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Considering the social dimension of invasive species: the case of buffel grass

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ABSTRACT

The status of many invasive plant species that are also of high commercial value is contentious. Management of negative impacts depends on the support and co-operation of people who regard the species as an asset. For example, buffel grass (*Cenchrus ciliaris*) is highly prized by many pastoralists in Australia as an introduced pasture grass for livestock but it also has significant and deleterious environmental impacts. Identifying management strategies that minimise environmental impacts yet support production benefits is crucial for achieving sustainable outcomes. We present and operationalise a framework for assessing social and economic dependency on buffel grass and the capacity of pastoralists to change their buffel grass management. We interviewed 85 pastoralists across four diverse regions in Australian rangelands and found that pastoralists are dependent on buffel grass for a range of social and economic reasons and to varying degrees. These social and economic components of resource dependency were significantly correlated with the capacity to cope with, and adapt to, change and with attitudes towards managing buffel grass on grazing lands and on public land of high environmental value such as National Parks. Understanding how pastoralists identified the costs and benefits of buffel grass also enabled us to understand pastoralist perceptions of acceptable management strategies. Building strong social networks amongst buffel grass stakeholders will be a priority for the development of sustainable buffel grass management strategies. We argue that dealing with contentious environmental species will not be possible without considering the social dimension.

1. Introduction

Plant invasions present a serious threat to biodiversity and ecosystem functions (Franklin et al., 2006; Grice, 2006a,b; Martin and van Klinken, 2006). The situation is compounded when invasive plant species have commercial value. Successful management of 'commercial weeds' (Grice et al., 2008) requires the support and co-operation of people socially and economically dependent on them, and hence there are important social issues to address regardless of the effectiveness of management strategies (Brenner, 2010). Identifying management strategies that minimise environmental impacts yet support commercial benefits will be crucial for realistically 'tackling' the issue since some measures, such as biological control, are unlikely to be socially acceptable or politically viable. The dearth of literature on management or policy explicitly addressing contentious species such as 'commercial weeds' suggests that consideration of socio-economic aspects is needed if environmental or biodiversity issues are to be effectively addressed. We present and operationalise a

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framework for understanding the social components of biological invasions – specifically, socio-economic dependency on them and the capacity to change – and use the case of buffel grass (*Cenchrus ciliaris*) in Australia as an example.

Buffel grass is a perennial grass that has been introduced to many regions such as the Americas (Brenner, 2010; Parsons, 1972) and Australia (Friedel et al., 2006). Its value as a pasture grass in rangeland grazing systems has long been recognised (Cavaye, 1991; Humphrey, 1967) and it is the most widely cultivated pasture species in northern Australia. However, in recent decades, negative impacts of buffel grass have also been recognised (Fairfax and Fensham, 2000; Friedel et al., 2006; Henderson et al., 2006). These relate to its tendency to naturalise in many environments and spread from the locations in which it was planted. It flourishes in many regions because of its drought tolerance, vegetative reproduction and prolific seed production (Franklin et al., 2006). Brenner (2010) suggests that buffel grass has been responsible for the deforestation of hundreds of thousands of hectares in regions such as the Sonoran Desert in Mexico. Buffel grass expands, dies and eventually burns in a self-perpetuating grass-fire cycle that kills native perennials and further favours buffel establishment (Brenner, 2010). In Australia, Franklin et al. (2006) showed that native pastures were 295% richer in native plant species than buffel planted pastures. Buffel grass pastures resulted in reduced biodiversity, lower biomass and reduced primary productivity (Franklin et al., 2006). Bioclimatic modelling suggests that buffel grass could establish in over 60% of mainland Australia (Lawson et al., 2004) and it has been identified as a 'transformer weed' of the Australian rangelands (Grice, 2006b). However, Brenner (2010) point out, that ''buffel grass is very, very popular''.

Buffel grass provides a good general example of a contentious species – one with both commercial value and impact as a weed – and one that is particularly important because of its likely extensive distribution and impact. Despite the serious deleterious environmental impacts of buffel grass, there are no national strategies currently available to manage it. Developing such a strategy could be fraught with difficulty (Manring et al., 1990). The implementation of resource-protection policies and strategies, regardless of whether they are associated with buffel grass or not, is a contentious process (Friedel et al., 2009; Lachapelle et al., 2003; Mascarenhas and Scarce, 2004). Natural resource management organisations frequently encounter resistance to their strategies for change: policy proposals are opposed, goals are frequently contested, public dissatisfaction mounts, people refuse to participate and comply, animosity and distrust towards the government grows, appeals and litigation increase, and occasionally even threats and violence occur (Jabareen, 2004; LeBillon, 2001). In the case of contentious plant species, the challenge is to steer a path towards sustainable use that addresses both production and conservation goals.

The purpose of this paper is to provide a mechanism to help optimise socio-economic and environmental outcomes in the management of contentious species. The inclusion of social information in the management of contentious species is more likely to result in socially acceptable strategies associated with less conflict, greater certainty, higher compliance and reduced transaction costs (Bryant and Wilson, 1998). Whilst the social dimension of contentious species occurs at larger scales through mechanisms such as globalisation, international transport policies and trade liberalisation (Brenner, 2010), it also occurs at much finer scales (individuals). Minimising conflict through the consideration of the social benefits that individuals gain, means that more effective strategies may be developed and implemented (Bennett and Virtue, 2005; Head and Muir, 2004). For example, in a recent study, Brenner (2010) found that the extent to which buffel grass was introduced in the Sonoran Desert in Mexico had direct bearing on individual ranchers in the region deciding to convert their pastures to buffel grass. Specifically, it was those ranchers with larger ranches who, over time, converted more land to improved pasture, suggesting that strategies targeting individuals are highly likely to achieve conservation goals (Brenner, 2010).

The social aspects that we consider in Australia at the individual scale centre on three main themes that are receiving increasing attention in the literature: perceptions of costs and benefits (Andersson et al., 2005; Hajkowicz, 2008), resource dependency (Fisher, 2001; Marshall, 2010) and social resilience (Gunderson, 2004; Marshall, 2010) (Fig. 1). We also examine the perceived feasibility of buffel management in areas of high environmental value and identify what factors are correlated with these perceptions. Specifically, the aims of this study were to:

(1) understand pastoral perceptions of the social and economic benefits and costs of buffel grass in four regions of Australia, and attitudes to different objectives, strategies and operational methods of dealing with the impacts of buffel grass;
(2) understand the level of social and economic dependency of pastoralists on buffel grass and their current management practices;
(3) identify the potential for change in perceptions, attitudes and values relating to buffel grass;
(4) identify the influence of dependency and potential for change on pastoralists' perceptions of buffel grass.

1.1. *Perceived costs and benefits of buffel grass*

This study is concerned with elucidating what the full (social and economic) range of perceived production benefits and costs of buffel grass might be. Perceived costs and benefits are not necessarily 'actual' costs and benefits, but they will provide significant insights into any 'barriers to change' preventing graziers from considering alternative management practices. By understanding how pastoralists perceive the costs and benefits associated with buffel grass, we are more likely to understand sources of conflict with other stakeholder groups and resistance to change (Friedel et al., in review) and develop realistic management strategies. Costs and benefits of buffel grass in the pastoral industry are also likely to be broader than those articulated by pastoralists. For example, pastoralists are unlikely to describe their emotional attachment to buffel grass (if any). Hence, we use the concept of resource dependency, described below, for a more complete understanding of what the range of costs and benefits are likely to be on pastoral lands. We test their applicability in four regions in Australia.