PROCEEDINGS OF THE AUSTRALIAN RANGELAND SOCIETY BIENNIAL CONFERENCE
Official publication of The Australian Rangeland Society

Form of Reference

The reference for this article should be in this general form;

Author family name, initials (year). Title. *In*: Proceedings of the *n*th Australian Rangeland Society Biennial Conference. Pages. (Australian Rangeland Society: Australia).

For example:

Anderson, L., van Klinken, R. D., and Shepherd, D. (2008). Aerially surveying Mesquite *(Prosopis* spp.) in the Pilbara. *In*: 'A Climate of Change in the Rangelands. Proceedings of the 15th Australian Rangeland Society Biennial Conference'. (Ed. D. Orr) 4 pages. (Australian Rangeland Society: Australia).

STRATEGIC GRAZING FOR THE CONTROL OF THE INVASIVE WETLAND WEED LIPPIA (*PHYLA CANESCENS*)

J. N. Price[1], C.L. Gross[1], R.D.B. Whalley[2] and J. Duggin[1]

[1]Ecosystem Management, University of New England, Armidale, NSW, 2351
[2]Botany, University of New England, Armidale, NSW, 2351

Email: jprice20@une.edu.au

ABSTRACT

Phyla canescens (lippia) is an invasive weed from South America that is now widespread throughout floodplains and wetlands of the Murray-Darling Basin in Australia. Lippia has invaded internationally significant wetlands often forming a dense ground-layer that excludes co-occurring native species and threatens the integrity of these wetlands. Lippia is unpalatable to grazing stock and in areas where invasion has occurred the loss of productive land causes managers to destock (55 - 100%). Traditional weed control measures including herbicides and mechanical means, are often impractical and unsuitable, particularly in environmentally sensitive areas and alternative measures need to be devised. The grazing regime is generally continuous/set-stocked in these wetlands. We are using strategic grazing to manipulate plant species composition in order to select for desirable perennial species. In particular, we addressed whether providing periods of rest from grazing permits native species to establish and out compete lippia in different hydrological zones in several wetland areas. Small exclosure cages (2 m x 2 m) were used on a fixed and rotational basis to preclude grazing stock, thereby providing a rest period at different stages of the year. Results suggest that maintaining native cover is an effective means of lippia control, with significant reductions in lippia biomass found with increased biomass of co-occurring species. Providing rest from grazing did promote increased growth of native species. The timing of rest that favoured the growth of native species differed between wetland sites, due to climatic differences and species composition (summer vs. winter active species). Complex interactions between flooding and grazing drive vegetation responses in these ephemeral wetlands and at this stage maintaining native cover is more closely linked to flood events than grazing management *per se.* Combining strategic grazing or rest periods with environmental flow releases or natural flood events may provide increased community resilience to weed invasions and reduce the spread of lippia in these wetlands.

Key words: *competition; floodplains; invasability; seasonal rest; weed control; grazing management*

INTRODUCTION

Lippia (*Phyla canescens*, Verbenaceae) is a perennial weed from South America which has invaded approximately 5.3 million ha of floodplain throughout the Murray Darling Basin (Earl 2003). Lippia invasion threatens the integrity of these wetlands and is estimated to cost the grazing industry $38 million in lost annual production (Earl 2003). Conventional weed control techniques, such as herbicide application and mechanical means, have provided no effective long-term suppression of lippia and/or are not suitable in environmentally sensitive areas. There is an urgent need to develop practical management solutions for lippia control, particularly for areas of conservation significance.

Lippia is a serious problem in the internationally significant (RAMSAR) Gwydir Wetlands and Macquarie Marshes of western NSW. Lippia is believed to have increased with reductions in the frequency and duration of floodplain inundation associated with river regulation. The native perennial grasses that are adapted to frequent inundation have declined with altered flow regimes and this is believed to have favoured the spread of lippia. Set stocked/continuous grazing also promotes lippia abundance through selective grazing of desirable species creating gaps and ideal conditions for the spread of lippia. Taylor and Ganf (2005) found that the native grass *Sporobolus mitchellii* exhibited strong resilience to lippia invasion at densities of > 25%. Landholders have reported some success using some form of rotational grazing.

The aim of the current study is to determine if grazing strategies can be identified in association with varying hydrological regimes that will reduce lippia dominance through promoting increased cover of competitive perennial species. In particular, we addressed whether providing rest from grazing at different times of the year can favour native species persistence and dominance over lippia.

METHODS

The study was conducted in *Paspalum distichum*/*Eleocharis plana* floodplain communities in the Gwydir Wetlands and Macquarie Marshes of western NSW. Lippia has been present for over 50 years in the Gwydir Wetlands and for around 20 years in the Macquarie Marshes. The spread of lippia has been related to past flood events, e.g. in the Gwydir region the lippia population increased markedly following flood events in 1996 and 1998 (Earl 2003). Lippia recruits from seed as well as asexually from fragments in response to inundation.

The experiment was established in December 2006 at 4 sites within two properties in the Gwydir Wetlands and Macquarie Marshes. Within each property, two sites were located in the same paddock (ca. 1 km apart) at different positions in the landscape. These were observed by landholders to experience different frequency and duration of flooding and are hereafter referred to as wet (annually flooded) and dry (infrequently flooded). The paddocks chosen were set stocked/continuously grazed by cattle under the control of the landholders at about 2.8 DSE/ha. Both sites had similar levels of lippia invasion and were dominated by *P. distichum* and *E. plana*. Small exclosure cages (2 x 2 m) were used on a fixed and rotational basis to preclude grazing by domestic stock and other large herbivores, thereby providing a rest period at different times of the year. Within each site, 4 replicate blocks with 5 grazing treatments were selected. Treatments were continuous graze (CG), continuous rest (CR) and 3 varying rest periods, these were rest 1 (R1, Dec, Jan, Feb, Mar), rest 2 (R2, Apr, May Jun, Jul) and rest 3 (R3, Aug, Sep, Oct, Nov). Above-ground biomass (0.125 m^2) was harvested in each plot in December 2006 (pre-treatment) and then at 4 monthly intervals (at the end of each rest period). The harvested material was sorted into lippia, graminoids, forbs (excluding lippia) and chenopods, dried at 80^0C for 48 h and weighed.

A series of floods, either natural or environmental flow releases, occurred during the study period. A small flood occurred in the Macquarie Marshes (inundating the wet site only) during August 2007, following an environmental release. Three flood events occurred in the Gwydir Wetland site (inundating the wet site only) in September 2007, December 2007 and February 2008.

Note: The experiment at the Macquarie Marshes was discontinued in December 2007 as the landholders moved to rotational grazing and paddocks were no longer set stocked. The Gwydir Wetlands wet site experienced three flood events from September 2007 through to February 2008 and subsequently fences were unable to be moved due to problems with site access from August 2007 to April 2008, so R3 plots were rested throughout this period.

Data analysis

Data were analysed by two-factor repeated measures ANOVA with site (wet/dry) and treatment as factors. The two wetlands were treated separately in the analysis due to the different lengths of the sampling periods.

RESULTS

Macquarie Marshes

There was no significant effect of site or treatment on total above-ground biomass ($p > 0.05$). Total biomass, however differed significantly through time with a significant time x site interaction ($p < 0.05$, Figure 1). Total biomass was significantly increased in the wet site in December 2007 following site inundation in August. Lippia biomass differed significantly through time but did not differ significantly between treatments. A significant time x site interaction was also found for lippia biomass, with increased biomass found in the wet site in December 2007. Above-ground biomass of forbs was significantly affected by sampling period but not by site or treatment, with significant increases found in August 2007. Graminoid biomass was significantly affected by site and treatment, as well as sampling period, with significant interactions between time and site and time and treatment. Graminoid biomass was significantly greater in the wet site in December 2006 (pre-treatment) and in August and December 2007. There was a significant treatment and site interaction with increased graminoid biomass found in continuous rest and rest 2 (Apr, May, Jun, Jul) plots in December 2007, in wet sites only. Hence, increased graminoid biomass was found in continuous rested plots and those rested in autumn/winter, but only in the site that had experienced a flood event.

(a) (b)

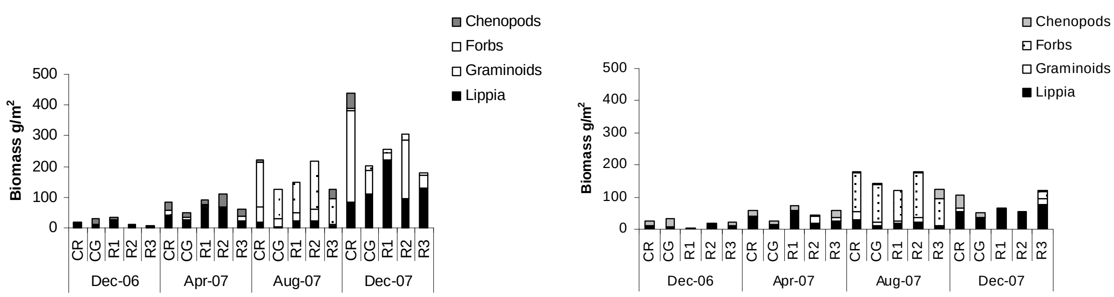

Figure 1. Mean above-ground biomass (g/m^2) in each of the growth-form categories in each treatment during the sampling period for the wet (a) and dry (b) site in the Macquarie Marshes. (CR = continuous rest, CG = continuous graze, R1 = rest during Dec, Jan, Feb, Mar, R2 = rest during Apr, May, Jun, Jul, R3 = rest during Aug, Sep, Oct, Nov). Standard errors are not shown to limit the number of charts necessary

Gwydir Wetlands

A significant interaction was found between time and site and time and treatment for total above-ground biomass (Figure 2). No significant effects for found in December 2006 (pre-treatment). In March 2007, significant increases in biomass were found in continuous rested plots and those rested during the sampling period (R1). In August 2007 and April 2008, wet sites had significantly greater biomass. In April 2008 in the wet site only, increased biomass was found in the continuous rested plots and those rested during the sampling period (i.e. R3 which due to flood events remained rested from August 2007-April 2008). A significant interaction between time and site was found for lippia biomass (Figure 2). No significant effects were found until August 2007, with significantly greater lippia biomass found in the wet site. By April 2008, this was dramatically reduced following the summer floods (< 20 g/m^2). We found a significant interaction effect between time and site and treatment for graminoid biomass. In December 2006, graminoid biomass was significantly greater in the wet site. In April 2007, we found a significant effect of treatment with increased graminoid biomass found in continuous rested plots and those rested during the sampling period (R1). In August 2007, graminoid biomass was significantly reduced in the wet site compared to the dry. Following the flood events in April 2008, the wet site had significantly greater graminoid biomass (ca. 1200 g/m^2). Forb biomass was significantly effected by site and also by time x treatment (Figure 2). In April 2007, forb biomass was significantly increased in continuous rested plots and those rested during the sampling period (R1). In August 2007, rested plots (CR and R2) also had greater forb biomass.

(a) (b)

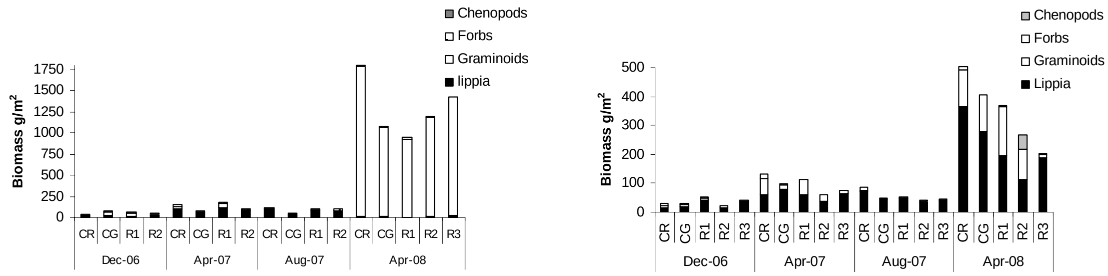

Figure 2. Mean above-ground biomass (g/m^2) in each of the growth-form categories in each treatment during the sampling period for the wet (a) and dry (b) site in the Gwydir Wetlands. Sites have different scale bars on the y-axis so patterns can be clearly seen for the dry site. (CR = continuous rest, CG = continuous graze, R1 = rest during Dec, Jan, Feb, Mar, R2 = rest during Apr, May, Jun, Jul, R3 = rest during Aug, Sep, Oct, Nov). Standard errors are not shown to limit the number of charts necessary

DISCUSSION

The study to date indicates that maintaining native cover is an effective means of lippia control with reductions in lippia biomass found with increased biomass of co-occurring species. Providing rest from grazing did promote increased growth of native species, however resting had no impact on lippia biomass. Significant reductions in lippia biomass were only reported in response to flood events, which may be a response to increased competition from co-occurring species, or to the duration of inundation, or both. The timing of rest that favoured growth of other species differed between wetland sites with autumn/winter rest increasing growth in the Macquarie Marshes and summer rest in the Gwydir Wetlands. This is likely due to compositional differences between the sites with mostly spring/summer active species found in the Gwydir site and a mixture of autumn/winter and spring/summer species in the Macquarie Marshes. In the Macquarie Marshes, most of the autumn actively growing species were annuals and hence, provided no long-term control over lippia as they quickly dried off and lippia biomass increased in the following spring sampling period. Further monitoring will determine if large increases in native graminoid biomass associated with spring/summer flooding in the Gwydir Wetlands will continue to control lippia growth. The role of resting following recent flood events on wetland dynamics will also be explored.

REFERENCES

Earl, J. (2003). The distribution and impacts of lippia (*Phyla canescens*) in the Murray Darling System. Agricultural Information & Monitoring Services.

Taylor, B. and Ganf, G.G. (2005). Comparative ecology of two co-occurring floodplain plants: the native *Sporobolus mitchellii* and the exotic *Phyla canescens*. *Marine and Freshwater Research* 56, 431-440.