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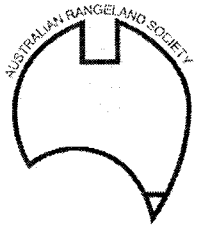

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DEMONSTRATING THE IMPACTS OF GROUND TANK CLOSURE ON BIODIVERSITY AND LANDSCAPE FUNCTION IN SOUTHEAST AUSTRALIAN RANGELANDS

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ABSTRACT

Abundant literature links provision of artificial water points in pastoral areas to negative environmental effects, including increased grazing pressure, prevention of regeneration and promotion of exotic plants and animals. Recent reports identify a knowledge gap in the relationship between water points and biodiversity. Despite incentives pastoralists are resistant to strategic water point closure and, where this has occurred, there is little data on biodiversity outcomes. A research project on Nanya Station in western NSW is monitoring the effects of total-closure, partial-closure and exclusion fencing of ground tanks on native and exotic plants and animals, including opportunists utilizing the resource.

INTRODUCTION

Water is a key limiting factor in arid environments and, prior to European settlement, Australian arid zones had few permanent water points (James *et al.* 1995). There is abundant literature to suggest that provision of artificial water through bores, dams and ground tanks in pastoral areas has had negative environmental effects (Landsberg *et al.* 1997). Currently there are few areas left that are distant from water. This problem exists in arid and semi-arid environments worldwide (e.g Thrash 1998, Noy-Meir 1996).

Some supposed impacts of watering points in the Australian rangelands include:

- Contributing to elevated macropod populations (James *et al.* 1995)
- High populations of exotic grazers including goats and rabbits (James *et al.* 1995)
- Redistribution of nutrients through deposition of dung (Lange & Willcocks 1978)
- Allowing establishment and spread of exotic plant species (Westbrooke 1990) and unpalatable native plant species such as *Nitraria* (Cunningham *et al.* 1981)
- Prevention of regeneration of native perennial plant species (Westbrooke 2005)
- Increased numbers of opportunistic water-dependent species (Draper *et al.* 2004) and use of ground tanks as 'stepping stones' for migration of birds.
- Indirect impacts on wildlife through providing a focus for activity of exotic predators (Owen-Smith 1996)
- Interaction between animal and plant effects such as the impact of changes in populations of insectivorous bird species on canopy-dwelling insects and consequent increase in health of the trees in the area (Landsberg *et al.* 1990, Grey *et al.* 1997).

There is a need to address this problem at a landscape scale. In western NSW and adjacent areas of South Australia, a major means of water provision is through ground tanks or dams storing diverted run-off following major rainfall events. There is widespread agreement that, for better control of feral grazers and improved grazing management in areas where biodiversity is a primary or secondary objective, closure of earth tanks or greater control of water distribution is a key management strategy. Despite the incentives available for

improving biodiversity outcomes on pastoral lands, there is reluctance among landholders to utilize these strategies (Hayward LMDCMA pers. comm.) and as a result, there are few opportunities to study in detail the responses of plant and animal populations to such closure. Past studies have not carried out experimental manipulation at the landscape scale to demonstrate the long-term impacts of tank closure on arid-zone biodiversity. Also, the usual procedure is to block inlet drains, which still leaves a depression to hold water following high rainfall. In this project the strategy of re-landscaping the site to its original profile to mitigate this problem is also being trialed.

Research is proposed to investigate the impacts of modification of ground tanks on biodiversity through three different treatments: 1. Fencing to exclude mammalian grazers, 2. Partial tank closure (i.e., blocking drains and breaching walls), 3. Complete tank closure and (i.e., returning site to original landscape profile). Each of these treatments will be carried out on four tanks with a further four tanks without treatment will be used as controls. Research will investigate the impacts of these treatments on a wide range of plant and animal groups.

METHODS

The core of the research project will be carried out on Nanya Station, a 30,000 ha property, 150 km northwest of Wentworth in south western New South Wales where the dominant vegetation comprises eucalypt open-scrub (mallee) (Westbrooke *et al.* 1998). Until 2004, Nanya Station was managed as a pastoral lease, but its purchase by the University of Ballarat for teaching, research and conservation now allows the proposed manipulation. There are currently 22 ground tanks on the property, and, of these, twelve tanks will be used in the research: four will be fenced to exclude all large grazing animals, four will be partially closed by blocking drains and creating breaks in the banks, and the remaining four will be completely closed with land returned to original form. The remaining of the tanks on the property are being closed or fenced. Tanks have been selected with maximum distance between treatments and, similarity in size and surrounding vegetation type.

At each tank four zones have been defined: Zone 1 – area within tank wall, Zone 2 – area of high impact between tank wall and tree-line, Zone 3 – area from tree-line to 1km distance, Zone 4 – area 1 – 2km. from tree-line. Assessments will be undertaken in each of these zones at sites along radii from the tank.

At all sites, the following assessments will be undertaken at distances from the tank both prior to and at six monthly intervals following treatment:

Large grazing mammals will be assessed through faecal accumulation plots. Plots will consist of a 5.64m diameter circle cleared of faeces. Plots will be checked for faeces accumulated during each assessment, and the number of faecal groups for each species will be identified, following the technique of Neff (1968).

Reptiles and small mammals will be assessed via lines of pitfall traps and drift-lines, established within each zone. All fox scats will be collected and analysed for hair and bone content.

Birds will be assessed via point survey counts at morning and evening, following Harrington (2002). Species and abundance will be assessed once each in morning and evening at zone within each site. At these points 20 minute stationary counts will also be made as these have been shown to be an efficient sampling technique.

Bats will be assessed using Anabat detectors placed at points within each zone to obtain relative activity levels of the species presence.

Ants will be collected in pitfall traps set up in arrays at each sampling site and identified to species. Species diversity and abundance will be determined to assess changes in species composition in relation to functional groups present at differing distances from water.

Vegetation will be sampled along tangential transects within each zone. The following vegetation parameters will be collected: the line intercept of all ground species along with litter and bare ground will be recorded along transect lines within each quadrat. Based on the centre of each quadrat, the point-centred quarter technique will be used to determine the occurrence and density of tree and shrub species. Permanent photo points will be established for each transect. Vegetation condition assessment will be assessed, based on methods developed for woodland condition assessment in northwest Victoria (Westbrooke *et al.* 2001, Gowans *et al.* 2005).

Landscape function analysis will be conducted using the techniques developed by (Tongway & Hindley, 1995).

Climatic variables will be assessed by automatic weather stations established at each water point since rainfall in the area is highly variable both temporarily and spatially.

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