitoring practices. This hypothesis would need to be experimentally tested before the alternative method could be considered a viable alternative.

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References

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