

Ageing of Trees and Shrubs in Central Australia

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BACKGROUND

Calcareous Shrubby Grasslands consist of annual oat grasses (*Enneapogon* spp.), copperburrs (*Sclerolaena* spp.) and *sida* spp. growing under scattered witchetty bush (*Acacia kempeana*) and broombush (*Senna artemisioides*) found on calcareous soils mainly south of Alice Springs (Bastin and Shaw 1988).

Calcareous Shrubby Grassland is commonly referred to as 'soft' country or country which can undergo considerable vegetation change (Bastin and Shaw 1988). These changes include a decline in witchetty bush and an increasing dominance of broad leaved unpalatable plants due to rabbit infestation. Such plant landscapes show a decrease in the density of trees and shrubs and loss of this important topfeed component. In a study by Friedel (1985) in Central Australia it was reported that "in calcareous shrubby grasslands rabbits severely depleted the smaller sizes of trees and shrubs". This has led to a lack of tree and shrub regeneration and environmental concern.

In contrast, shrub increase or encroachment, tends to be a more severe threat to the pastoral industry particularly to the north of the Macdonnell Ranges. Open woodlands are typical pasture types which are susceptible to increasing shrub densities. Juvenile ironwood (*A. estrophiolata*), mulga (*A. aneura*) and witchetty bush are examples of pasture encroachers.

The growth of seedling shrubs and trees is critical to sustainable cattle grazing and the productivity of various pasture types. Regeneration is a concern particularly in calcareous shrubby grasslands as woody plants in these environments are vulnerable to being grazed down by rabbits at the seedling stage, leading to a low rate of seedling establishment.

OBJECTIVE

Given that both a decline and an increase in woody plants can have a serious impact on sustainable carrying capacities it is important to our understanding of ecological processes to be able to estimate the age of juvenile trees and shrubs. This provides us with the means to establish the relative age of plants in a community and to gain an insight into the events that may have acted as catalysts to seed germination. These events may have been human induced, for example, rabbit control, or natural events such as fire or a sequence of wet years.

METHOD

In 1985 CSIRO tagged and measured the height of young trees and shrubs growing on calcareous country adjacent to Alice Springs which had been fenced off from rabbits. In 1996 I visited the rabbit proof enclosures and, by measuring the height of every tagged plant which could be located, I was able to estimate the rate of growth of these plants. A total of 397 measurements of tagged plants was made. The average growth rate over the period 1985-1996 was calculated, the results of which are tabled below. The species of trees and shrubs which were involved included mulga, witchetty bush and broombush.

RESULTS

Table 1. Yearly growth rates for shrubs in calcareous shrubland (1985-1996)

Common Name	Growth rate cm/annum \pm s.e.	Sample number
Mulga	16.45 \pm 2.61	10
Witchetty	4.97 \pm 0.20	314
Broombush	4.75 \pm 0.65	16

Table 2. Average annual growth rates of shrubs in height (cm) and total annual rainfall (mm)

	1985-1986	1986-1987	1987-1996	1985-1996
Yearly Total Rainfall	157.4	342.7	216.6 mean	222.7 mean
Name				
Mulga	14.6 \pm 9.03	30.5 \pm 6.17	15.6 \pm 2.05	16.45 \pm 2.61
Witchetty	3.08 \pm 0.65	9.77 \pm 0.86	4.81 \pm 0.21	4.97 \pm 0.20
Broombush	0.26 \pm 2.97	7.21 \pm 4.46	5.76 \pm 0.49	4.75 \pm 0.65

THE EFFECTS OF SEASON

The average rate of growth over the 11 year period 1985 to 1996 is 16 cm for mulga, 5 cm for witchetty bush and 5 cm for broombush. The period, 1985 to 1996 was one of dry years and drought as the rainfall statistics in Table 2 below indicate. Higher growth rates may have been achieved at more favoured locations and with more positive seasonal influences. The data in Table 2 suggests the average growth each species showed in the period 1986 to 1987 was more than double the growth of the previous poorer season

(Sample numbers vary due to the fact that varying numbers of plants were measured over the 1985 to 1987 periods).

The difference between the growth rate of mulga and the two other species listed may be attributed to their individual growth habits. Mulga usually appears as a single stemmed shrub or tree. Witchetty bush is a multi-stemmed shrub or small tree and broombush is a shrub. The latter two exhibit lateral as well as vertical growth.

Growth rates are influenced by inherent soil fertility and constant drought stresses placed on plants in low rainfall years. Plants may experience long periods of stagnation in growth or suffer extremes of foliage dieback leading to a reasonably large variation in the 'average growth rate'. This was shown by the fact that moderately high standard deviations occurred in the sample population means. As a consequence of these results, however, it is possible to speculate on the age of these plant species. For example, under the prevailing drought conditions which were experienced between 1985 and 1996, a 2 metre mulga growing on calcareous soils may be estimated to be approximately 13 years old. However, the same plant subject to a sequence of 'above' average years may be only half this age. A 2 metre high witchetty bush, on the other hand may be 20 to 40 years old depending on the seasons.

A set of photostandards could be used to estimate the relative age of plants by depicting the average size of plants at various ages. See Figures 1 to 4. These are photographs of some typical trees and shrubs shown together with a measuring stick as reference examples of plants of known age.

REFERENCES

Bastin, G. and Shaw, K. Rangeland Pastures of the Alice Springs District. Department of Primary Industries and Fisheries. Agnote. June 1988. Agdex 330/30.

Friedel, M. H. (1985). The population structure and density of central Australian trees and shrubs, and relationships to range condition, rabbit abundance and soil. Aust. Rangel. J. 7 (2): 130-9.

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APPENDIX

Acacia aneura

Year	1996-1985	1996-1987	1987-1986	1986-1985
Mean Growth Rate	16.45	15.6	30.5	14.6
Standard Deviation	8.28	7.94	19.52	27.1
Standard Error	2.61	2.05	6.17	9.03
Sample Number	10	15	10	9

Acacia kempeana

Year	1996-1985	1996-1987	1987-1986	1986-1985
Mean Growth Rate	4.97	4.81	9.77	-3.08
Standard Deviation	3.58	3.95	14.11	11.09
Standard Error	0.2	0.21	0.86	0.65
Sample Number	314	336	267	290

Senna artemisioides

Year	1996-1985	1996-1987	1987-1986	1986-1985
Mean Growth Rate	4.75	5.76	7.21	0.266
Standard Deviation	2.63	2.44	16.69	11.52
Standard Error	0.65	0.49	4.46	2.97
Sample Number	16	24	14	15

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Figure 1. Photograph of a juvenile *Acacia aneura* (Mulga) tree in calcareous shrubby grassland. With an average growth rate of 16 cm per annum this tree is estimated to be approximately 20 years old.



Figure 2. Photograph of a juvenile *Acacia estrophiolata* (Ironwood) tree in calcareous shrubby grassland. With an average growth rate 29 cm per annum, this tree is estimated to be approximately 12 years old.



Figure 3. Photograph of a juvenile *Acacia kempeana* (Witchetty Bush) shrub in calcareous shrubby grassland. With an average growth rate of 5 cm per annum, this shrub is estimated to be approximately 13 years old.

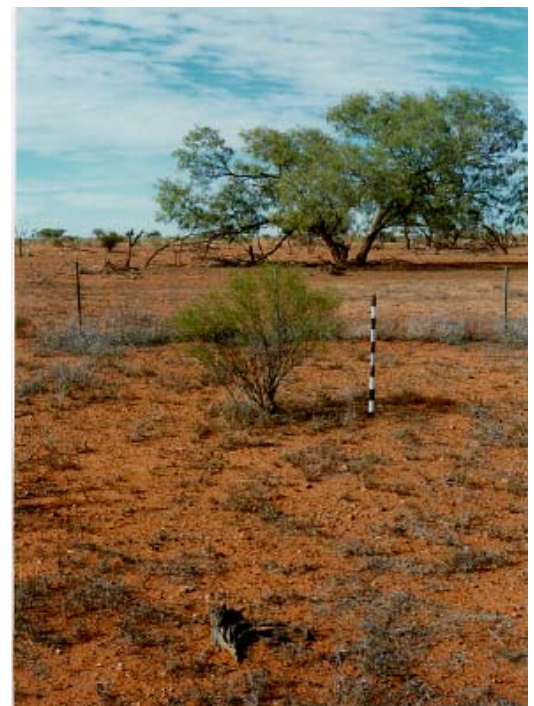


Figure 4. Photograph of a mature *Sena artemisioides* (Broombush) shrub in calcareous shrubby grassland. With an average growth rate of 5 cm per annum, this shrub is estimated to be approximately 20 years old.