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Effect of two types of tree guards (with and without weed control) on tree seedling establishment.

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Introduction

There are many potential problems that can limit the success of revegetation efforts (Close & Davidson 2002; Close *et al.* 2007), many products available for revegetation, and little independent research on the efficacy of those products. For example tree guards are commonly used to establish native woody plants in ecological restoration projects yet the effectiveness of tree guards in promoting seedling establishment is uncertain (Lai & Wong 2005; Close *et al.* 2007). Tree guards may protect seedlings from vertebrate herbivores, and/or protect seedlings from desiccating hot wind and/or frost (Corr 2003; Gould 2005). In Aldinga, South Australia the summers are hot and dry and it is possible that tree guards could aggravate this heat stress (Close *et al.* 2007). However, due to the Mediterranean climate, winters are cold and tree guards may be beneficial because they limit seedling exposure to cold stress during the early establishment phase. Here we present the results of a trial in which we evaluated the microclimate amelioration effect of two types of tree guard, with and without weed control, on seedling establishment in Pink Gum (*Eucalyptus fasciculosa*) in South Australia.

Methods

The seedling establishment trial was conducted at Aldinga, South Australia. The climate in the region is Mediterranean with cool-wet winters. The land is drained swampland and the thick-cracking clay soils on the site reflect this alluvial origin. The site was ungrazed ex-pasture dominated by exotic herbaceous species, with the dominant grass being Bearded Oat (*Avena barbata* Pott ex Link), and the dominant forbs being *Brassica* spps. L., Ribwort Plantain (*Plantago lanceolata* L.), Salvation Jane (*Echium plantagineum* L.), Sea Rocket (*Cakile maritime* Scop.) and Cleavers (*Galium aparine* L.).

In this trial we compared seedling establishment in quadrats with three different tree guard treatments: no tree guard, coreflute tree guards, and tree guards constructed from glasshouse plastic and bamboo stakes (see http://www.jag.net.au/land1treeguards.shtml). The three tree guard treatments were implemented with- and without weed control, resulting in six unique experimental treatments. Weed control quadrats were sprayed with glyphosate 360 herbicide (Roundup™ Monsanto, St. Louis, Missouri, USA) 2 weeks before initiating the trial and black polypropylene (80 g/m^2) weed mat (http://www.jag.net.au/landweedmat.shtml) was installed on the weed control quadrats on the day of planting to inhibit weed regrowth. Although the plant guards were used soley to assess microclimate amelioration, repeated observations were made during the experiment for evidence of vertebrate herbivore damage to target seedlings, and/or of animal scats. There were eight replicate quadrats (1 m^2) for each treatment, and each replicate quadrat contained three seedlings. Replicate seedlings were Pink Gum sourced from a commercial native plant nursery (IndigiFlora, Hackham, South Australia). Seedlings were planted as tube stock as per standard restoration practice. Each individual seedling was tree guarded separately (when relevant) and the mean (±SE) biomass of seedlings on the day of planting was 1.1 g ± 0.18. The experimental treatments were replicated across eight blocks (48 quadrats and 192 seedlings) in a randomised complete block design. The seedling establishment trial commenced in May 2007 and seedlings were harvested after 9 months of growth, in late February 2008.

Plant biomass at the end of the growing season was the response variable used in statistical analysis. Data were analysed by analysis of variance (ANOVA), followed by the Tukey-Kramer HSD test to assess significant differences in seedling establishment across treatments. Data were tested for normality using the Spahiro-Wilk Statistic (JMP v 5, Cary, North Carolina).

Results

There were highly significant differences across treatments ($F_{5,42}$ = 13.172, $P < 0.0001$), whereby improved seedling establishment occurred where tree guards were used. This was only the case, however, in qudrats in which weeds were controlled (Fig. 1). Seedling growth in quadrats with weed control and coreflute tree guards was marginally better than seedling growth in quadrats with weed control and glasshouse plastic tree guards, though the Tukey-Kramer HSD test indicated that trend was not statistically significant (Fig. 1). No evidence of vertebrate herbivore damage to seedlings or animal scats was observed.