

Maintaining biodiversity in tropical rangelands

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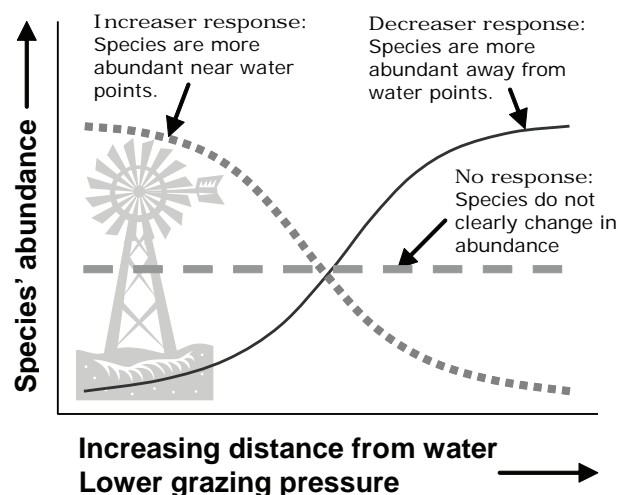
Introduction

The term 'biodiversity' is shorthand for the 'variety of life'. It includes all the different species of native plants and animals, the variety of environments in which they live, and the natural processes that sustain them. Biodiversity is an important part of the overall 'health' of a landscape – it contributes to ecosystem function and to the resilience of the system (the ability to recover from undesirable change).

Pastoral lands are very important for biodiversity conservation in the tropical rangelands of northern Australia. Many species and their habitats occur only on pastoral lands, or rely on these areas for their survival. Where pastoral land use maintains native pastures and avoids broadscale clearing, it is also possible to maintain good quality habitat for many native species. Unfortunately, we also know that overgrazing or other poor management can lead to negative impacts on biodiversity, and ultimately the extinction of some species. As new grazing management systems are developed in the tropical rangelands, it is

important to ensure that they do not reduce regional biodiversity values.

In extensive grazing systems like that in the VRD, pastoralists are seeking to improve economic performance and achieve more uniform grazing. While this may have some positive environmental benefits, it could also have negative impacts on certain native species. Research has shown that in most environments there are a set of species (known as decreasers) that are sensitive to grazing, and these species thrive in areas of land that receive little or no grazing (often areas that are a long way from watering points). If intensification of pastoral use means that most of the landscape is subject to relatively high utilisation levels, then some or many of these species will have no 'refuges', and may gradually disappear from that landscape.





PIGEON HOLE FIELD DAY
GRAZING STRATEGIES
 FOR TOMORROW

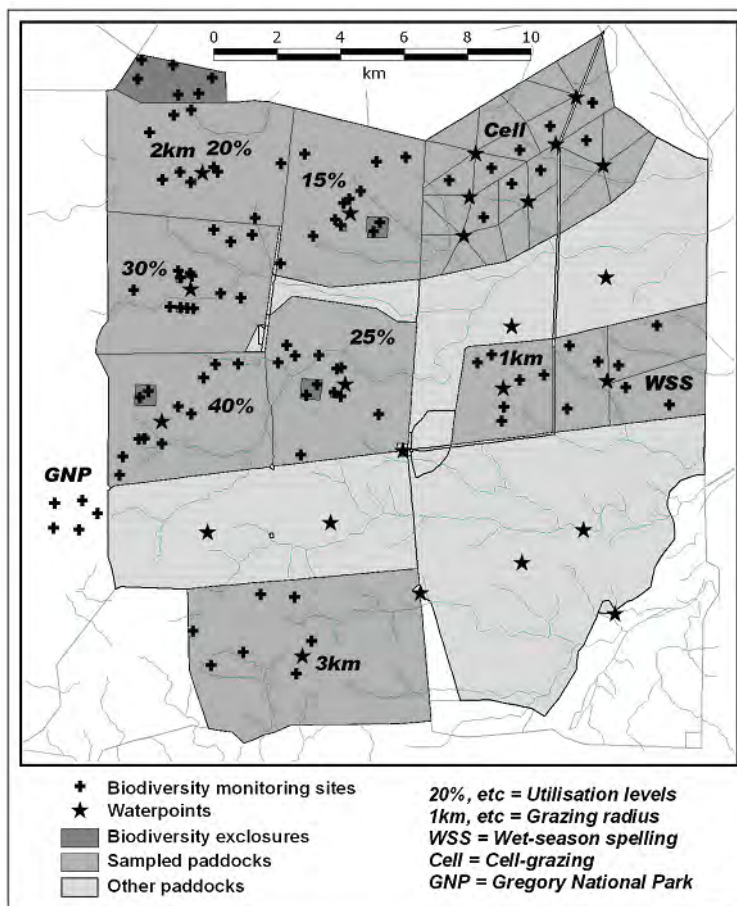
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Biodiversity studies in the Pigeon Hole Project

The biodiversity studies in the Pigeon Hole Project aimed to answer two main questions:

- Are there different impacts on biodiversity from the different utilisation levels and grazing management systems? In particular, is there a 'threshold' level of utilisation above which there is unacceptable negative effects on native plants and animals? Alternatively, were some of the grazing management systems 'better' for biodiversity than others?
- Assuming intensification of pastoral use has some negative impacts on biodiversity, are there management options to help protect the native wildlife that occurs within the property? For example, would setting aside some areas of the paddock help to protect the most grazing-sensitive species? How large would these areas need to be in order to be effective?

It is not possible to sample all of 'biodiversity'. We chose to study plants, birds, reptiles, small mammals and ants, as representatives of biodiversity in the trial area. We wanted to understand if the total number of species and the species composition (what particular species occur there and the relative abundance of each) changed over time depending on the management system or utilisation level.



We set up a large number of sample sites in most of the different grazing management treatments within the Pigeon Hole Project (see map) and monitored biodiversity at these sites for each year that the project was running. We also set up a total of 16 exclosures of different sizes (0.4ha to 400ha) where there was no grazing, and monitored what happened to the biodiversity in these 'conservation areas'. There were a total of 100 biodiversity monitoring sites, which were sampled twice each year from 2003 to 2007.

Biodiversity at Pigeon Hole

Our sampling showed the large number of native plant and animal species that occur within the project area (see Table). Within a single hectare, there could be as many as 85 plant, 26 ant, 25 bird, eight reptile and two

small mammal (as well as two macropod) species. It is worth noting that the cracking-clay grasslands within the Pigeon Hole Project are one of the more species-poor habitats in northern Australia, and the number of native species occurring in most woodland areas would be considerably higher.

	Total number of species (all sites)	Average number of species per ha.
Plants	231	39.0
Ants	63	20.2
Birds	75	9.2
Small mammals	4	0.5
Reptiles	20	9.7

Sampling over five years showed that there was a lot of variation in species richness and composition at our sites over time, not related to the grazing treatments. For example, the average number of bird species per site in 2005 was about 50 per cent higher than other years, whilst the mean number of plant species per site was lowest in that year. These differences between years were mostly due to variation in the amount and timing of seasonal rainfall at Pigeon Hole, although changes in bird composition also depended on conditions in other parts of the region or country (for example, there were huge numbers of budgerigars in 2005, but few in other years).

Although the Pigeon Hole project area is relatively uniform in habitat, there was also quite a lot of variation in species composition between sites across this area (which may partly be related to the previous, long-term grazing history). These sources of variation are important to understand, because they make it more difficult to detect any changes in biodiversity due to the new grazing treatments.

Effects of grazing management treatments on biodiversity

Some biodiversity data is still to be collected in late 2007, and analysis of all the biodiversity data has not yet been completed. Preliminary analyses show that none of the different utilisation levels, or grazing management systems, caused pronounced changes in biodiversity over the first four years of the trial. Rather, the new grazing regimes have tended to make species composition more similar amongst biodiversity sampling sites, reducing the pre-existing differences between treatment paddocks. There was some indication from the 2006 data that bird composition within exclosures was diverging from that of sites in adjacent grazed paddocks, and (as would be expected) the cover and basal area of perennial grasses has gradually increased in the exclosures.

Conclusions and management recommendations

Biodiversity sampling in the Pigeon Hole Project has shown that there were not significant short-term impacts on biodiversity from relatively high levels of utilisation, or from a variety of grazing management systems. However, the implications of these findings for pastoral development in the broader region must be considered cautiously:

- As noted above, natural variation in this system makes detecting management-related changes difficult, until these are quite pronounced;
- It is likely that the effects on biodiversity of a new grazing management regime will only become evident in the medium- to long-term (particularly after several cycles of good and poor seasons). For this reason, we recommend that there must be adequate long-term monitoring of biodiversity in tropical rangelands;
- A number of studies have shown that these black-soil grassland systems are relatively resilient to grazing impacts. It is likely that the impacts on biodiversity would be more rapid and pronounced should similarly high utilisation levels be applied in most other land types.



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Management recommendations aimed at protecting biodiversity will be refined at the end of this project. However, information from a number of studies has been used to develop a set of general guidelines for biodiversity-friendly land management in the tropical rangelands¹, and these are summarised below.

¹ Fisher, A. and Kutt, A.S. (2006). *Biodiversity and land condition in tropical savanna rangelands: summary report*. Tropical Savannas CRC, Darwin.

Further information

There is a large amount of information available about biodiversity in the northern Australian rangelands, and how grazing (and other land management issues) affect biodiversity. Most of this information is accessible through the 'Northern Australian Land Manager' website being developed by the Tropical Savannas CRC (www.landmanager.org.au).

Management guidelines for retention of biodiversity in tropical savanna rangelands

These guidelines are primarily aimed at management at an enterprise scale, and complement biodiversity management actions at regional (as defined in regional Natural Resource Management Plans) and State scales (eg. NT Parks and Conservation Masterplan).

1. Maintain cover and diversity of native perennial grasses

- this will help guarantee the survival of many native plant and animal species
- this is already a goal of good pastoral management, and ways to achieve it are described in Grazing Land Management manuals (noting that the use of exotic species is counter-productive)
- management strategies may include conservative and/or variable stocking rates, wet-season spelling, rotational grazing, and the maintenance of appropriate fire regimes.

2. Where possible, use grazing strategies that rest large areas of country

- this will assist in the seeding and recruitment of native plant species, improve breeding success in some native animals, and reduce predation on some species
- may be achieved by wet-season spelling or rotational grazing systems
- particularly important where there are high stocking rates.

3. Protect special areas, by fencing out stock if necessary

- special areas include key habitat for threatened species; important breeding areas for animals (such as waterbirds); vegetation types that are very sensitive to grazing; and remote or unwatered country (see below).

4. Where possible, retain and protect natural waterholes

- waterholes and creeklines are usually rich in plant and animal species; contain species that are not found elsewhere in the region; and often have special species or breeding areas
- these areas are also vulnerable to damage by concentration of stock
- where possible, fence off waterholes and major creeklines and pipe water outside the fences (although not into previously ungrazed areas).

5. Retain some areas on the property (of each habitat) with little or no grazing pressure

- this will help maintain populations of all species on the property, particularly the ones most sensitive to grazing
- ideally, the non-grazed areas would be 5-10 per cent of the area of each land type on the property
- ideally, these areas would be in a few large blocks rather than tiny, scattered areas
- having little or no grazing pressure may be achieved by controlling the spread of waterpoints and/or by fencing 'refuge areas'
- this principle becomes more important as pastoral use is intensified.

6. Try to maintain a variety of burning regimes

- different plant and animal species require different fire regimes – so a variety of burning practices will benefit most species
- avoid either no fire, or very frequent fire, over large areas of country
- avoid burning large areas of country in most years
- a patchy pattern of burning is ideal, with some areas that are not burnt for a long time. This can be achieved through cool winter burns, or storm burning
- the period areas are best left unburnt will vary from region to region, and local information should be sought as to appropriate periods.

7. Maintain structural and micro-habitat diversity

- leaf litter, fallen logs, standing dead trees, large trees with hollows and termite mounds are all important habitat for some species
- a diverse midstorey with trees and shrubs of a variety of ages and sizes contributes to habitat diversity
- avoid grazing and fire regimes that reduce this diversity over substantial areas.

8. Control problem weeds and restrict further spread

- this is a standard management practice on most properties
- identify and target weed species that threaten special areas or special species (eg. taking over areas used by breeding waterbirds)
- exotic pasture species can be considered as weeds to native wildlife. Ideally all introduced species should be avoided, but if exotic pastures occur, prevent these species becoming dominant over large areas.

9. Control feral grazing animals

- this is a standard management practice on most properties, and reduces total grazing pressure
- concentrations of feral animals may damage special habitats, even in areas set aside for conservation.

10. If possible, reduce numbers of feral predators

- cats (and in some areas, foxes) kill large numbers of native animals, but are very difficult to control
- dingos may help keep cat and fox numbers down. Dingos can also help control feral pig numbers (which damage wetlands and riparian areas), and reduce the numbers of large macropods (which contribute to total grazing pressure).



11. If possible, avoid clearing native vegetation

- clearing, especially over large areas, dramatically effects many native plants and animals
- if clearing is considered essential, restrict clearing to <30 per cent of each land type (habitat) on each property, and create mosaics of cleared and uncleared vegetation, rather than extensive clearings.
- retain substantial buffers of native vegetation around watercourses and wetlands, and retain connecting strips of native vegetation within cleared areas
- the trade-off for clearing should be lower stocking rates and/or improved spelling in other parts of the property
- in certain cases, it may be important to control the invasion of native grasslands by woody plants, or ecologically undesirable thickening of tree or shrub layer, through appropriate fire management.

12. If possible, avoid using introduced pasture plants

- where introduced pastures are considered essential, make sure introduced species can't spread outside a controlled area
- prevent exotic pastures from becoming dominant monocultures, as this can reduce wildlife diversity, and eliminate palatable native grasses
- restrict introduced pastures to a small, concentrated portion of the property (such as those that are already cleared or in poor condition)
- the trade-off for introduced pastures should be lower stocking rates in other parts of the property.

13. Be informed about biodiversity

- find out what habitats and species occur on your property
- try and observe annual and seasonal patterns of wildlife on your property
- find out where the special places and special species occur, and what special management they might require
- seek expert advice or assistance if necessary.

14. Be aware of changes in biodiversity

- are some species declining or disappearing?
- are some species getting more common?
- are new feral (pest) species appearing?
- these changes may indicate management issues that need to be addressed
- if possible, keep a record of your biodiversity observations.

15. Have a property management plan that considers biodiversity

- the plan would address all the issues listed above
- the biodiversity management section would integrate with the property grazing land management systems
- the property plan should be developed in the context of regional biodiversity values, neighbouring and regional landuse patterns, and regional and State NRM or conservation plans
- seek expert advice or assistance if necessary.