Does plant response to the limiting resource explain invasibility? An experimental test using two invasive weeds and their non-invasive native congeners

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Summary *Alternanthera philoxeroides* (Mart.) Griseb. (alligator weed) and *Phyla canescens* (Kunth) Greene (lippia) are two exotic weeds invading wetlands and riparian habitats in Australia. Current management methods are only partially effective in controlling these invasions. To develop more effective management methods, we need to understand how ecosystem properties are linked with community invasibility. Recently, the concept of niche opportunity, which is comprised of natural enemy escape and resource availability, has been emphasised in theoretical discussions for the management of weed invasions (Shea and Chesson 2002). Human activity is increasing nutrient levels in many ecosystems around the world. Many conceptual and mathematical models have suggested that increase in resource availability can raise community susceptibility to invasion (Tilman 1999, Davis *et al*. 2000). Increases in resource availability may favour introduced invasive plants if they are able to make more effective use of these resources than native plants (Davis *et al.* 2000). We hypothesised that greater phenotypic plasticity may be the mechanism that gives invasive species an advantage when competing for limiting resources. Therefore, one potential strategy involves managing disturbances and resources (i.e. bottom-up management) to favour native species (Daehler 2003).

Preliminary studies showed that at low nutrient levels, lippia and alligator weed were healthy but their growth rates were reduced. Tissue analyses of plants collected from the field revealed nitrogen/phosphorus ratios <14, which indicate nitrogen is probably the primary nutrient limiting plant growth. In a glasshouse study, we compared the growth responses of both invasive plants and their 'native non-invasive' congeners to differing nitrogen concentrations. We contrasted *A. philoxeroides* to *A. denticulata* and *P. canescens* to *P. nodiflora*. Plants were grown individually in a washed peat-sand (20:80) substrate at five levels of nitrogen (1mmol L^{-1} to 30mmol L^{-1}). All other nutrients were supplied at non-limiting concentrations. Dry biomass (roots, stems and leaves), shoot characteristics, leaf area and physiological characteristics were measured. Relative growth rate, the below-ground biomass to above-ground biomass ratio and the physiological responses were compared between the nitrogen concentrations and among the four species.

These data are currently being analysed. We expect that the response of the invasive species along the nitrogen gradient will be more plastic (variable) than that of the non invasive species. It is also anticipated that the invasive species will respond more strongly to an increase of resources than the native species. In this presentation we discuss results and implications they may have for the management of these two invasive weeds.

Keywords Invasive weed, alligator weed, lippia, nitrogen, relative growth rate, phenotypic plasticity.

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