Ecosystem impacts of an exotic grass in northern Australia: effects on structure and carbon stocks

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Summary Over the past decade, there has been an increasing recognition of the capacity of exotic plants to transform native ecosystems by altering important ecosystem processes such as fire regimes and nutrient cycling (Corbin and D'Antonio 2004, Levine *et al.* 2003). Exotic grasses are a large and important component of Australia's weed flora. They pose a major threat to natural ecosystems worldwide. However, there have been relatively few detailed assessments on the extent of ecological impacts, particularly at the ecosystem level. In Australia, the perennial C4 grass *Andropogon gayanus* Kunth. (gamba grass) is currently invading relatively undisturbed mesic savannas, and displacing native annual and perennial C4 grasses. Over the past decade we have been researching the impact of invasion by gamba grass on biodiversity and ecosystem processes in the northern Australian savannas. The research has assessed impacts on stand structure, community composition, nutrient, carbon and water cycling, and disturbance (fire) regimes. Research outcomes demonstrate that gamba grass invasion directly affects all of these components of the native savanna ecosystem to varying degrees but that the most dramatic and important impact is the change in fire regime, which can have feed forward effects on other ecosystem processes (Rossiter *et al.* 2008). Gamba grass invaded savanna produces substantially greater biomass each year than native savanna and consequently supports more intense fires than ever recorded in native savanna (Rossiter *et al.* 2003).

In this paper we summarise ecosystem changes following gamba invasion. We focus on documented changes in tree density over time following invasion by gamba grass at a range of locations in the NT savannas. This was quantified by using a combination of digitised historic and current aerial photography, together with field surveys of vegetation structure. The amount of change varied depending on the vegetation community and the management history. Based on data on changes in tree/grass ratios, we estimated carbon stocks in invaded and native savanna and suggest that gamba grass invasion leads to a short-term increase in the rate of carbon cycling and could lead to a reduction in carbon storage in the longer term. By applying a dollar value to the carbon stock, the data can be used in economic evaluations of the impacts of gamba grass on Australia's tropical savannas.

Keywords *Andropogon gayanus,* invasive alien species, fire grass cycle, vegetation change, aerial photography, Poaceae.

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