

## APPENDIX 7: MONITORING AND RESEARCH

### A7.1 INTRODUCTION

Through this study, our understanding of the Finke Bioregion and its conservation values has increased substantially, but there are still knowledge gaps that need to be addressed. Monitoring is required to evaluate, and if necessary modify, any conservation actions that may arise from recommendations made in this report. Focused monitoring and research will be needed to increase our knowledge and/or make decisions about ecosystems or species that are likely to be impacted by climate change. Monitoring will also facilitate progressive adaptation to climate changes as they occur (Howden *et al.*, 2003).

Monitoring is fundamental to adaptive management strategies (i.e. approaches to management that can absorb and accommodate future events in what ever unexpected form they may take; Holling, 1973). Burgman and Lindenmayer (1998) list the following principles of adaptive management:

- consider a variety of different strategies;
- favour actions that are informative, reversible and robust to uncertainty;
- experiment with the system;
- validate the assumptions underlying management decisions;
- monitor the results of management; and
- regularly modify decisions and management practices in the light of new information.

### A7.2 MONITORING

Landholders are familiar with monitoring schemes which seek to monitor trends in pasture condition over time (e.g. the Tier 1 photopoint monitoring in the Northern Territory). In more recent times, satellite imagery coupled with ground-truthing is being developed to assist in the assessment of land condition. However, these monitoring schemes do not directly measure the health of animal populations (Price *et al.*, 2000; Fisher, 2000). The goals of biodiversity conservation are largely aimed at regional scales. Therefore, inventory and monitoring of biodiversity requires an integrated approach at the regional level which draws on a range of techniques and expertise (Fisher, 2000).

It is not impossible to monitor every component of biodiversity. However, Fisher (2000) provides examples of several attributes which have the potential to provide information on biodiversity or general 'environmental health':

- *Environmental variables* – Pasture monitoring sites which measure land condition may be useful biodiversity indicators (e.g. local species diversity and community structure). Remote sensing tools can be used to measure vegetation change or patchiness. The Centre Land Watch Scheme developed by the Centralian Land Management Association (CLMA) encouraged pastoralists to develop and participate in their own monitoring to meet their individual needs (Walsh, 2003). There are some specific recommendations from this resource assessment report that could be easily integrated with monitoring schemes such as Centre Land Watch. For example, monitoring known populations of threatened species where they occur on pastoral land (e.g. the Rainbow Valley Fuchsia Bush *Eremophila* A48866 Rainbow Valley and Peter Latz Wattle *Acacia Latzii*).
- *Threatening processes* – Measurement of the extent and/or intensity of processes believed to threaten biodiversity such as the spread of weeds, abundance of feral animal species, or the frequency, intensity and extent of fire.
- *Indicator species* – Changes in the status of one species or group of species may be indicative of changes in the status of a wide range of species or ecological processes. For example, the disappearance of birds that rely on tree hollows for

breeding may be indicative of major changes occurring in Eucalypt woodland habitats. Different types of indicator species may be useful for monitoring the impacts of climate change (see Appendix 5, section A5.10). For example, 'detector' species which occur naturally in an area may show measurable responses to environmental change (e.g. changes in distribution or behaviour). 'Sentinel' species which are sensitive species introduced into the environment, may act as early-warning devices by exhibiting changes in physiology, phenology and distribution and abundance (Howden *et al.*, 2003). Indicator species are potentially useful but we need to further our understanding of the relationships between species chosen as indicators and environmental change (Burgman and Lindenmayer, 1998). Usually a range of techniques and indicators need to be used that incorporate a variety of scales.

- *Focal species* – Species that are known to have declined in the region or endangered species may be considered as focal species. However, if the endangered species has a very limited range and specific habitat requirements, they may not be good indicators of broader 'ecosystem health'.

There is useful and easily recorded information on biodiversity that can contribute to property-scale management plans and regional strategies (Fisher, 2000). For example, knowing the:

- area and configuration of native vegetation on the property;
- area and configuration of land not subject to grazing by stock;
- timing and extent of weed invasions;
- numbers and distribution of feral animal species;
- timing, extent and frequency of fires and an estimation of their effects on vegetation;
- changes in cover and composition of native perennial pastures;
- changes in numbers and local distribution of distinctive wildlife (e.g. bustards and other bird species, kangaroos); and
- for those that might be keen bird watchers, compiling a bird species lists and noting when new species appear and others are longer seen (Fisher, 2000).

A special issue of *Austral Ecology* (a journal of ecology in the southern hemisphere) released in 2004 deals specifically with biodiversity monitoring in Australia's rangelands (*Austral Ecology*, Volume 29, Number 1, February 2004).

### **A7.3 FUTURE RESEARCH**

Major knowledge gaps exist in understanding the functioning of arid zone ecosystems, which limits our ability to make precise recommendations. Approaches to management across landscapes often relies heavily on extrapolations from basic natural history observations. Effective management of the natural values of the Finke Bioregion and other areas of the southern Northern Territory must be based on a sound understanding of the mechanisms responsible for the patterns observed in nature and on an adequate knowledge of the impact of threatening processes. This knowledge can only be acquired through applied research that targets relevant questions at the appropriate temporal and spatial scales. The Natural Resource Management theme of the Desert Knowledge Co-operative Research Centre (CRC) presents a unique opportunity through which to focus research effort. Some important topics requiring further research are described below.

#### ***Fire Ecology***

A sound understanding of the impacts of fire on the biota of central Australia is a priority for research. The effects of fire regimes on plant populations in terms of fire frequency, intensity, timing and extent need to be understood. This knowledge base must be at the level of the biology of individual species to allow an understanding of the mechanisms by which species respond to disturbance (re-sprouting versus regeneration from seed), cues for germination, and disturbance thresholds. For example, the management of a

taxon such as Undoolya Wattle *Acacia undoolyana* will differ greatly depending on whether the taxon is really 'fire sensitive' (as currently hypothesised), or whether seedling recruitment requires a hot wildfire to kill adults followed by a fire free period of specific length for seedlings to establish before flowering and seeding. Impacts of fire regimes on animal populations also need to be assessed.

### ***Buffel Grass***

Research that demonstrates the impacts of Buffel Grass on ecosystems, particularly changes in flora diversity, vegetation structure and wildlife assemblages is a priority. If Buffel Grass invasion is responsible for deleterious ecosystem changes then research needs to focus on the development of effective control measures. Related research on seed bank longevity is needed to assess the ability of affected plant assemblages to recover once Buffel Grass is removed.

### ***Soil Seed Banks***

Research is needed into soil seed bank dynamics to understand issues of plant persistence in relation to disturbance regimes (including fire and weeds).

### ***Habitat Restoration***

The restoration of habitats subject to high levels of modification needs to be addressed. On a small scale, research could target options such as the provision of artificial nest-boxes as nest and roost sites for hollow-dependent fauna.

### ***Grazing Impacts on Chenopod Vegetation***

A specific research project of particular relevance in the Finke Bioregion, is to assess the impact of cattle grazing on chenopod vegetation. The Finke Bioregion is unique in that two small chenopod-specialist bird species (Slender-billed Thornbill and Thick-billed Grasswren) have gone extinct since European settlement. Elsewhere in their ranges, both species co-exist with sheep, often where stocking densities are high. This observation raises the possibility that the impacts of cattle grazing on chenopod vegetation are more severe than impacts from sheep grazing. This possibility could be of great significance for conservation planning in the Finke Bioregion given the extent and importance of chenopod associations.

### ***Vegetation mapping***

Any assessment of the conservation values of plant assemblages requires adequate vegetation mapping at an appropriate scale. This is currently not available for the Finke Bioregion but could be attempted in the future using the available information from this and other studies.

### ***Incorporation of key habitats in the reserve system***

This resource assessment report has recommended landscape-level conservation planning and management across the Finke Bioregion to maintain ecological processes and ecosystem health. Ecological processes are essential for biodiversity conservation as well as the maintenance of sustainable production systems. Land use in the Finke Bioregion is dominated by pastoralism. It is recommended that a conservation strategy should emphasise the importance of off-reserve conservation models which address key conservation issues within a framework of co-operative and integrated land management. However, this should not preclude incorporation of key floodplain areas, Mulga shrubland, chenopod shrubland and chenopod herbland within a reserve system if the opportunity arises. Further analyses of available data will be required to assess the value and representativeness of areas of priority habitats in the Finke Bioregion that may become available for acquisition in the future.

### ***Climate change – information gaps and uncertainty***

Research and monitoring is required to address a number of information gaps and uncertainties with regard to the likely impacts of increased atmospheric carbon dioxide (CO<sub>2</sub>) levels and climate change on ecosystems and their constituent species, and how best to manage our natural resources for climate change (Howden *et al.*, 2003). Key

information gaps identified by participants of a workshop on climate change in relation to biodiversity held in Canberra in October 2002, and reported in Howden *et al.*, (2003), include:

- documentation of impacts that are already occurring in response to existing climate trends;
- an understanding of the factors affecting the distribution and abundance of species;
- analyses of the species, ecosystems and regions most vulnerable to climate changes, including those likely to be impacted by species that are advantaged by the changes (e.g. weeds and feral animals);
- a comprehensive assessment of adaptation options available, including modifications needed to existing conservation planning and practice, and the existing reserve estate;
- analyses of present and future social and economic costs of climate change impacts on biodiversity with or without adaptation;
- an understanding of the factors that determine the resilience and adaptive capacity of ecosystems, including the roles of habitat extent, habitat connectivity and quality, disturbances, and management of habitat mosaics; and
- how to develop policy that is robust to the uncertainties and long response times of climate change impacts and adaptations (Howden *et al.*, 2003).