PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE

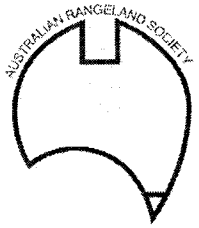
Official publication of The Australian Rangeland Society

Form of Reference

The reference for this article should be in this general form;
Author family name, initials (year). Title. *In*: Proceedings of the nth Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).
For example:
Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite *(Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

Disclaimer

The Australian Rangeland Society and Editors cannot be held responsible for errors or any consequences arising from the use of information obtained in this article or in the Proceedings of the Australian Rangeland Society Biennial Conferences. The views and opinions expressed do not necessarily reflect those of the Australian Rangeland Society and Editors, neither does the publication of advertisements constitute any endorsement by the Australian Rangeland Society and Editors of the products advertised.



The Australian Rangeland Society

WOODY WEED POPULATION DYNAMICS NEAR BOGGABRI, N.S.W.

A.H. Grigg and J.A. Duggin

Department of Ecosystem Management, UNE, ARMIDALE N.S.W.

ABSTRACT

Data on the population dynamics of three 'woody weed' species *Acacia deanei*, *Cassia nemophila* and *Dodonaea viscosa*, collected over a 12 year period at a disturbed site near Boggabri showed that recruitment generally occurred on an annual basis as soil moisture conditions allowed. Population numbers for *A. deanei* and *C. nemophila* rose dramatically after approximately 4 and 5 years respectively due to maturation of and seedfall from early individuals. *Dodonaea viscosa* showed a slower rate of increase, presumably due to lower levels of seed production. Mortality was highest for all species up to age two while mature individuals persist in the population structure. The results provide further information on the temporal changes of these species populations over the longer term, with a view to assisting in the refinement of control strategies.

INTRODUCTION

The term 'woody weed invasion' has been used to describe the development of dense stands of endemic shrub species over extensive areas of western New South Wales. The phenomenon poses a number of difficulties for graziers including a reduction in herbage production and therefore stock carrying capacity. Control methods have centered on prescribed burning or grazing management, both of which utilise knowledge of the biology of these shrubs to reverse further expansion. This paper presents information on the population dynamics of three 'woody weed' species over a 12 year period, to expand our understanding of these shrubs and assist in refining control strategies.

METHODS

Six transects, 10m x 30m were used to monitor shrub recruitment, growth and survival at a site near Boggabri in the central north of New South Wales. The site was disturbed by mining, respread with stockpiled topsoil in 1979 and allowed to regenerate. Cohorts were defined as all new individuals recorded at each measure, with division into sub-cohorts for measurement intervals exceeding one year by frequency analysis of height data. Individuals were mapped and fates were determined using preceding location and height data.

RESULTS AND DISCUSSION

Recruitment in *A. deanei* and *D. viscosa* occurred annually, usually during the autumn and winter months when presumably soil moisture is greatest. An extra cohort was identified when good rainfall persisted throughout 1983. Rainfall at the site (mean 643 mm/yr) is likely to have assisted the regular germination pattern and survival of young seedlings compared with more arid sites (Hodgkinson, 1979). *Cassia nemophila* showed less regular recruitment including a period of over three years with no new individuals. Total numbers of this species were low during this time.

Rapid population expansion (Fig.1) was observed in *A. deanei* some 4 years after initial recruitment (Cohorts 6-3 onwards) and in *C. nemophila* after 5 years (Cohort 6 onwards). The population of *D. viscosa* doubled between 4 and 8 years but total numbers were low relative to the other two species and the rate of expansion subsequently decreased. The size of new cohorts in *A. deanei* and *C. nemophila* has continued to increase since initial expansion.

Average shrub densities using bulked data had reached 2,356 stems/ha for *A. deanei*, 2,506 stems/ha for *C. nemophila* and 233 stems/ha for *D. viscosa* respectively after 135 months. Distributions of the former two species showed increasing aggregation. For *A. deanei*, 80% of Cohorts 6-3 and younger were within 2 metres of older plants 2 metres or taller at 91 months. For *C. nemophila*, 99% of Cohorts 6 to 8 were within 2 metres of older plants 1 metre or taller at 91 months.

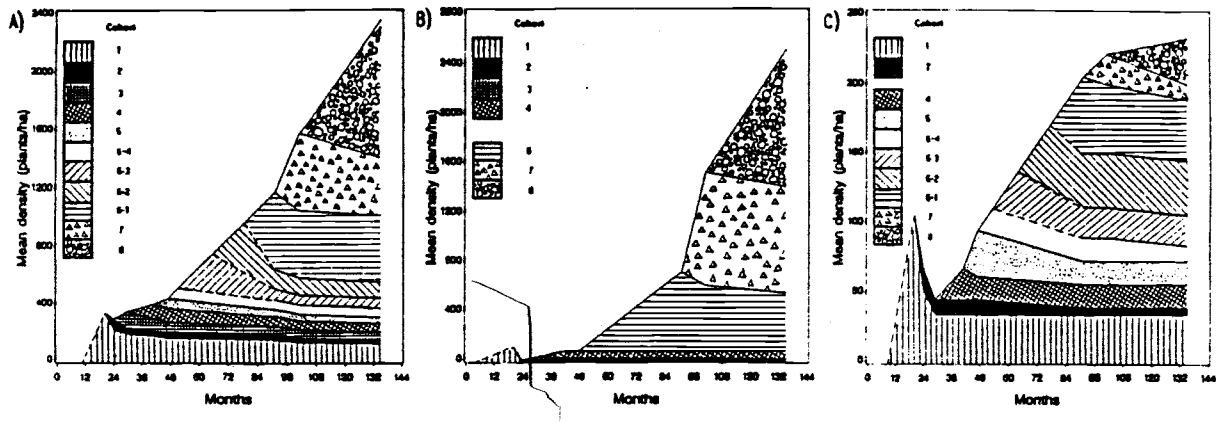


Figure 1. Population structure by cohort for (a) *Acacia deanei*, (b) *Cassia nemophila* and (c) *Dodonaea viscosa* growing an a site disturbed by mining near Boggabri, NSW. Cohorts are defined in the text.

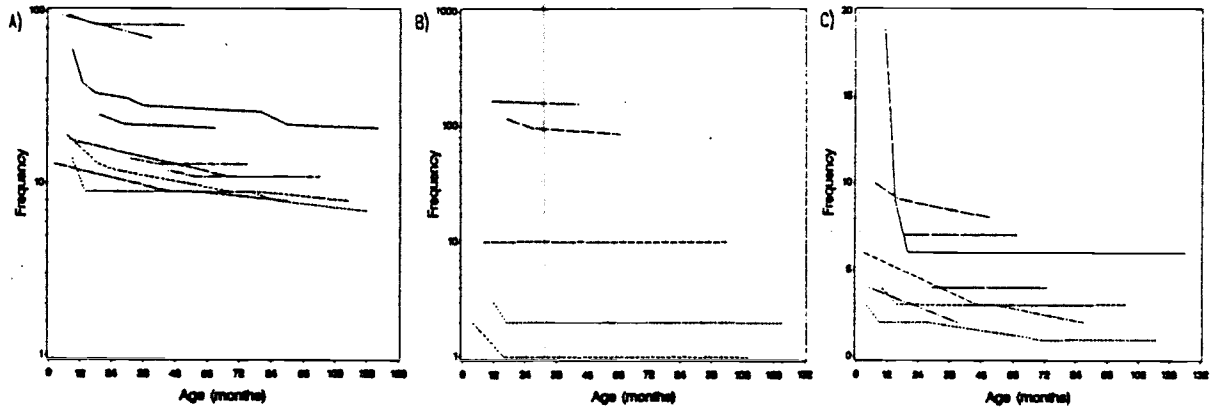


Figure 2. Survival curves of cohorts for (a) *Acacia deanei*, (b) *Cassia nemophila* and (c) *Dodonaea viscosa* growing an a site disturbed by mining near Boggabri, NSW. Cohorts are defined in the text.

The sizes of population expansion for each species, and the distribution of younger individuals concur with the available literature on seed production, soil seed pools and dispersal patterns. This indicates that *A. deanei* and *C. nemophila* reach reproductive maturity at approximately 4 and 5 years respectively. Low numbers in *D. viscosa* made estimation of reproductive age unreliable. Control methods aimed at limiting the soil seed pool of these shrubs, for example by fire, should therefore consider this time frame. This is particularly so in newly cleared or disturbed areas where the size of the shrub seed pool is initially low.

Average height growth for each species and the maximum individual height after 135 months are given in Table 1. The data give no indication of a decrease in growth rates for the earliest cohorts, suggesting maximum heights have not yet been achieved at this site.

Table 1: **Mean height growth and maximum individual height after 135 months for three shrub species at a site near Boggabri, NSW.**

Species	Mean ht growth (m/yr)	Max. ht at 135 months (m)
A. deanei	0.42	5.7
C. nemophila	0.24	2.7
D. viscosa	0.36	4.4

Survival curves for cohorts of each species (Fig.2) showed that most mortality occurred within 2 years from establishment. Half-lives (measured following the first appearance of individuals) for cohorts of *A. deanei* varied from 23 to 111 months. Half-lives could not be reliably calculated for the other species. Once established, shrubs were generally long-lived and have persisted in the population structure (Fig.1), probably due in part to the more mesic climate of the site.

Mature shrubs contribute a disproportionately large amount of seed to the soil seed pool compared to their numbers (Grice, 1987). Given the low turnover of mature established shrubs continuing shrub infestation is expected at this site.

REFERENCES

Grice, A.C. 1987. Soil seed-bank dynamics of some arid zone shrubs. Weed Seed Conference, Department of Agriculture, Orange

Hodgkinson, K.C. 1979. The shrubs of Poplar box (*Eucalyptus populnea*) lands and their biology. *Aust. Rangel. J.* 1(4) 1979, 280-93.