January 2010

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

Brenton Ladd
University of Bonn

Stephen P. Bonser
University of New South Wales

Joshua R. Larsen
University of Wollongong, jrl29@uow.edu.au

Recommended Citation

Ladd, Brenton; Bonser, Stephen P.; and Larsen, Joshua R.: Effect of two types of tree guards (with and without weed control) on tree seedling establishment 2010, 74-75.
https://ro.uow.edu.au/scipapers/300

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

Keywords
effect, types, tree, guards, two, without, control, weed, seedling, establishment

Disciplines
Life Sciences | Physical Sciences and Mathematics | Social and Behavioral Sciences

16.5

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

Brenton Ladd[1,2], Joshua R. Larsen[3,4] and Stephen P. Bonser[2] ([1]Institute of Crop Science and Resource Conservation (INRES), Soil Science and Soil Ecology, University of Bonn, Bonn, D-53115, Germany; Tel: +49 0228 73 2195; Email: brenton.ladd@uni-bonn.de; [2]Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW 2052, Australia; Tel: +61 (0)2 93853863; Email: s.bonser@unsw.edu.au; [3]School of Earth and Environmental Sciences, University of Wollongong, NSW 2522, Australia; Tel: +61 (0)2 4221 4688; Email: jrl29@uow.edu.au; [4]Australian Nuclear Science and Technology Organisation, ANSTO, Institute for Environmental Research, Menai, NSW 2234, Australia).

Key words: *competition: tree guard, tree seedling establishment, weed control.*

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™) 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.

Implications for Management

This trial showed tree guards had the effect of increasing growth rates, probably because they protected the

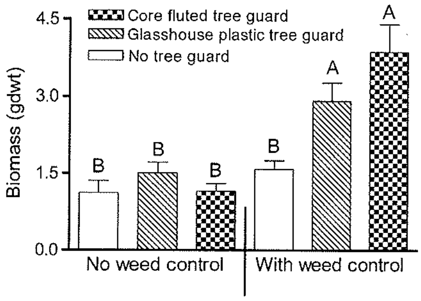

Figure 1. The interactive effects of weed mat and tree guards on tree seedling establishment in Southern Australia. Columns with the same letter are not significantly different (ANOVA and Tukey-Kramer HSD test). gdwt, grams of dry weight. Data presented are untransformed mean seedling biomass per quadrat (±SE).

seedlings from excessive exposure during the early months of establishment. To date there have been very few independent evaluations of tree guards in revegetation. Therefore, perhaps unsurprisingly, the limited number of empirical results disagree i.e. the effects that microhabitat amelioration by tree guards might have on seedling establishment is uncertain (Lai & Wong 2005; Close *et al.* 2007). Our results were consistent with Lai and Wong (2005) and suggest that tree guards may improve seedling performance. However the effect was only apparent in quadrats where weeds were controlled. This reinforces the importance of weed control for successful growth of seedlings. Restoration efforts are typically directed towards degraded habitats, often with a very high proportion of competitive-exotic species that may inhibit tree seedlings by pre-empting resources (e.g. light, nutrients and water) (Cramer *et al.* 2008). Weed control should be a first consideration in any restoration project.

Acknowledgements

This seedling establishment trial was funded by Grigson's Trading Pty Ltd (a wholesaler of horticultural products in South Australia). We thank the anonymous referees for their critiques of earlier versions of the MS. SPB was supported by a UNSW vice-chancellor's research and teaching fellowship and a Faculty Research Grant, and JRL was supported by a UOW postgraduate award and an ANSTO scholarship.

References

Close D. C. and Davidson N. J. (2002) Revegetation to combat tree decline in the midlands and Derwent Valley Lowlands of Tasmania: practices for improved plant establishment. *Ecological Management and Restoration* **4**, 29–36.

Close D. C., Ruthrof K. X., Turner S., Rokich D. P. and Dixon K. W. (2007) Ecophysiology of species with distinct leaf morphologies: effects of plastic and Shadecloth tree guards. *Restoration Ecology* **17**, 33–41.

Corr K. (2003) *Revegetation Techniques: A Guide for Establishing Native Vegetation in Victoria*. Greening Australia, Victoria.

Cramer V. A., Hobbs R. J. and Standish R. J. (2008) What's new about old fields? Land abandonment and ecosystem assembly. *Trends in Ecology & Evolution* **23**, 104–112.

Gould L. (2005) *Planting Companion: A Guide to Native Revegetation in the ACT Region*. ACT Forests, Canberra.

Lai P. C. C. and Wong B. S. F. (2005) Effects of tree guards and weed mats on the establishment of native tree seedlings: implications for forest restoration in Hong Kong, China. *Restoration Ecology* **13**, 138–143.

BOOK REVIEWS

26.7

'Ecology of Fragmented Landscapes' by S. Collinge The Johns Hopkins University Press, Maryland, USA, 2009, xiii + 340 pages. Price AUD$70.00. ISBN 978-0-8018-9138-0 (hardcover).

The foreword by Richard T Forman promises that this book is a 'treasure in your hand' delivering a practical summary of the ecology of fragmented landscapes with a unique linkage to urban planning. So does it deliver?

Well, like me, you are probably thinking that there could scarcely be the need for another book dealing with habitat fragmentation, especially after all the Hobbs, Saunders, Lindenmayer literature that formed much of the cornerstone of this field of study. Yet this little book does a surprisingly good job of drawing connections between isolated fragments of the vast literature on this topic. Its first-person style, relating often to the author's own experiences, is engaging and personable, and yet the book packs a scientific punch too.

The introduction states that Collinge intends to 'help the reader appreciate the collective body of research' and challenges the reader to 'critically evaluate the accumulated knowledge presented' and 'use it to move forward to devise creative solutions...to alleviate the threats for biological diversity and ecosystem services'. In this, the book succeeds where few others have – it is not a dry and dusty presentation of yet more of the vast literature in the field. Instead this book extracts and applies the findings of this literature to biodiversity conservation.

In terms of the format of this book, the downside is that a reader seeking a well-illustrated textbook, with glossy pages pertaining to each topic will be disappointed. Sure, there are a few black and white photos and diagrams, but this small, personable book is one to read rather than to flick through. It is not so much your average undergraduate textbook, as the thinking, applied ecologist's read. The 12 chapters of this book lead us through a vast array of pertinent content in an engaging way.

In terms of content, the book starts well in Chapter one, by immediately disentangling the concepts of habitat loss and fragmentation and exploring the basic concepts and literature. After presenting these concepts, Collinge usually illustrates their application with well chosen studies. She then proceeds in Chapter two, to conceptual frameworks such as metapopulation theory.