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Journal of Arid Environments 67 (2006) 391–402

Journal of Arid Environments

www.elsevier.com/locate/jnlabr/yjare

Growth rates and age of native palms in the Baja California desert

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Received 19 September 2005; received in revised form 13 January 2006; accepted 9 March 2006
Available online 18 April 2006

Abstract

For the benefit of management and basic biology, we studied growth rates and age–size relations in two palms native to the desert of the central portion of the Baja California peninsula, using a new method for estimation of long-term growth with repeat photography. For both *Washingtonia robusta* and *Brahea armata* we found no well-defined relation of growth to height, but crown diameter tended to change with height. *W. robusta* was more sensitive to microhabitat but generally grew faster than *B. armata*. Reproductive maturation occurred at c. 8 m height in *W. robusta* and c. 4 m in *B. armata*; the tallest palms in our sample were 32.0 m and c. 18.9 m, respectively. Age estimates based on growth in recent decades suggests that potential longevity in both species exceeds 500 years.

Keywords: Growth models; Age–size relations; Reproduction; Allometry; Sonoran desert; *Washingtonia*; *Brahea*

1. Introduction

Size-related trends of growth in linear dimensions have been used with a variety of methods to estimate age of plants for the benefit of studies of the dynamics of populations or ecosystems and for management (Lamont and Downes, 1979; Steenbergh and Lowe, 1983; Lieberman et al., 1985, 1988; Martínez-Ramos et al., 1988; Pinard and Putz, 1992;

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0140-1963/$ - see front matter
doi:10.1016/j.jaridenv.2006.03.002

Bullock et al., 2004). The patterns of stem growth and of size–age relations are probably diverse, corresponding to the diversity of architecture, physiology and stress factors among perennial plants. Some cacti may maintain a roughly constant ratio of photosynthetic area to total stem length or volume, so that growth (per unit size) increases with size (Parker, 1988; Bowers, 1996). Some palms presumably or apparently show constant height increments, although there may be temporal variations or trends driven by varying light conditions, damage and life-history factors (Pinard and Putz, 1992). Although constant increments in stem volume implies decreasing growth per unit volume or unit height, this pattern would require explanation, given the general assumption that total leaf area remains constant on palms with mature-diameter stems. In contrast, the generally expected pattern should be declining increments, attributable to a decreasing ratio of photosynthesis to the combined costs of respiring stem tissue, reproduction, mechanical strengthening, defense, etc (e.g. Barot and Gignoux, 1999).

We studied two fan palms native to the Baja California peninsula, *Washingtonia robusta* H. Wendl. and *Brahea armata* S. Watson (Fig. 1), in order to evaluate long-term trends in growth, to make a first estimates of size–age relations, size or age at first reproduction and "maximum" longevity. Anecdotal information suggested that these desert monocots may attain supra-centenarian longevity. They are also of interest due to the great size of *W. robusta* (>30 m), multiple local uses and widespread cultivation, their probable importance as food for wildlife, the touristic value of their oases, and the threat to their populations by some resource use practices.

This study also presents and exemplifies a new technique that permits the time interval for growth measurements to be extended to several decades, yet is extremely rapid in the field. The method should be readily transferable to other few-stemmed, large-leaved species of open habitats.

Fig. 1. *Washingtonia robusta* and *Brahea armata* in arroyo (center) and hillslope (upper left) situations at Santa María. (Photo by R.H. Webb.)