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ASSESSING BIODIVERSITY OUTCOMES FROM WATERPOINT MANAGEMENT IN THE ARID RANGELANDS

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ABSTRACT
The aim of this paper is to introduce a study that develops, tests and refines techniques for measuring biodiversity condition and management outcomes using before and after scientific experiments of waterpoint manipulations. It will be undertaken on selected arid rangeland cattle properties in the Stony Plains region of South Australia. A key outcome expected from our proposed research is authentication of biodiversity outcomes from waterpoint management.

INTRODUCTION
It is clear that resource managers urgently need tools to assess the condition of rangeland biodiversity (including native vegetation) and identify appropriate management options. However, unless we can authenticate on-ground biodiversity outcomes from management interventions, further public investment in biodiversity conservation will be questioned. This is already a big issue in South Australia where waterpoint management is regulated by a permit system that trades-off pastoral and biodiversity conservation values. Perverse outcomes in permit approvals can have huge impact through real opportunity costs, production losses or a loss of natural assets. The government is being pressured to show in a transparent fashion that real biodiversity outcomes and improved ecosystem services are achievable from waterpoint management.

OBJECTIVES
Our objectives cover developmental, experimental and knowledge and adoption (K & A) aspects of the research spectrum. They are:

1. Develop indices of biodiversity condition and management outcomes.
2. Test (i) the assumption that waterpoint management controls most of total grazing pressure across the landscape, (ii) the reliability of indices, (iii) the appropriateness of sampling scales for monitoring biodiversity condition and management outcomes, and for the influence of natural rainfall events on condition and outcomes from the intervention.
3. Standardise, make accessible and document indices and field measurements of biodiversity condition and management outcomes and their measurement, and make recommendations to SA government agencies and other stakeholders on the efficacy of waterpoint management as a biodiversity management tool.

RESEARCH APPROACH

Key issues

In the arid rangelands, waterpoints control the distribution of most grazing animals both spatially and over time, especially where domestic stock and feral animals need daily access to water in the summer months and every few days during the winter months (Fisher et al. 2005). Kangaroos appear less influenced (Fuduka 2006). Better management of waterpoints therefore could be a powerful management tool for achieving biodiversity outcomes by controlling the influence of total grazing pressure (TGP) on native biodiversity. In substantiating achievement from management intervention, it is important that we tease apart other confounding factors such natural variation due to climate variability (Underwood 1993).

Biodiversity condition and outcomes from intervention will be measured using attributes of soils, vegetation and animals. Key issues are:

- To demonstrate management outcomes, we must show that average changes in biodiversity condition at places where intervention occurs are more than the expected changes observed in places where no intervention occurs.
- The highly variable and unpredictable rainfall events also drive ecological patterns and processes and influence the responses of biota in equally variable and unpredictable ways spatially and over time (Griffin & Friedel 1985; Friedel 1990; Watson & Novelly 2004).
- Topography and soils also have a strong influence on biotic distributions, as fertile pockets can be found amongst vast areas of infertile landscape (Stafford Smith & Morton 1990). These places are significant for biodiversity as they tend to support higher plant diversity, growth and palatability, are preferentially favored by domestic and wild stock and native fauna for forage and are distributed unevenly throughout the landscape.
- Indices of condition and outcomes can be data hungry and therefore need intelligent development if they are to be feasible. Indices also must be repeatable and reliable in their use. They involve a high level of risk if the understanding of the attributes for measuring biodiversity condition, outcomes from intervention and TGP are inadequate (Smyth et al. 2003). A mix of surrogates may be needed for the development of indices (Smyth & James 2004; Hunt et al. 2006).
- Time is a limiting factor for testing the outcomes of waterpoint intervention (Griffin & Friedel 1985).

Questions

In recognition of these issues and our objectives, we will address the following questions:

1. (a) What are the key biodiversity outcomes we can realistically achieve on the ground from waterpoint management, (b) what are the impediments to achieving them and (c) how could this influence the assessment of condition and management outcomes?
2. Given the key biodiversity outcomes identified in Q1, (a) what are the most appropriate attributes of soils, vegetation and animals for measuring biodiversity condition and management outcomes for the study area, (b) what are the appropriate resolutions for monitoring them and (c) do techniques already exist for deriving indices?
3. How do waterpoint interventions influence biodiversity attributes and TGP in (a) different land systems at places with (b) different gradients of soil condition?
4. How do rain events affect the ability to detect biodiversity outcomes from waterpoint interventions?
5. (a) How reliable are the derived indices and (b) what refinements are needed?

Overall approach to problem

We will undertake this project using a fast-track or evolutionary strategy of research project planning as shown in Figure 1 because it is a highly innovative project with some high risks (e.g., participating producers withdrawing from project part way through the study). The project is separated into four activities. Activities 1 and 2 are part of the developmental phase. Activity 1 involves fine-tuning of the research design in face-to-face consultations with the project team, adoption steering group and participating pastoralists. It will investigate Q1 and Q2a and b and will be completed before any of the other activities. Activities 2, 3 and 4 (central box of Fig. 1) will be carried out concurrently. Activity 2 describes the design of the indices (Q2c) which involves evaluating existing techniques, identifying surrogates as parameters for indices of biodiversity condition, developing the indices and testing their consistency using other data. Activities 3 and 4 are a part of the experimental phase. Activity 3 investigates Q3 and Q5 which involves running a 'before-after' manipulative experiment for most of the life of the project. Activity 4 investigates the impact of rain events on biodiversity outcomes (Q4) and assesses further refinements if needed (Q5). Activity 5 is the knowledge management and adoption phase and will be done concurrently with all other activities.

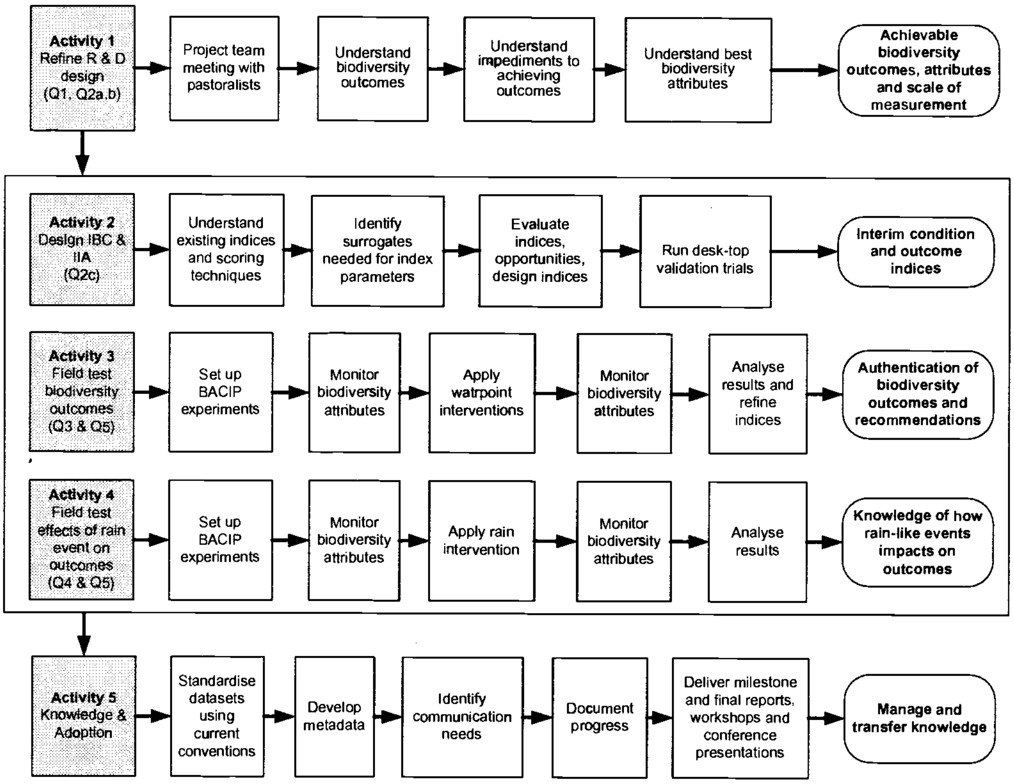

Figure 1: Proposed research approach for studying the authenticity of biodiversity outcomes from waterpoint management. (BACIP – Before, After and Control, Impact experimental design with time Periods; IBC – Index of Biodiversity Condition; IIM – Index of Intervention Management)

RESEARCH DELIVERABLES

Key deliverables of our research will be indices of biodiversity condition and outcomes, an understanding of appropriate sampling scales for monitoring condition and outcomes, authentication of biodiversity outcomes from intervention and recommendations on options for waterpoint management to inform the SA government waterpoint management policy.

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