

**Encroachment of sandplain heathland (kwongan) by  
*Allocasuarina huegeliana* in the Western Australian  
wheatbelt: the role of herbivores, fire and other factors**

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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# Abstract

Kwongan, also known as sandplain heathland, occurs in remnant vegetation throughout the fragmented landscape of the Western Australian wheatbelt. This vegetation community has high levels of species richness and endemism, and is of high conservation value. In many vegetation remnants in the wheatbelt the native tree species *Allocasuarina huegeliana* (rock sheoak) is expanding out from its normal range and encroaching into kwongan. *A. huegeliana* may ultimately dominate the kwongan, causing a decline in floristic diversity. Altered disturbance regimes, particularly the absence of fire and reduced or absent browsing mammal herbivores, are likely to be responsible for causing *A. huegeliana* encroachment.

This study used experimental and observational data from patches of kwongan in three Nature Reserves in the central and southern wheatbelt to investigate the role of fire, native mammal activities and interactions between these two factors in shaping *A. huegeliana* woodland–kwongan community boundaries. Investigations were carried out into the characteristics of encroaching *A. huegeliana* populations; the environmental factors affecting the extent of encroachment, naturally recruited juveniles, and seedling emergence and establishment; historical and current abundances of native mammals; and the effects of mammal herbivores on seedling establishment during inter-fire and post-fire periods.

Results from this study confirm that *A. huegeliana* has encroached into kwongan throughout the wheatbelt region and recruitment appears likely to continue in most areas. Few of the environmental factors measured in this study affected the extent of

encroachment, the locations of naturally recruited *A. huegeliana* juveniles, and seedling germination and establishment. Western grey kangaroos (*Macropus fuliginosus*) browsed extensively on seedlings, which largely prevented them from establishing in open areas of kwongan. However, numerous *A. huegeliana* seedlings escaped browsing herbivores by establishing in perennial shrubs, where they appeared to be tolerant of increased levels of inter-specific competition.

There was no native mammal common to all three Reserves that declined around the time that *A. huegeliana* encroachment most likely began in the 1970s. In addition, tammar wallabies (*Macropus eugenii*) had little effect even where their densities were high. It is therefore unlikely that the decline of an individual mammal species initiated encroachment. *A. huegeliana* encroachment appears to be driven by increased propagule pressure, which is in turn caused by increased inter-fire intervals. Long periods of time without fire have enabled fire-sensitive *A. huegeliana* trees to produce increasing quantities of seed that are continuously released into kwongan. A range of other factors may interact synergistically with this process to affect encroachment and these are also discussed. This study considered the implications of these findings for management of remnant vegetation in fragmented landscapes, particularly kwongan in the Western Australian wheatbelt, and areas for further research are suggested.

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