

# Periodicity of recruitment of *Acacia mellifera* in semi-arid central Namibia

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**Keywords:** age; episodic; fire; recruitment; states; transitions

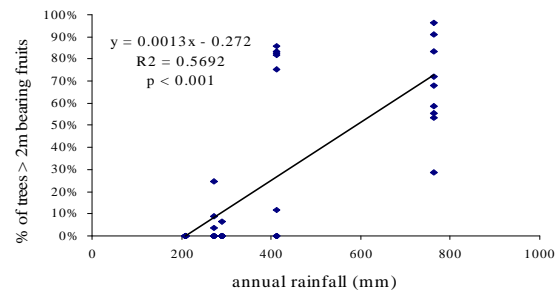
**Introduction** The semi-arid savannas of Namibia are prone to bush encroachment. Based on empirical work, a conceptual model (Joubert *et al.*, in press.) was compiled that outlined the states, transitions and drivers of these transitions. It includes possible effects of grass competition, browsing by small mammals and fire on seedling and sapling survival. The objective of this paper was to investigate the recruitment patterns of *A. mellifera* (an important bush encroachment species) in a semi-arid savanna in Namibia with a mean annual rainfall of 361 mm (C.V. = 40 %).

**Materials and Methods** Data on annual rainfall, seed production, germination and survival of *A. mellifera* seedlings were collected between 1998 and 2005 from a site in the Highland Savanna of Namibia. In addition, growth rates of mature plants were determined between 1972 and 2007 and the growth rates of six year old sapling determined during 2007. The possible correlation between seed production and annual rainfall of the previous season was tested and the data used to infer recruitment patterns by relating the collected data to annual rainfall patterns over 110 years (Table 1).

**Results** Mass seed production only occurred during the years which received above average rainfall (2000 and 2001) and seedlings were only observed during 2001 and 2002, supporting evidence that the species does not form persisting seed banks. No, or few, seeds were produced in other years. A significant ( $P < 0.01$ ) correlation between rainfall and seed production (expressed as the % of mature trees bearing seeds) was observed (Figure 1). Mean stem diameter of the 6 year old saplings was 4.9 mm (s.d. 1.9 mm;  $n = 19$ ) (0.82 mm/year growth). Mature plants grew in height by 3.2 cm/annum (s.d. 1.50 cm;  $n = 16$ ). Based on the assumption that recruitment only occurs during three consecutive years of above average rainfall the likely ages of *A. mellifera* in the Highland Savanna are presented in Table 1.

**Table 1** Likely recruitment periods and ages of cohorts of *A. mellifera* trees in the Highland Savanna, Namibia

Age (years)	Recruitment period (year[s] of likely germination in parentheses)	Annual rainfall during years of recruitment (mm)
6	2000-2002 (2001)	624; 462; 374
19-20	1986-1989 (1987; 1988)	458; 396; 449; 390
29-32	1975-1980 (1976; 1977; 1978; 1979)	668; 482; 515; 402; 366; 393; 372
50-53	1953-1958 (1954, 1955, 1956, 1957)	441; 725; 354; 487; 388; 532
68-69	1937-1940 (1938, 1939)	458; 536; 426; 364
109	1897-1899 (1898)	542; 391; 544
> 109	Before rainfall records	



**Figure 1** Percentage of trees > 2 m with fruits in relation to annual rainfall of previous season (1998-2005)

**Conclusions** Based on these results, which support the conceptual model proposed by Joubert *et al.* (in press.), recruitment of *A. mellifera* is most likely limited to periods spanning three consecutive years that received above average rainfall. Land owners perceive that recruitment is frequent and that shrub growth is very rapid, but episodic mass recruitment has probably only occurred six times in the last 110 years. Fire is the most important natural disturbance that can interrupt this transition. Based on measured growth rates, the largest individuals (height > 4 m; stem diameter > 30 cm) are likely to be much older than 110 years. Conclusions regarding bush encroachment drawn from studies on different species in different climates (for example, continuous recruitment of *Prosopis glandulosa* in an area with twice the annual rainfall (Brown & Archer, 1999)) should not be generalised.

## References

Brown, J.R., Archer, S., 1999. Shrub invasion of grassland: recruitment is continuous and not regulated by herbaceous biomass or density. *Ecology* 80, 2385-2396.

Joubert, D. F., Rothauge, A. Smit, G.N. in press. A conceptual model of vegetation dynamics in the semi-arid Highland savanna of Namibia, with particular reference to bush thickening by *Acacia mellifera*. *Journal of Arid Environments*.