NOTES ON FIRE INTENSITY & THE *BANKSIA GRANDIS* POPULATION FOR INTERMEDIATE FIRE SCHOOL, 1981

BY

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ABSTRACT

The ability of summer fires (of a "one hit" nature) to re-structure the *B. grandis* population, thereby changing its site dominance status, is largely a function of fire intensity and of the original population structure.

Sexually mature and over-mature *B. grandis* displayed a poor capacity to regenerate from rootstock and most were killed by fires in excess of 1000 kwm^{-1} under dry summer conditions. The fire resistance of individuals of this physiological age class was determined by bark thickness, (or stem diameter) with larger diameter stems surviving fires of 1500 kwm^{-1}.

Suppressed and sexually immature individuals were killed to ground level by mild ($<$ 300 kwm^{-1}) fire but quickly regenerated from rootstock.

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1. INTRODUCTION

Control of the jarrah dieback disease of which *Phytophthora cinnamomi* Rands is the primary causal organism, may be achieved on some sites by replacing the susceptible proteaceous understorey with a leguminous understorey (Shea & Hopkins, 1973).

Banksia grandis is one such highly susceptible understorey species which fully occupies many sites. Reduction in the competition from the overstorey, disturbance and frequent low intensity spring burning are factors which probably favoured the strong development of this lower tree species (Shea, 1975).

Shea & Malajczuk (1977) have suggested that the replacement or partial replacement of the dense *B. grandis* understorey with suitable native legume species can be achieved with fire on some sites. They suggest a higher intensity fire than the current cool spring burns with suitable followup fire treatment to further discourage *B. grandis* development.

This paper presents and discusses the results of a study which examined the susceptability of *B. grandis* populations to a range of one hit fire intensities.

2. METHODS

A total of 46 small (2 ha) plots located near Dwellingup and near Jarrahwood were experimentally burnt under summer conditions. In each plot, 20 sub plots each of 80 m^2 were permanently located. Banksias within the sub plots was placed into one of three height classes. The three height classes were selected on the basis that each class represented readily recognizable stages of physiological development within the *B. grandis* population. To enable the construction of D.B.H.O.B. - frequency distribution curves, a stratified random sample of 200 *B. grandis* stems were taken from each location.

2.1 Description of Banksia Height Classes

2.1.1 "A" Class *B. grandis*

Height class "A" consisted of all suppressed, sexually immature individuals <1 m top height. This class represented the future overstorey and, having a well developed rootstock, would respond by fully utilizing the site should the existing overstorey be removed. This class of Banksias was further typified by a lack of protective bark and had instead a toughened epidermis.

2.1.2 "B" Class *B. grandis*

These individuals were the non-competitive or suppressed component of the Current Banksia overstorey. As such they were 1 - 2.5 m in height, sexually immature (with a few exceptions), had a well developed rootstock and a thin protective bark.

2.1.3 "C" Class *B. grandis*

Such Banksias have been dubbed "rogue" Banksias because of their prolific canopy development, their seeding potential and suppression of understorey species. These co-dominants of the lower tree stratum range in height from 3 - 6 m and in diameter from 60 - 150 mm and have a thick protective bark. Such individuals have the potential to provide a considerable food base for the development and spread of *P. cinnamomi*.

2.2 Fire & Other Data

See App. for vegetation and fire behaviour variables measured in each plot.

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2.3 Fire Intensity

Although not completely satisfied with Byram's (1959) intensity measure, a lack of suitable alternatives left no option but to try to relate this measure to Banksia fire kill.

i.e.; $I = H.W.R.$

where I = intensity (kwm^{-1})

H = heat yield (18,600 $kjkg^{-1}$)

W = weight of available fuel (kgm^{-2})

R = fire rate of spread (ms^{-1})

3. RESULTS

3.1 Pre-burn Banksia Population - Jarrahwood Study Area.

m

3.2 Pre-burn *B. grandis* Population Structure - Dwellingup

3.3 Post burn Population Structure - Jarrahwood (a Selection of Intensity Ranges)

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3.4 Post burn *B. grandis* Population Structure - Dwellingup
(a Selection of Intensity Ranges)

4. DISCUSSION OF RESULTS

There are noticeable differences in the pre-burn population structures of the two study areas. These differences may be attributed to past cutting history, fire history, site differences or combinations of these factors. In essence, it can be said that there are more larger ("C" class), mature individuals/unit area in the Dwellingup area than there are in the Jarrahwood area. However, although fewer in numbers, the "C" class or mature class of the Jarrahwood population contains larger diameter stems.

From the post burn figures, it can be seen that the smaller *B. grandis*, having a well developed and viable rootstock insulated deep in the soil, are highly resistant to fire. Very cool fires (< 300 kwm^{-1}) were sufficient to girdle and kill these smaller stems to ground level but 12 months after burning they had reached pre-burn dimensions with a new dynamic shoot.

The larger, co-dominant individuals did not have a viable rootstock and were killed outright by girdling. The fire intensity necessary to girdle these mature stems is dependent on bark thickness, which is in turn a function of stem diameter, which on fully occupied sites, is determined by stocking rates. It is for this reason that the *B. grandis* population at the Dwellingup study site proved more susceptible to fire class the Jarrahwood stands. A fire of an intensity of 1200 kwm^{-1} killed ≈ 85% of the mature individuals at the Jarrahwood site. A fire of the same intensity resulted in ≈ 96% kill of the mature stand.

5. CONCLUSION

High intensity summer fire will temporarily re-structure the *B. grandis* population by killing outright, large sexually mature individuals. Sexually immature individuals will be killed to ground level but will re-sprout from rootstock.

The erractic nature of fire creates difficulties in ensuring a widespread and total treatment of an area at a prescribed intensity. It is unlikely, therefore, that fire regimes alone will completely remove the *B. grandis* component. This can be achieved to a degree. The level of site occupation to which Banksias must be kept in order to significantly disfavour the development of *P. cinnamomi* is unknown at this stage.