Status of Biodiversity Monitoring in the Rangelands

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A report prepared for the Australian Collaborative Rangeland Information System (ACRIS) through a contract with the Desert Knowledge CRC

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SUMMARY

As part of the background research for the 2007 Tracking Changes report by the Australian Collaborative Rangelands Information System (ACRIS - a national group that focuses on reporting change), an assessment of current biodiversity monitoring activity in the rangelands was conducted. Information was collected via an email questionnaire, face to face or telephone interviews and email requests for details of specific programmes. 115 people were contacted across the rangelands States and the NT.

Widespread systematic monitoring programmes for biodiversity were virtually non existent in the rangelands. Most existing systematic monitoring programmes were carried out on pastoral lands only and had not been designed for the purposes of biodiversity monitoring. Biodiversity information extracted from such data sets is compromised by inappropriate attributes/variables, stratification based on distance from water, selective collection of data (eg pastoral species information only) and the omission of non-production landscapes, many of which encompass habitats of prime importance to the documentation of biodiversity (eg rocky hills and ranges, wetlands, sand plains, stony desert). Most of the programmes that did provide biodiversity information were carried out at the local or regional level, and provided either baseline or short term information.

Programmes of relevance to the ACRIS report were selected from the information received and those not already being utilised by ACRIS identified. These included flora and fauna Surveys by State and Commonwealth government departments and other organisations, large scale programmes related to riparian systems (including waterbird surveys), individual species monitoring, specific research programmes, local detailed fire mapping and the status of the national reserves system. Features of these programmes are outlined in the body of the report and details provided in appendices.

A preliminary assessment of data sets that might be appropriate for further development as indicators of biodiversity change in the rangelands was carried out. However concerns with the need for validation of such indicators and their actual use for management decisions make the conclusions tenuous and further detailed discussion is strongly recommended. Irrespective of which indicators are ultimately chosen, their use will require a considerable injection of financial support.

The questionnaire requested information about knowledge of the ACRIS group and the associated Biodiversity Working Group (BWG). There were 23 responses for this section. Of these, 65% of respondents were aware of the BWG and 75% were aware of ACRIS. However, in general, very few had had any contact with the groups and most knew very little about the roles and functions of the groups. This suggests the need for more effective communication by ACRIS with the relevant stakeholders**.**

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ACRONYMS

ARP	Arid Recovery Project
CAPAD	Collaborative Australian Protected Areas Database
CARRS	Comprehensive, Adequate and Representative Reserve System
CRC	Cooperative Research Centre
CMA	Catchment Management Authority
DEW	Department of Environment and Water Resources (Commonwealth) (formerly DEH Department of Environment and Heritage)
DEC	Department of Environment and Conservation (NSW)
DK-CRC	Desert Knowledge Cooperative Research Centre
DLWBC	Department of Land, Water and Biodiversity Conservation (SA)
GAB	Great Artesian Basin
LMD	Lower Murray Darling
MDBC	Murray Darling Basin Commission
NHT	Natural Heritage Trust
NLWRA	National Land and Water Resources Audit
NRM	Natural Resource Management
NRS	National Reserves System
PMIS	Pastoral Management Information System (SA)
RAP	Rangelands Assessment Programme (NSW)
SRA	Sustainable Rivers Audit
SLATS	Statewide Landcover and Tree Study (QLD)
UKTNP	Uluru Kata Tjuta National Park
WARMS	Western Australian Rangeland Monitoring System

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Many people assisted with providing information for this project and their efforts are greatly appreciated. Contributions included general background information, contact details and comments on the draft questionnaire. Special thanks are due to the people who provided detailed information by completing the questionnaire, doing an interview or by sending details about projects in response to a specific request; some did all three.

The names of all who provided information, time or comment are listed (in alphabetical order by surname) below (my apologies for any omissions).

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1. INTRODUCTION

Rangelands occupy a major proportion of Australia's landmass and encompass an immense variety of habitats and landscapes. Despite some apparent problems (eg a high rate of mammal extinctions, invasion of exotic weeds) the rangelands are relatively undisturbed and not only support a great diversity of flora and fauna, but also provide important refuge areas for many species (Morton et al 1995). Consequently, due to both their geographic extent and condition, the rangelands have the potential to act as a reservoir for a significant component of Australia's biodiversity.

Biodiversity is declining across Australia (NLWRA, 2006), and biodiversity in the rangelands is no exception. However factors bringing about change in the rangelands differ from those operating in the more intensive land-use zones. Unlike the tangible, localised results of activities such as clearing of native vegetation, the impacts of pressures in the rangelands are reflected in broad, diffuse, low level change across the landscape. As such, any consequent change in biodiversity can be difficult to measure. In addition, for most of the rangelands, high variability in rainfall confounds the separation of human-induced change from natural variability. All these factors are further compounded by the geographic extent of the area and the small number of people available to assess any impacts on natural resources.

Biodiversity monitoring in the rangelands has been a point of discussion for many years and several reviews and workshops have addressed the major issues (eg Whitehead et al, 2001, Smyth et al, 2003). Although there is quite good baseline information about biodiversity in many parts of Australia, some of the bigger gaps occur in the rangelands. Not only does the baseline data need improvement, but work in the last few years (NLWRA 2001, Bastin and members of the ACRIS Management Committee 2005) concluded that very little of the information that is available could be used to assess change.

The Australian Collaborative Rangelands Information System (ACRIS)

ACRIS was formed in response to the 2001 NLWRA report *Rangelands – Tracking Changes* which articulated the need for a single body to act as a focal point for information on the rangelands. The management committee for ACRIS comprises 1-2 representatives from the Natural Resources agencies of each of the rangelands States (NSW, QLD, SA and WA), the NT and the Commonwealth. The work is coordinated by a small management unit co-located with CSIRO and the Desert Knowledge CRC in Alice Springs.

The goal of ACRIS is to draw together information originally collated at the regional and State level in order to provide a national overview of changing conditions in the rangelands. The ACRIS management committee and the management unit are in the process of developing and testing methods to do this, as exemplified in a preliminary pilot project covering 5 regions (Bastin et al 2005).

In 2007 ACRIS will release a report on change in the rangelands for the period 1992 to 2005. As a result of gaps in biodiversity information identified in the

preliminary pilot project, the ACRIS participants called upon the Biodiversity Working Group (see below) to assist them with information relating to biodiversity.

The Biodiversity Working Group (BWG)

Most of the information available for rangelands focuses on pastoral priorities (eg forage plants, production landscapes etc) and the consequent lack of solid biodiversity information has long been identified as a problem (NLWRA 2001). A Biodiversity Working Group was formed in 2002, consisting of an expert in the field from each of the relevant States and the NT. It was intended that the group assist with identifying biodiversity information available at the State or regional level that had not previously come to the attention of ACRIS. In 2005, DEWR requested that the BWG assist with ACRIS reporting. To this end the group has met several times, most recently in December 2006 (at DEWR in Canberra) where they reached a consensus on a basic set of ten biodiversity indicators (see Table 2, p 10) that could be used for the 2007 report. While agreeing there were a lot of problems with the list, the group felt that the attributes chosen were ones where a reasonable amount of information was available across the jurisdictions.

The Project

The present project was designed to assess the current level of biodiversity monitoring activity in the rangelands. The original contract tasks were to:

1. report on jurisdictional activity, capacity and commitment in relation to biodiversity monitoring in the rangelands, (including knowledge of ACRIS and the BWG)
2. identify biodiversity data sets actively managed or held within each jurisdiction, and provide a commentary on their relevance to ACRIS (eg applicability, availability, reliability, consistency across jurisdictions), and
3. with respect to their capacity to demonstrate change at the national scale, assess identified datasets as to whether they were immediately available(or could be made relevant/available with minimal additional resources), desirable and could be available with moderate additional effort/resources; and highly desirable, but requiring significant development.

It was not possible to address all these concerns in detail within the time frame of the project. In general the report outlines current biodiversity monitoring activity identified by respondents, indicates current data sets of possible use to ACRIS and presents a brief discussion of the awareness of ACRIS and the BWG.

This report is intended to provide background information for the biodiversity section of the 2007 ACRIS report. It should be noted that the methodology for the project was set up before the BWG identified the basic set of indicators to be used, so the data were collected using a different format (see methodology in chapter 2). Cross references to the BWG indicators are provided where appropriate.

2. METHODOLOGY

Process followed for collection of data

A questionnaire was designed in consultation with the project supervisors [Gary Bastin (DK-CRC) and John Lumb (DEW)] and circulated to members of the BWG for comment. After modification, a cover letter (see Appendix 1) was attached and the final version (see Appendix 2) circulated. The questionnaire was sent to members of the BWG with the request that they forward it to relevant colleagues with appropriate endorsement. Alternatively they provided a list of possible respondents and the questionnaire was then sent to them directly. In some cases I sent requests directly to a contact asking for details about only a specific programme (ie not the full questionnaire).

Participants in survey

Initially the survey focused on government staff based in natural resource departments i.e. the bodies legislatively responsible for monitoring the natural resources of the rangelands in the various States and the NT. In order to clarify issues raised in the questionnaire, it was proposed that face-to-face interviews take place in one or two centres in each State. This occurred in SA (Adelaide and Port Augusta) and the NT (Darwin and Alice Springs). In NSW, QLD and WA this proved too difficult due to the time constraints of potential interviewees and time line of the project. As the survey proceeded and contact information was received from respondents the survey broadened a little to include some regional bodies (eg NRM groups, CMAs), private companies (eg BHP Billiton), conservation organisations and individual researchers etc. Initially some contact was made with indigenous organisations, but such information is now being collated under a separate DEW contract, so this avenue was curtailed.

Indicators for biodiversity monitoring

It is difficult to measure biodiversity directly, and usually only a subset is measured (eg species richness or abundance of a taxonomic group or groups, structural diversity of vegetation or landscape, genetic variability of a species). Consequently derived indicators are often used to reflect the state of biodiversity. To ensure that respondents were aware of the wide range of possible information that could be used to assess change in biodiversity, a list of indicators was included in the questionnaire. This list was modified from one presented in Hunt et al (2006), which includes a thorough analysis of the chosen attributes and the reasons for their use.

Hunt et al (2006) divided the indicators into 3 categories depending on whether they were of a type indicating a direct biotic response, (eg the distribution and abundance of bird species), an indirect type referring to a threat to the biota (eg distribution and abundance of introduced weeds) or a management action that may have an effect on the biodiversity (eg fencing to exclude feral predators). This distinction was retained in the presentation of the indicators in the questionnaire.

The original attributes were also categorised according to whether they were to be used at the property or regional level and whether they were to be used for regulation and compliance, or for investment allocation. These distinctions were not made in the current questionnaire and the attributes were simply divided into those that documented characteristics of the fauna, the flora or the landscape. The attributes presented in the questionnaire are listed in Table 2 and are matched with the biodiversity indicators chosen by the BWG for use in the 2007 ACRIS report.

In retrospect this list was too comprehensive. It increased the magnitude of the project to a somewhat unmanageable level given the time available and may also have discouraged people from responding to the questionnaire. A focus on direct indicators may have been more productive.

Selection of data sets with potential for use by ACRIS

Much of the information submitted was very good. However, many of the data sets were not directly applicable for use by ACRIS in that the datasets assessed biodiversity but were not capable of indicating change. From the data sets for which detailed information was received (see Appendices 5-9) the most relevant data sets were selected by assessing them against guidelines in relation to three criteria - their usefulness as an indicator of biodiversity, the inclusion of sampling over time, and the spatial extent of the data (see Table 1).

Table 1. Guidelines for assessing data sets as good, fair or poor with respect to measurement of biodiversity, time frame and spatial extent of data.

Criterion	**Standard**		
	Good	**Fair**	**Poor**
Relevance as a measure of biodiversity in the rangelands	Direct inclusive measure; OR one of several data sets covering a range of attributes all collected in the same place.	Restricted direct measure (eg measures only 1 species or attribute); OR indirect measure with strong identified links to biodiversity change.	Indirect measure.
Time frame suitable for monitoring	Regularly repeated sampling over more than 3 years.	At least one repeat sample.	Baseline data only OR irregular and inconsistent collection eg opportunistic observations.
Spatial extent	Remote sensing OR widespread sampling (i.e. all habitats across more than one bioregion).	Comprehensive at regional level OR similar to work in other regions OR widespread (but selective) sampling.	Local data only.

Table 2: Indicators for biodiversity. The left column shows the indicators of biodiversity used in the questionnaire (derived from Hunt et al 2006); the right column shows the equivalent biodiversity indicators used by the Biodiversity Working Group.

Indicators used in questionnaire	Indicators for Biodiversity Working Group
RESPONSE TYPE - FAUNA	
R1.Composition and abundance of waterbirds	
R2. Composition and abundance of terrestrial birds	BWG4. Bird composition
R3. Composition of terrestrial fauna	BWG6. Terrestrial fauna
R4. Composition of aquatic invertebrates	
R5. Kangaroo abundance	ACRIS reporting product separate to BWG
RESPONSE TYPE - FLORA	
R6. Composition of perennial terrestrial vegetation	BWG7. Terrestrial flora
R7. Cover and structure of perennial terrestrial vegetation	
R8. Vegetation greenness indices	
R9. Abundance & distribution of aquatic vegetation	
RESPONSE TYPE - FLORA & FAUNA	
R10. Status of threatened species and communities	BWG2. No. and status of threatened Spp
R11. Number of threatened species and communities	
R12. Distribution & abundance of significant fauna & flora	
RESPONSE TYPE - LANDSCAPE	
R13. Extent and distribution of floodwaters	
R14. Flow of perennial streams	
R15. Landscape function	ACRIS reporting product based on pastoral monitoring data
R16. Riparian/aquatic condition	BWG9. Wetlands
THREAT TYPE - FAUNA	
T17. Abundance and distribution of feral pest carnivores	
T18. Density and distribution of feral and native herbivores	ACRIS has some capacity to report for feral herbivores
THREAT TYPE - FLORA	
T19. Distribution and abundance of terrestrial and aquatic weed species	ACRIS has some capacity to report for selected terrestrial weeds
T20. Extent of clearing of remnant native vegetation	BWG3. Extent of clearing (partial match), some capacity to report
T21.Number and extent of listed weed species	
T22. Distribution and abundance of ecologically significant introduced plants (not listed as weeds)	BWG8. Distribution and dominance of economically significant introduced species
T23. Localised grazing pressure on sensitive areas	
THREAT TYPE - LANDSCAPE	
T24.Fire frequency and extent across landscape	Reported by ACRIS
T24. Fire frequency & extent in fire sensitive communities	
T26.Land tenure change	Reported by ACRIS
T27. Landscape pattern metrics (patch size, connectivity)	
T28. Average stocking rate	Change in stocking density reported by ACRIS
T29. Percentage of land area remote from water points	)
T30. Number and output of free-flowing bores	) BWG5. Water point distribution
T31. Density of artificial water points	)
T32. Water quality (eg concentration of pesticides)	
MANAGEMENT ACTION TYPE	
M33. Progress toward CARRS (comprehensive, adequate, and representative reserves system)	BWG1. Progress to CARRS
M34. Infrastructure to protect special areas	
M35. Property environmental plans	
	BWG10. Change in ground cover/bare ground

3. CURRENT ACTIVITY

Information received was not comprehensive due to the low response rate to the questionnaire (see Appendix 3). Of 115 people contacted, 27 (23.5%) completed the questionnaire. In addition, 22 people (19.1%) provided information via personal or telephone interview, or provided detailed written information in response to a specific request. Some (28) provided contact details only. Many people acknowledged the importance of the information requested, but did not have time to participate, or provided minimal information. In several instances people stated that they had already provided similar information for the Biodiversity section of Australia State of the Environment report (NLWRA, 2006). Part C of the questionnaire was originally intended to elicit more detailed follow up information. This was possible for only six respondents

In general the most comprehensive information was received from respondents in South Australia and the Northern Territory, jurisdictions where I was able to make visits and talk to people in person. For New South Wales, Queensland and Western Australia, I was unable to schedule visits in the time frame available and relied on the questionnaire, telephone and email requests for information. The responses from NSW and QLD were very patchy. Although several people responded apologetically, saying that time constraints prevented them from completing the questionnaire, some did not respond at all and/or did not return phone calls. Government personnel in WA collated information from various sources and submitted summary material covering most of the sections.

It is important to note here that the low rate of response means there may well be other relevant data sets available that were not uncovered in the course of this work. *Any conclusions are based only on the information available, and hence need to be interpreted with care*. However, with respect to programmes not included, I am inclined to think that while other information may exist, there is probably not a lot that can actually be used to report changes in biodiversity.

The information received from the relevant States and the Northern Territory is tabulated in Appendices 4-9. General indications about activity are in Appendix 4, which contains a 2-page summary table for each State and the NT. More specific information about individual data sets or programmes is to be found in Appendices 5 (NSW), 6 (NT), 7 (QLD), 8 (SA) and 9 (WA).

In general, the rangelands States and the NT all have basic information on many of the indicators. However, with the exception of that from pastoral programmes, most of it does not constitute monitoring, as there is no resampling component, and much of it is local or regional in scale. A few general points can be made from the summary information in Appendix 4:

- There is a considerable amount of good baseline biodiversity information available, most of which is recorded in the relevant State/Territory Flora and Fauna database (eg Atlas of NSW Wildlife). This information is vitally important as a benchmark against which future information can be assessed, and in some

cases a great deal of ongoing effort has been, and is being applied to gather this information (eg vegetation classification of NSW; see Benson (2006); Flora and Fauna survey programme in SA). However it is important to note that in some instances, there are real gaps in spatial coverage for the rangelands.

- For the most part, this baseline information does not allow detection of change in biodiversity, as very few of the contributing programmes sample the same locations more than once.
- For some jurisdictions, the capacity to detect change is limited by the dispersion of the information across several different data bases.
- Biodiversity programmes that do have a resampling component are usually local or regional in scale, and often are not long term programmes.
- Programmes that are widespread usually provide only indirect information about biodiversity (eg vegetation greenness, fire frequency/extent, pastoral survey data on frequency of perennials) and, although undoubtedly linked in some way, the strength and nature of the correlations with biodiversity have yet to be validated.
- Programmes that operate over a widespread area usually sample the environment selectively (eg include only production landscapes, focus on riparian habitat).
- Information about weeds and feral/pest animals rarely seems to be consolidated into some kind of centralised data base.

Selection of data sets relevant to biodiversity change

I selected data sets that were applicable to detecting change in biodiversity by using the guidelines in Table 1 (see methods p8). Any data sets categorised as poor against either the biodiversity or temporal criteria were discarded. Data sets categorised as poor at the spatial level were retained, as long as they scored well (i.e. at the good or fair level) for the biodiversity and time criteria. The data sets that remained fell into 12 major groups. These groups of data are listed in Table 3. For reference they have, where possible, been matched with the BWG indicators.

The individual data sets that contributed to these groups of data are listed, by jurisdiction, in Table 4. Data from several of the types listed in Table 4 are already being used by ACRIS for preparation of material for the 2007 report e.g. SLATS, RAP, WARMS, fire mapping, land clearing etc. As such, they are not considered further as the information they contain is already in use. The remaining data sets are the subject of further discussion in Chapter 4.

Table 3. The selected groups of data sets matched with the Biodiversity Working Group indicators

Groups of usable data sets	**BWG INDICATORS**
Status of Reserves System	1. Progress to CARRS
Individual species Monitoring - usually State Government	2. No. and status of threatened Spp
Native vegetation clearing	3. Change in woody cover
Water birds	4. Bird composition (and 9 – Wetlands)
Pastoral infrastructure	5. Water point distribution
(Flora and) Fauna Surveys: State and Commonwealth government, and other	6. Terrestrial fauna (and 4 – Bird composition)
Flora (and Fauna) Surveys: State and Commonwealth government, and other	7. Terrestrial flora
Pastoral Monitoring	7. Terrestrial flora
	8. Distribution and dominance of economically significant introduced species
Riparian health	9. Wetlands
	10. Change in ground cover/bare ground
Case studies (examples in Table 4)	
Kangaroo surveys	Reported separately by ACRIS to BWG
Surveys of ferals	
Fire mapping - remote sensing; - local/regional	Reported separately by ACRIS to BWG

Table 4: Current activities with potential for use in monitoring change in biodiversity.					
Type of activity (BWG category –see Table 3)	**NSW**	**NT**	**QLD**	**SA**	**WA**
Reserve System (BWG 1)	CARRS	CARRS	CARRS	CARRS	CARRS
Individual species monitoring - usually State Gov (BWG 2)	Threatened and iconic species monitoring eg brush tailed rock wallaby, mallee fowl	Threatened (& other iconic) species monitoring eg Redtailed Black Cockatoos, Bustards, Brolgas.	Threatened species monitoring eg hairy nosed wombat	Threatened species monitoring eg yellow footed rock wallaby	Individual threatened species recovery and monitoring programmes eg Gilbert's potoroo, numbat.
Waterbirds (BWG 4)	EAWS	Aerial waterbirds surveys eg NRETA, Wetlands International	EAWS	ARIDFLO	
Pastoral infrastructure (some data not current) (BWG 5)	Dept of Lands	Biograze project	DNRW	PMIS (average stocking rate, % land area remote from water, density watering points)	DPI DAFWA: % land area remote from water, density of watering points
State flora &fauna surveys (BWG 6,7)		Bioregional surveys (some resampling)		Fauna and flora monitoring in National Parks especially Bounceback Programme	Site-specific regional and local biodiversity surveys e.g. Pilbara Survey
Commonwealth (& other) flora & fauna surveys BWG 6,7		UKTNP Fauna Survey.		Olympic Dam Mine (ODM) flora and fauna surveys; ARP	
Pastoral monitoring (some limitations) BWG 6,7	RAP	Tier 1 and 2 pastoral monitoring	SLATS, TRAPS, GRASSCHEK etc	PMIS (Pastoral vegetation monitoring etc)	WARMS ; DAFWA DPI, & Pastoral Lands Board
Riparian health BWG 9	MDBC SRA (3yr pilot)		ARIDFLO	ARIDFLO	
Case studies No BWG	Tarawi survey 1997-2004	UKTNP Fauna Survey.	Simpson Desert study (Dickman); Desert uplands	Bounceback, rare rodent surveys, ODM, ARP.	
Kangaroo abundance No BWG	Aerial kangaroo survey (reported by ACRIS)		Kangaroo harvesting & aerial surveys (reported by ACRIS)	Kangaroo surveys eg pastoral zone, Flinders Ra, ODM, ARP (reported by ACRIS)	Annual kangaroo aerial survey program (data not available to ACRIS for reporting)
Surveys for ferals No BWG		Semi-regular aerial survey for some feral herbivores eg camels, buffalo,		Feral monitoring & control in NPs (eg Bounceback); feral surveys at ODM and ARP	
Native veg clearing No BWG		Spatial coverage of extent of clearing	EPA groundcover disturbance		
Fire mapping - remote sensing No BWG	Fire frequency and extent	NRETA Fire History			Firewatch (DOLA)
Fire mapping - local/regional No BWG		Fine scale fire mapping in Central Australian NPs, W Arnhem Land & Bradshaw			

4. DATA SETS WITH POTENTIAL FOR USE BY ACRIS

In the previous chapter, several programmes were selected because they met the basic criteria for being of possible use to ACRIS in preparation of the biodiversity section of their 2007 report. Information from some of these programmes (eg WARMS, SLATS, kangaroo surveys, fire mapping etc) is in fact already being applied to the ACRIS analyses. However, some of the identified data sets are not currently being used by ACRIS to provide information (see Table 5). The patchy response to the questionnaire means that those listed are not necessarily the best available. However, they do represent reasonably direct indicators of biodiversity and do have a capacity to detect change.

Table 5: Data types not currently being used by ACRIS

Data types (BWG indicator)	**Specific data sets**
Status of Reserves System (BWG 1)	CARRS reports to the Commonwealth from each State and the NT
Individual species monitoring (usually State Government). (BWG 2)	Individual threatened or iconic species monitoring (e.g. NSW: brush tailed rock wallaby, mallee fowl; QLD: hairy nosed wombat; SA: yellow footed rock wallaby, rare rodents; NT: Carpentarian rock rat, *Acacia latzii*, bustards; WA: Gilbert's potoroo)
Water birds surveys. (BWG 4 and 9)	EAWS; ARIDFLO NRETA Water Birds surveys; Wetlands International Water Birds surveys;
Flora and Fauna Surveys: State and Commonwealth government, & other. (BWG 6 and 7)	Flora and Fauna surveys that are repeated eg UKTNP Fauna Survey Specific regional programmes eg Bounceback in Flinders and Gawler Ranges in SA; Monitoring at Mine sites: eg Olympic Dam Mine, Arid Recovery Project
Riparian health (BWG 9)	Pilot programmes leading to long term monitoring eg MDBC Sustainable Rivers Audit (3 yr pilot complete; 2004-2010 in progress); ARIDFLO (3 year programme completed).
Specific research programmes	Long term research sites eg Simpson Desert work by Chris Dickman
Surveys of feral pests	Semi-regular aerial survey for problem feral herbivores in NT e.g. camels, buffalo; feral control & monitoring in SA NPs (Bounceback); feral surveys at Olympic Dam Mine & ARP.
Fire mapping - local/regional	Fine scale fire mapping in Central Australian NPs, Western Arnhem Land & Bradshaw

Details for many of these data sets have been collated and are included in Appendices 10-15 (10: Olympic Dam Mine; 11: Arid Recovery Project; 12: Bounceback; 13: Waterbird surveys; 14: Simpson Desert data; 15: Threatened and iconic species monitoring). The details for UKTNP Fauna survey, and for two data sets where only a small amount of information was submitted (ARIDFLO and MDBC-SRA) are collated in Appendix 16.

Most of these data sets are local or regional in scope, but their temporal aspect, both in terms of repeated sampling and time span of the data, enhances their value. Several contain data collected in a systematic, consistent way over more than 10 years. In addition, some contain several different kinds of information (eg fauna, flora, and feral pests) and hence give a more holistic view of what is happening in a specific region. For example, the monitoring associated with the Bounceback programme (Appendix 12) in the Flinders and Gawler Ranges of South Australia, provides a suite of complementary information that documents the response to an intensive programme for goat and fox control that was begun in 1993. Data are collected for small vertebrates, bushbirds, vegetation, kangaroos, yellow-footed rock wallabies, cats, foxes, goats and rabbits. The programme has involved a very successful collaboration between Parks staff, regional landholders and other community groups and is coordinated by the SA Department of Environment and Heritage, which is also responsible for management of the data base. Strong regional support means that the likelihood of continuation is high. Once the immediate threat has been reduced the level of programme activity may decline, but it seems possible that related new activities (eg re-introduction of locally extinct species) will form the basis for an ongoing programme.

Several people interviewed in South Australia commented not only on the Bounceback programme, but also on the importance of the long running monitoring being conducted by the Arid Recovery Project (ARP) associated with the BHP Billiton Olympic Dam Mine (ODM). The Environment section of ODM has its own monitoring programme (see Appendix 10), and the data sets are complementary.

However the ARP data (see Appendix 11) has a broader coverage. A wide range of information is being collected, some for almost 10 years, and again the success of the project would appear to be due to the range of people and organisations involved. The breadth of data collected covers small mammals and reptiles, birds, plant richness and cover, cats, foxes, rabbits and weeds. Some of the information is from inside a predator and rabbit proof exclosure, (14 sq km in 1998, increasing in stages to 86 sq km in 2004), and in conjunction with control data from outside the exclosure provides important regional information about the state of the system.

Government departments responsible for natural resources in all the rangelands States and the NT carry out a significant regional biological survey programme, but most are still completing initial baseline surveys across all the bioregions of their jurisdiction. Some excellent inventories have resulted from such work (eg Duguid et al 2005, Neagle 2003). In some areas, departments have begun to resurvey

selected sites (eg Cobourg Peninsula in the NT), so it is likely that these data will be of greater use in the future. While covering a relatively small area compared to a full bioregional survey, the Uluru Kata Tjuta Fauna Survey (see Appendix 16) is one of the few programmes where long term data have been collected. The 8 permanent sites were first sampled in September 1987 and resampled 7 times in the first 3 years. There have been 8 more surveys since 1994, with the most recent one in 2006. Of similar importance is the work on the ecology of desert fauna in the Simpson Desert being conducted by Dr Chris Dickman (see Appendix 14). This study began in 1990 and has involved quarterly sampling since 1996. The work is ongoing, but dependent on external funding.

In specific regions, the monitoring programmes for threatened or iconic species (see Appendix 15) not only provide important information on the target species, but also on the level of threat (cats, foxes, weeds etc) in the region. The public concern associated with the status of the relevant species means that the programmes tend to run for several years and so can provide a good temporal record.

Some of the data sets listed here are also of value because they may be complementary and hence lend themselves to meta-analysis. For example there are several sets of data for desert small mammals in the SA/NT/QLD desert region (ARP, ODM, rare rodent grids from SA DEH, NRETA small mammal data from the Simpson Desert, Chris Dickman's Simpson Desert study). There are also several sets of data for waterbirds – the long running NRETA surveys in the Top End (for birds affected by hunting), the Wetlands International data sets for the NT and QLD, the EAWS aerial surveys in the southeast (see Appendix 13) and the ARIDFLO data for SA and QLD.

Two aquatic programmes are worthy of mention – the pilot programme on Sustainable River Health by the Murray Darling Basin Commission and the ARIDFLO programme covering the inland rivers and waterways of SA and QLD (see Appendix 16). While the pilot was only 3 years, a 10 year programme is now in place. The SRA programme is fully outlined on the relevant website (www.mdbc.gov.au/SRA). The 800 page report on the ARIDFLO project has only just been released but is available on CD.

Other data sets that might be of use.

In the course of collecting information for this report, several possible leads were mentioned that I was unable to follow up. Some of these data sets may contain relevant information and could well be available for use by ACRIS in the future. Examples include long term data from University field stations (eg Koonamore and Middleback in SA, Fowler's Gap Arid Zone Research Station (UNSW) in western NSW), "control" data from mine sites (eg ALCOA has a long record of environmental monitoring), specific local/regional research programmes and surveys on private conservation reserves (eg the Bush Heritage Fund properties).

5. FUTURE USE OF TYPES OF DATA

Given that there is relatively little activity in the rangelands that focuses primarily on biodiversity monitoring, it is important to set priorities in terms of future action. The focus here should be deciding on the best use of current (and any additional) resources, to make the greatest improvement in availability of useful data. The type of activity currently occurring provides some clues about the most effective programmes to use now, and which ones to develop further for future use.

The contract for this project specified the identification of 3 basic types of data sets for biodiversity monitoring in the rangelands:

- those available now, (or that could be with minimal additional resources), that are currently being used to provide information about biodiversity change (not necessarily the best surrogates for biodiversity);
- those that could provide good information on change in biodiversity, but requiring a moderate level of additional resources to render them usable;
- those that could provide good information on change in biodiversity, but requiring a considerable amount of additional resources to render them usable.

At this point it is relevant to point out that the actual use of an indicator often depends more on the practicalities of application than on whether it is a good measure of biodiversity. For example, in discussing indicators with stakeholders, Hunt et al (2006) found that aspects such as the degree of skill and experience required to use the measure, and whether there was a clear link between the specific indicator and on-ground management decisions were very important. Such factors need to be taken into account when evaluating techniques for development.

It is also worth noting that for many indicators, much work still needs to be done to validate the proposed correlation between the indicator and biodiversity (Hunt et al 2006, Woinarski et al 2001), especially in relation to use in the rangelands. Even measures currently accepted as providing good biodiversity information have been found wanting when tested (eg Clarke et al 2006 for biological and pastoral surveys as measures of plant species richness).

Hence it can be seen that allocation of data sets and indicators to categories such as the ones proposed above is fraught with difficulty. These issues need extensive discussion by the BWG. However, selecting from only the pool of data sets identified in this report, a preliminary allocation of some of the programmes to each of the required three classes has been made (see Tables 6, 7 and 8). Some supplementary comments have been included.

In conclusion, to identify the best indicators for monitoring biodiversity in the rangelands, and make best use of the resources required to apply them, careful consideration needs to be given to their validation. Of similar import are the factors raised in Hunt et al (2006), which, although focused on the local and regional stakeholder level, are also relevant for the development of national approaches.

Table 6. Data that are available now, with minimal resources required for application to the assessment of biodiversity change.

Type of data	Information found during this survey.	Comments
Kangaroo distribution and abundance	Annual aerial surveys in all States but not in the NT; additional ground surveys in SA	An indicator of grazing pressure, but not necessarily a high priority biodiversity indicator. Considerable effort may be required to make datasets amenable to consistent analysis. This has been done (and made available to ACRIS) for Qld, NSW & SA. WA was unable to make their data available for national reporting.
Native vegetation clearing	Spatial coverage of extent of clearing EPA groundcover disturbance (QLD) SLATS (QLD)	As a measure of habitat loss, a reasonably good indicator of decline in biodiversity, although the links are less well understood for rangelands. This measure is less relevant in jurisdictions with relatively little clearing. Reasonably consistent datasets and methods of analysis are needed amongst jurisdictions where clearing is an issue. The AGO provides nationally consistent satellite (Landsat) data but its statistics on change in 'forest' cover do not relate well to clearing as a threat to biodiversity. The AGO's methods (and results) are also contested by some jurisdictions.
Fire - widespread	Fire frequency and extent is well documented in all States and the NT. WA Land Information Authority (Landgate) provides nationally consistent data (1997 to present). www.landgate.wa.gov.au/corporate.nsf/web/Fire+Scar+History+Maps	Indicates loss in both quantity of habitat and quality (change in composition and structure of vegetation); ground truthing sometimes important; good interpretation requires knowledge of fire history.
Pastoral attributes and infrastructure (stocking rate, % land area remote from water etc)	Biograze project (completed). www.cazr.csiro.au/biograze Infrastructure records kept in all States and NT, but updates are often irregular.	The basic link with biodiversity has been established for water points in some land systems by the Biograze project; further work is needed to enhance interpretation; other land systems will require further on-ground work. The frequency of reporting for infrastructure data influences usefulness and interpretation. Infrastructure data can only identify areas of potential concern, not actual status of biodiversity.
Reserve System	All jurisdictions contribute spatial and statistical information annually to the national Collaborative Australian Protected Areas Database (CAPAD), administered by DEW (www.environment.gov.au/parks/nrs/capad).	Presumes a positive correlation between reservation extent and biodiversity. There is very little monitoring of real "outcomes"; perhaps add use of a CAR "score" (Woinarski et al 2001, p469).

Table 7: Data that could potentially provide good information on change in biodiversity, but requiring a moderate level of additional resources to render them usable for this purpose.

Type of data	Information found during this survey	Comments
Water birds	NRETA aerial surveys for waterbirds in the NT; Wetlands International (NT); EAWS (NSW and QLD)	Methods well established, but all use external funding so continuity is at risk; need additional funding to extend to WA, and develop links to the SA & NT data. High level of technical skill required. As for all data sets in the rangelands, the high level of seasonal variability means that sufficient data and suitable analyses are required to determine a 'seasonally corrected' trend / change.
Monitoring of individual species: usually by State agencies, some NGOs.	Threatened and iconic species monitoring in all States & NT; examples: NSW: brush tailed rock wallaby, mallee fowl; QLD: hairy nosed wombat, SA: yellow footed rock wallaby, rare rodents, grass wrens; NT: Carpentarian rock rat, Slater's skink, bustards; WA: Gilbert's potoroo	Many programmes are at risk due to funding cuts; commitment to long term external funding required. Community involvement enhances political will and can provide considerable in-kind support.
Surveys of feral pests – State agencies, some mine sites.	In the NT semi-regular aerial survey for feral herbivores in problem regions eg camels, donkeys, buffalo. SA: Feral monitoring & control in NPs; surveys at ODM & ARP	Additional funding is required to maintain centralised data bases for both weeds and feral pests. However the economic imperative increases the probability that such programmes will be supported.
Fire – local/regional	Fine scale fire mapping in NT (National Parks, Western Arnhem Land & Bradshaw)	Need to identify and monitor fire-sensitive communities of limited extent that are threatened by current practices. Despite the high degree of technical skill required, focusing on these communities increases the efficiency of the resource use.
Pastoral Monitoring (vegetation and landscape)	Examples**: NT**: Tier 1 and 2 pastoral monitoring; **NSW**: RAP; **QLD**: SLATS; **WA**: WARMS; **SA**: PMIS.	Due to omissions of species and, especially, whole landscapes that are important components of biodiversity in the rangelands, the selective nature of these data means that the information does not adequately reflect biodiversity and must be used very judiciously. See pp 358-366 in Whitehead et al 2001 for some indicative costs associated with increasing coverage and species. Monitoring programs that are not required for compliance or legislative purposes could be under threat in the future.

Table 8: Data that could potentially provide good information on change in biodiversity, but that will require a considerable amount of additional resources to render them usable for this purpose.

Type of data	Information available	Comments
Flora and Fauna surveys - State Government	Fauna and flora monitoring in National Parks (eg Bounceback Programme in SA); Site-specific regional and local biodiversity surveys (e.g. Pilbara Survey in WA; Cobourg in NT; Tarawi NR in NSW)	Bounceback completed; In all States and the NT, external funding is needed to instigate the required programme of resampling selected, representative sites. Considerable technical expertise is required to identify such sites, to carry out accurate flora and fauna surveys, maintain the associated databases, analyse data, and disseminate information.
Flora and Fauna surveys - Commonwealth and other	UKTNP Fauna Survey; Olympic Dam Mine flora & fauna surveys; Arid Recovery Project at ODM.	Long term surveys need to be maintained and data analysed and disseminated; control site data from mine sites could be shared (the rehabilitation data are no doubt confidential); Comments in box above also relevant.
Riparian health	MDBC – Sustainable River Audit (SRA) ARIDFLO	3 year pilots completed for both; MDBC SRA 2004-10 in progress; ARIDFLO has ended. As for fauna and flora surveys, projects require a considerable degree of technical expertise, and resources for analysis and dissemination of information and maintenance of the associated databases.
Long term research	eg Simpson Desert Study: Chris Dickman, University of Sydney	The example given is a long term (17 years to date) study dependant on external funding. Considerable technical expertise is required as well as the involvement of many staff and volunteers. Such studies often rely on the dedication of one or many committed individuals and would rarely continue without them.

6. KNOWLEDGE OF ACRIS AND THE BIODIVERSITY WORKING GROUP.

Section 3 of the questionnaire examined whether people were aware of the existence of ACRIS and the Biodiversity Working Group, what kinds of interactions occurred with the groups, whether people felt the groups were fulfilling their perceived roles and whether they had any recommendations for changes in the role of the groups. The responses are summarised in Table 9 (for full collation of responses see Appendix 17).

There were 23 responses to this section of the questionnaire. Of these, most (65%) were government staff. This reflected the contact base for the questionnaire. Other affiliations included University staff (3), NGOs or independent consultants (4) and 1 mining company.

The percentage of respondents aware of the groups was relatively high (75% for ACRIS and 65% for BWG). However of those who were aware, very few (9%) had ever contacted either group. For ACRIS, this is perhaps not surprising given that ACRIS is a rangelands group which in the past has focused on pastoral issues whereas most of the people contacted were primarily focused on biodiversity or worked in non production aspects of natural resource management.

About 22% of the respondents had been contacted by an ACRIS member, with the interaction ranging from a request for a presentation at an ACRIS meeting to giving advice on remote sensing and provision of information to a strategy for Aboriginal lands. About 13% had been contacted by a BWG member, where the requests were general or in relation to monitoring activities.

Of those aware of the groups, many were unable to state the role of the groups (55% for ACRIS and 67% for BWG). Of those who could, most focussed on collation of information and standardised monitoring as the role for ACRIS, although the cover letter for the questionnaire may have influenced this perception. For the BWG, the responses varied from it establishing standards to being an advisory group to the Minister.

Of those aware of ACRIS, 76.5% did not know if it was fulfilling its role. Of the 4 who did, 3 agreed that it was, at least partially, and 1 did not. None of the 23 respondents knew whether the BWG was fulfilling its role.

Recommendations for changes in the role of the group or other general comments came from 30% of the respondents for ACRIS, and 22% for BWG. These varied widely (see Table 9). Three respondents identified the need for more on-ground/local contact, ie talk to the people doing the work. More collaboration with other groups (eg NLWRA, CRCs) was also mentioned as was the need to contact both community groups as well as agencies. Here, and at other points in the questionnaire, people requested more information about the groups.

In general, the small number of responses makes broad conclusions difficult, but the respondents did seem to be aware of both ACRIS and the BWG. However, the lack of knowledge about the roles of the 2 groups suggests that information about their functions and activities needs to be circulated more effectively to the natural resources audience in the rangelands.

Table 9. Knowledge of ACRIS and the Biodiversity Working Group.
Respondents: Total 23 (NSW: 8; QLD: 4; NT: 6; SA: 4; WA: 1)

	Australian Collaborative Rangelands Information System	Biodiversity Working Group
Are you aware of the existence of this group?	Yes: 17 No: 6	Yes: 15 No: 8
How often have you contacted any members of the group?	Never: 21 Occasionally/not often: 2	Never: 21 Occasionally: 1 6-10 times: 1
What was the nature of your query or request?	NA: 21 From those who responded: - use of remote sensing to asses rangelands biodiversity; - general	NA: 21 From those who responded: - fauna monitoring - general
Have you ever been contacted by a member of the group?	Yes: 5 No: 18	Yes: 3 No: 20
What was the nature of their query or request?	NA: 17 From those who responded: - Access to aerial survey data - Information - Use of remote sensing to assess rangeland biodiversity - Invited to give a presentation to an ACRIS meeting in Alice Springs. - Input into strategy for Aboriginal lands - Meeting attendance	NA: 20 From those who responded: - fauna monitoring - nature of monitoring activities - Information
What was your perception of the function/role of the group when it was set up?	Don't know: 16 From those who responded: - To provide a network of information for rangeland managers - National monitoring standards - Collect and collate information - To carry out a comparative assessment of monitoring in the rangelands and examine whether the different methods used by the States can provide useful information at the national level. - To develop and lead implementation of strategic, standardised and targeted biodiversity monitoring in rangelands ecosystems - Interesting - To standardise monitoring systems across the rangelands & provide a central place for the storage of data	NA or not sure: 20 From those who responded: - establishing standards - standardise monitoring - advisory group to Minister

Table 9 continued. Knowledge of ACRIS/BWG p2

	Australian Collaborative Rangelands Information System	Biodiversity Working Group
Is it currently fulfilling this role?	Don't know/NA: 19 (1 respondent stated they receive no feedback) From those who responded: - no, but this project will be a good start - somewhat - seems to be - yes (assuming they can determine the most appropriate methods for use at a national level)	Don't know/NA: 23 (1 respondent expanded: not easy to see what group does; EA site not very forthcoming).
Do you have any recommendations for change in the function/role of the group?	No: 16 From those who responded: - identify key programs that can deliver information on landscape change - need information on role, then may comment - need to make more contact with those in the field collecting data - liaise more closely with people involved in the national audit and CRCs. - support development of a strategy for aboriginal lands - grant oriented - involve more people on the ground and local landholders & conservation groups who are doing the monitoring rather than just relying on Govt employees who visit the region but don't live in it.	No: 18 From those who responded: - produce part 2 of the monitoring work - need information on role, then may comment - is great need for a federal ministerial advisory group on biodiversity issues that was accessible (proactively) to community interest groups as well as to agencies - University oriented - Disseminate ideas/findings more widely so people are aware of the existence of these groups. Ask for people's opinion on issues/ideas
Any other comments?	No: 19 From those who responded: - funding is a major issue - I'd like more information - the Invasive Animals CRC has summarised State/Territory invasive animal and abundance monitoring - clearly need to get collaborative and strategic approach to rangelands biodiversity monitoring especially in light of likely additional pressures being put on rangelands environments as climate change and knee-jerk management responses kick in (eg added development pressure and intensification of agriculture & horticulture in northern rangelands).	No: 21 From those who responded: - more information would be good - Can this group work in with the local SAAL region NRM biodiversity advisory group??

7. Overall Conclusions

Responses to the standard questionnaire revealed that there are virtually no programmes collecting biodiversity data that provide information of a high standard for monitoring **change** in biodiversity across the rangelands. Such programmes would ideally share the following characteristics:

1. sites are distributed throughout the full range of habitats across the rangelands;
2. data have been collected in a systematic, consistent, repeatable way; and
3. repeated sampling has taken place over a time-span of at least 5 years.

Some programmes meet some of the criteria eg

- State/NT government survey programmes meet 1 and 2 but not 3;
- local or regional surveys, or programmes for monitoring endangered species meet 2 and 3 but not 1;
- pastoral monitoring programmes meet 2 (albeit with highly selective data) and 3 but not 1.

Some of the programmes that provide indirect information fit all 3 (eg fire mapping programmes) but further data would need to be collected and analysed to assess the biodiversity implications. Many represent programmes where data was originally collected for another purpose and, without validation or further research quantifying their predictive power, are of limited value as indicators of biodiversity.

In terms of current activity:

- There is a considerable amount of good baseline biodiversity information recorded in the relevant State/Territory Flora and Fauna databases (eg Atlas of NSW Wildlife); however there are gaps in coverage for the rangelands.
- Biodiversity programmes that do have a resampling component are usually short term and local or regional in scale;
- Programmes that are widespread usually provide only indirect information about biodiversity;
- Programmes that operate over a widespread area usually sample the environment selectively;
- Information about weeds and feral/pest animals is only rarely consolidated into a centralised data base.

Information that is not currently being used, but is relevant to the purposes of ACRIS, includes the national data on the status of the reserves system. Significant local and regional programmes that have potential as case studies of trends in biodiversity over several years include programmes providing direct (biotic response) such as:

- individual threatened or iconic species monitoring;
- flora and fauna surveys that are repeated;
- specific regional programmes;
- monitoring at mine sites;
- water birds surveys;
- pilot programmes leading to long term monitoring of river health; and
- long term research sites.

In addition some programmes that provide indirect information on threatening processes could also be utilised eg

- Surveys for feral pests;
- Local/regional fire mapping.

The choice of data sets and indicators to develop for future use in monitoring biodiversity in the rangelands requires further discussion. This preliminary analysis has only been able to produce tentative conclusions. It has however highlighted the many factors to be considered, including the high cost of skilled technical staff, maintenance of data bases, validation of the relevant indicators and the factors influencing actual use of the indicators.

Relatively few responses were received to the survey about knowledge of ACRIS and the BWG but there was a reasonable awareness of the existence of both groups. However, there was a general lack of knowledge about their respective roles which suggests the need for more effective communication with the relevant groups.

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9. APPENDICES

APPENDIX I

COVER LETTER sent out with questionnaire

Re: Audit of Biodiversity Monitoring in the Rangelands

I am writing to ask for your cooperation in a project to document the current level of biodiversity monitoring being carried out in the rangelands.

The project will contribute information to a report (see below) being prepared by ACRIS, the Australian Collaborative Rangeland Information System. The primary purpose of ACRIS is to collate and analyse data that allows reporting of change in Australia's rangelands (see http://deh.gov.au/land/management/rangelands/acris/index.html). ACRIS operates as a partnership of State, Northern Territory and Australian Government agencies with an interest in the rangelands. Its activities are guided by a management committee of representatives from these partner agencies. The Natural Heritage Trust (NHT) provides funding support to assist agencies with their reporting and also supports a small management unit.

ACRIS is currently working towards a 2007 report for the entire rangelands that will use various indicators to document recent change (~1992-2005) in the following areas:

landscapes or ecosystems, sustainable management, **biodiversity,** sustainable water management, social & economic values, and the importance of climate variability.

The ACRIS report has been requested by the Audit Advisory Committee and Natural Resource Programs and Policy Committee, both of which are joint Australian – State/NT government policy committees. The ACRIS Management Unit is coordinating reporting activity, disseminating national products to state & NT partners for their reporting and assisting individual jurisdictions where it can. It will also build a national synthesis of change from the data and information products provided by contributing agencies.

A considerable amount of work has been done in the last 5 years to clarify the most useful, relevant and informative data required to assess the status of biodiversity in the rangelands and also to identify the best possible approaches to monitoring change in biodiversity. These are both daunting tasks given the range of potential measures, but progress has been made in identifying the most useful approaches. However, in most cases, the details of such monitoring processes are still to be determined and put into practice in the Rangelands. A recent ACRIS pilot project across 5 bioregions ("Reporting Change in the Rangelands" – see Summary Brochure at website above) concluded that "there are no suitable monitoring data as yet to adequately report change in the biodiversity".

As a part of the work on Biodiversity indicators for the 2007 report, I have been contracted to audit current Biodiversity Monitoring activity across the Rangelands and assess the intention and capacity of the contributors to maintain such activity.

I have prepared a questionnaire to collate the information required. The questionnaire includes a table to identify current activity and a summary table for the entry of basic information about relevant data sets or programmes. For a selection of these, answers to a set of supplementary questions will be requested. The questionnaire can be filled out electronically ahead of time, or via discussion with me during a series of visits to each of the relevant jurisdictions.

The audit will identify areas where available information is potentially applicable to the measurement of biodiversity change. It will also indicate where important information is lacking and where resources may best be used to enhance the capacity to report on biodiversity change.

I would greatly appreciate it if you could complete questionnaire needs to be completed and returned to me at the address below by **Friday the 8th of September**.

Information from the questionnaire will be collated and the resultant report submitted to the Department of Environment and Heritage, the funding body for this component of the 2007 ACRIS report.

I would like to thank you in anticipation for your assistance in gathering this information. If you have any questions regarding the project or the questionnaire please contact me at the address below. If I am unavailable, please contact Gary Bastin (ACRIS Management Unit: 08 8950 7137; Gary.Bastin@csiro.au) or John Lumb (Department of Environment and Heritage: 02 6274 1036; John.Lumb@deh.gov.au).

Yours Sincerely

Lynn Day

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APPENDIX 2. QUESTIONNAIRE

BIODIVERSITY MONITORING IN THE RANGELANDS

Introduction
The information gathered in this questionnaire will contribute to the biodiversity section of a 2007 report on change in the rangelands. The preparation of the report is being coordinated by the Management Unit of the Australian Collaborative Rangeland Information System, ACRIS. This questionnaire seeks to summarise current activity on biodiversity monitoring in the rangelands. There are also some questions on the role of ACRIS and the Biodiversity Working Group.

Some of the listed data bases or programmes will be selected for follow up. A supplementary set of questions will document how the information is being used and ask about the capacity of the responsible organisations to maintain or expand the work.

A recent report (Hunt, L., A Fisher, A Kutt & T. Mazzer (in prep) Biodiversity Monitoring in the Rangelands: A Way Forward. Vol 2 Case Studies) has brought together a great deal of work done on biodiversity monitoring over the last 5-10 years and generated a list of the biodiversity indicators with the potential to be the most useful for monitoring change. The list of indicators from that document is used as the basis for the questionnaire.

Structure of the questionnaire
The structure of the questionnaire is as follows:

Part A: Summary of Current Biodiversity Monitoring
Question 1: Current activity for 35 Biodiversity Indicators
Question 2: Summary table outlining basic features of relevant activities or databases

Part B: ACRIS and the Biodiversity Working Group
Question 3: Knowledge of ACRIS and the Biodiversity Working Group

Part C: Supplementary questions - *for selected data sets or programmes only*
Question 4: Current use & value of information; data availability; capacity to maintain or expand activity.

Thank you for the time and effort required to complete this questionnaire.

Respondent details:

Name :
Organisation/Department :
Position or Role in organisation:
Mailing address:
Phone: **Fax:** **email:**

PART A: SUMMARY OF CURRENT BIODIVERSITY MONITORING

Question 1: Current activity for 35 Biodiversity Indicators: Indicators are classified according to Hunt et al as "response" types (assess the biotic response of species, groups, taxa or ecosystem attributes to land-use pressures), "pressure" types (threats or land-use pressures that affect or are likely to affect biodiversity) and "management" types (management actions likely to increase biodiversity).

a. <u>RESPONSE TYPE</u>

In reference to the following indicator, is systematic monitoring (able to detect CHANGE) currently occurring throughout the rangelands in your State?	**If Yes, what is the name of the activity or relevant database?**	**If No, give the name of any other (eg local or regional) activities or databases relevant to this indicator?**
FAUNA		
Composition and abundance of waterbirds		
Composition and abundance of terrestrial birds		
Composition of terrestrial fauna [birds, mammals, reptiles and ants]		
Composition of aquatic invertebrates		
Kangaroo abundance		
FLORA		
Composition of perennial terrestrial vegetation		
Cover and structure of perennial terrestrial vegetation		
Vegetation greenness indices		
Abundance and distribution of aquatic and semi-aquatic vegetation		
FLORA & FAUNA		
Status of threatened species and communities		
Number of threatened species and communities		
Distribution and abundance of significant fauna and flora eg effective recruitment in populations of special biota; status of iconic plant or animal species		
LANDSCAPE		
Extent and distribution of floodwaters		
Flow of perennial streams		
Landscape function		
Riparian/aquatic condition		
OTHER (add if necessary)		

b. PRESSURE OR THREAT TYPE

In reference to the following indicator, is systematic monitoring (able to detect CHANGE) currently occurring throughout the rangelands in your State?	**If Yes, what is the name of the activity or relevant database.**	**If No, give the name of any other (eg local or regional) activities or databases relevant to this indicator.**
FAUNA		
Abundance and distribution of feral pest carnivores (especially foxes)		
Density and distribution of feral and native herbivores		
FLORA		
Distribution and abundance of terrestrial and aquatic weed species		
Extent of clearing of remnant native vegetation (by land type?)		
Number and extent of listed weed species		
Distribution and abundance of ecologically significant introduced plants (those not listed as weeds)		
Localised grazing pressure on sensitive areas (eg mound springs)		
LANDSCAPE		
Fire frequency and extent across landscape		
Fire frequency and exent in fire sensitive communities		
Land tenure change		
Landscape pattern metrics (patch size, connectivity)		
Average stocking rate		
Percentage of land area remote from water points (by land type?)		
Number and output of free-flowing bores		
Density of artificial water points		
Water quality, including concentration of pesticides and nutrient pollutants		
OTHER (add if necessary)		

c. MANAGEMENT ACTION TYPES

In reference to the following indicator, is systematic monitoring (able to detect CHANGE) currently occurring throughout the rangelands in your State?	**If Yes, what is the name of the activity or relevant database**	**If No, give the name of any other (eg local or regional) activities or databases relevant to this indicator?**
Progress toward CAR (comprehensive, adequate, representative) reserves system		
Infrastructure to protect special areas		
Property plans (containing environmental measures eg biodiversity friendly grazing strategies)		

Question 2: SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

Please complete the table using the list of activities in both columns of question 1.

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (include contact details)**	**What format is the data in? Is the data spatially enabled?**

Part B: ACRIS AND BIODIVERSITY WORKING GROUP

Question 3: Knowledge of ACRIS and the Biodiversity Working Group.

	ACRIS	**Biodiversity Working Group**
Are you aware of the existence of this group?		
How often have you contacted any members of the group?		
What was the nature of your query or request?		
Have you ever been contacted by a member of the group?		
What was the nature of their query or request?		
What was your perception of the function/role of the group when it was set up?		
Is it currently fulfilling this role?		
Do you have any recommendations for change in the function/role of the group?		
Any other comments?		

PART C: SUPPLEMENTARY QUESTIONS

FOR SELECTED DATA SETS OR PROGRAMMES ONLY.

You will be contacted again with a request for further information if necessary.

Question 4: Please answer the questions in relation to identified activity or data set.

ACTIVITY or DATA BASE:	
Current Use and Value of Information	
What is the main use of the information/data base at the moment?	
Was this programme originally developed for purposes other than Biodiversity monitoring?	
How reliable do you think the data is for the purposes of Biodiversity monitoring? Excellent, Good, Fair, Poor (consider possible errors in technique, expertise of personnel required to collect data accurately, consistency of data collection within and between data collection events etc) .Please note major reasons for your evaluation.	
How easy or difficult is it to interpret the data?	
Does the information from this monitoring programme actually affect land management decisions? For example?	
Data availability	
Is the data compatible with similar data being collected in other regions or States?	
Is this data used by other jurisdictions? Please specify user category eg State or Commonwealth government department, NGO, NRM group, property owner etc)	
Is the data custodian prepared to permit ongoing access to the data?	
Is this data ready for use by external agencies and/or individuals? If NO, please indicate the extent of modification required.	
Capacity to Maintain or Expand Activity	
Does the department/organisation intend to continue this activity? Yes/No **If yes,** will it be at the same, a reduced or an expanded level? **If no**, (or at a reduced level), why not?	
What additional **information** is required for this to become an effective monitoring programme for biodiversity in the rangelands?	
What additional **resources** would be required for this to become an effective monitoring programme for biodiversity in the rangelands? (if possible, please give a qualitative guesstimate of operational funding and/or staff FTEs)	

APPENDIX 3. RESPONSE RATE TO QUESTIONNAIRE

Summary of responses to questionnaire

State or Territory	Questionnaire completed	Personal or telephone interview; or detailed response to a specific request	Background information or contact details	No response	Total
NSW	9	2	4	10	**25**
NT	7*	10	9	3	**29**
QLD	3	2	4	6	**15**
SA	6	8	7	2	**23**
WA	2*	0	3	3	**8**
National	0	0	11	4	**15**
Total (%)	**27 (23.5)**	**22 (19.1)**	**38 (33.0)**	**28 (24.4)**	**115**

* Includes a response which was a compilation from many sources.

APPENDIX 4

SUMMARY TABLES FOR ALL STATES – collation of responses to Question 1

New South Wales

Northern Territory

Queensland

South Australia

Western Australia

SUMMARY OF CURRENT BIODIVERSITY MONITORING IN NSW

Does not include programmes/projects just starting or short term (< 3 years) programmes.
No systematic monitoring programme: Response received indicating no widespread systematic monitoring programme.
Information not found: No response to direct queries, no contact details available or unable to contact in time allocated.
Refer ACRIS Committee: ACRIS committee working with State contacts on this data.

BIOTIC RESPONSE INDICATORS	**NSW - widespread**	**NSW – regional/local/baseline**
FAUNA		
Composition and abundance of waterbirds	Eastern Australian Waterbird Survey (EAWS)	Atlas of NSW Wildlife
Composition and abundance of terrestrial birds	No systematic monitoring programme	Atlas of NSW Wildlife Some NP surveys
Composition of terrestrial fauna [birds, mammals, reptiles and ants]	No systematic monitoring programme	Atlas of NSW Wildlife Some NP surveys
Composition of aquatic invertebrates	MDBC - Sustainable Rivers Audit	Information not found
Kangaroo abundance	Aerial survey of kangaroos	Some ongoing ground based density surveys (eg Mungo National Park)
FLORA		
Composition of perennial terrestrial vegetation	RAP (pastoral lands only); refer ACRIS Committee	Atlas of NSW Wildlife; Some local NP surveys eg Salt Interception Scheme vegetation monitoring at Mallee Cliffs
Cover and structure of perennial terrestrial vegetation	RAP (pastoral lands only); refer ACRIS Committee	Some local NP surveys eg see previous box; Lake Victoria NP
Vegetation greenness indices	Information not found	Information not found
Abundance and distribution of aquatic and semi-aquatic vegetation	Information not found	Atlas of NSW Wildlife
FLORA & FAUNA		
Status of threatened species and communities	NSW DEC – Biodiversity Conservation Unit / NSW Scientific Committee	Some high profile species monitored
Number of threatened species and communities	NSW DEC – Biodiversity Conservation Unit	Some high profile species monitored
Distribution and abundance of significant fauna and flora eg status of iconic plant or animal species	Information not found	Some local Information (eg Mallee Cliffs NP malleefowl surveys)
LANDSCAPE		
Extent and distribution of floodwaters	Collected routinely during EAWS but dependent on coverage. Other projects use landsat imagery	Information not found
Flow of perennial streams	MDBC Sustainable Rivers Audit – Hydrology theme; DNR Salinity Monitoring network	Information not found
Landscape function	Information not found	Information not found
Riparian/aquatic condition	MDBC Sustainable Rivers Audit; UNSW uses waterbirds as indicators of floodplain/ wetland condition	Various CMA projects at Catchment scale; GAB monitoring

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PRESSURE OR THREAT INDICATORS	NSW - widespread	NSW – regional/local/baseline
FAUNA		
Abundance and distribution of feral pest carnivores (especially foxes)	No systematic monitoring programme	Some local longterm fox baiting & associated monitoring; NSW DEC; NSW DPI Pest Animal Survey 2002
Density and distribution of feral and native herbivores	Annual aerial survey of kangaroos (also records goats)	NSW DPI Pest Animal Survey 2002, NSW DEC
FLORA		
Distribution and abundance of terrestrial and aquatic weed species	No systematic monitoring programme	No systematic monitoring programme – local DPI authorities have inspection records but not centralised; baseline database being developed.
Extent of clearing of remnant native vegetation	Information not found	Monitoring through PVPs (Property Vegetation Plans) (under the *Native Vegetation Act 2003*(NSW DNR)
Number and extent of listed weed species	Information not found	NSW DPI records new pest outbreaks; baseline database being developed.
Distribution and abundance of ecologically significant introduced plants (those not listed as weeds)	Information not found	Information not found
Localised grazing pressure on sensitive areas (eg mound springs)	Information not found	Information not found
LANDSCAPE		
Fire frequency and extent across landscape	Refer ACRIS committee	Fire frequency & extent mapped for some NPs
Fire frequency and exent in fire sensitive communities	Refer ACRIS committee	Fire frequency & extent mapped for some NPs
Land tenure change	No systematic monitoring programme	Crown Lands Information Database (CLID): data maintained on tenure type, lease purpose, lease conditions, ownership, rental status; some CMAs (eg LMD) have a landuse database.
Landscape pattern metric	Information not found	Information not found
Average stocking rate	No systematic monitoring programme	Carrying capacities recommended for each property; compliance unknown.
Percentage of land area remote from water points (by land type?)	DNR – refer ACRIS committee	Information not found
Number and output of free-flowing bores	DNR – refer ACRIS committee	DNR GAB monitoring
Density of artificial water points	DNR – refer ACRIS committee	Information not found
Water quality (eg concentration of pesticides and nutrient pollutants	Information not found	DNR – blue green algae monitoring, salinity monitoring network
MANAGEMENT ACTION INDICATORS		
Progress toward CARRS	Monitored by DEC.	Information not found
Infrastructure to protect special areas	Information not found	Information not found
Property plans with environmental measures eg biodiversity friendly grazing strategies.	Information not found	PVPs under the *Native Vegetation Act 2003*

SUMMARY OF CURRENT BIODIVERSITY MONITORING IN NT

Does not include programmes/projects just starting or short term (< 3 years) programmes.
No systematic monitoring programme: Response received indicating no widespread systematic monitoring programme.
Information not found: No response to direct queries, no contact details available or unable to contact in time allocated.
Refer ACRIS Committee: ACRIS committee working with State contacts on this data.

BIOTIC RESPONSE INDICATORS	**NT – widespread**	**NT – regional/local/baseline**
FAUNA		
1.Composition and abundance of waterbirds	Magpie Geese (Waterbirds affected by hunting); jabirus, Burdekin Ducks.	Water birds of inland wetlands; Wetlands International;
2. Composition and abundance of terrestrial birds	Australian Bustards, Brolgas, Redtailed Black Cockatoos	NRETA database of bird records (can be interrogated to assess change)
3. Composition of terrestrial fauna [birds, mammals, reptiles and ants]		NRETA database of vertebrate records (some resampling); Bioregional surveys by NRETA; Biodiversity Monitoring in Tanami & Sangster's Bore Predator Monitoring (CLC); UKTNP Fauna Survey.
4. Composition of aquatic invertebrates	Information not found	some data for Daly River;
5. Kangaroo abundance	No systematic monitoring programme	
FLORA		
6. Composition of perennial terrestrial vegetation	Refer ACRIS Committee for Tier 1 and Tier 2 pastoral monitoring.	NRETA database: plot & point data for plants. NRETA Bioregional surveys; CLC Tanami Biodiversity Monitoring Project
7. Cover and structure of perennial terrestrial vegetation	Refer ACRIS Committee for Tier 1 and Tier 2 pastoral monitoring	NRETA database of plot data from inventory survey; Parks biophysical mapping sites; Fire plots in some NPs;
8. Vegetation greenness indices	Refer ACRIS Committee	
9. Abundance and distribution of aquatic and semi-aquatic vegetation	Information not found	Baseline inventory for arid wetlands;
FLORA & FAUNA		
10. Status of threatened species and communities	BCD maintains and reviews list of TS&C;	NRETA threatened spp. programmes Mulgara, tjakura monitoring at UKTNP
11. Number of threatened species and communities	BCD maintains and reviews list of TS&C	
12. Distribution and abundance of significant fauna and flora eg status of iconic plant or animal spp.		NRETA Programmes for: flock bronzewing, bustards, waterbirds (see R1) and crocodiles.
LANDSCAPE		
13. Extent and distribution of floodwaters	No systematic monitoring programme	No systematic monitoring programme
14. Flow of perennial streams	No systematic monitoring programme	Where present (eg Flora R)constant monitoring of water height (flow index)
15. Landscape function	Tier 2 pastoral monitoring – "land condition" assessment	Tier 1 - limited but only database in every IBRA region of the Rangelands.
16. Riparian/aquatic condition	No systematic monitoring programme	AUSRIVAS: baseline for Katherine, Roper, Vic & Daly R; CDU & ERIS some programs to assess riparian health; 2001 aerial survey lower Finke;

Appendix 4 NT p2

PRESSURE OR THREAT INDICATORS	NT - widespread	NT – regional/local/baseline
FAUNA		
17. Abundance and distribution of feral pest carnivores (especially foxes)	No systematic monitoring programme	Sangster's Bore Predator Monitoring (CLC)
18. Density and distribution of feral and native herbivores	Semi-regular aerial survey for feral herbivores in problem regions Camels, donkeys, buffalo, horses, pigs etc	No systematic monitoring programme
FLORA		
19. Distribution and abundance of terrestrial and aquatic weed species	Lists only – No systematic monitoring programme	Each NP has a database
20. Extent of clearing of remnant native vegetation (by land type?)	Up to date spatial coverage of extent of clearing (by IBRA or veg type)	
21.Number & extent of listed weed spp	WONS, NT list	
22. Distribution and abundance of ecologically significant introduced plants (not listed as weeds)	No systematic monitoring programme	Very limited change detection through Herbarium database and survey plot data; Can report on some species
23. Localised grazing pressure on sensitive areas (eg mound springs)	No systematic monitoring programme	Small number of specific programmes eg pigs in rainforest patches
LANDSCAPE		
24.Fire frequency and extent across landscape	NRETA Fire History dbase	No systematic monitoring programme
24. Fire frequency and extent in fire sensitive communities	NRETA Fire History dbase	Systematic monitoring programme at finer scale (250m) in NPs plus Western Arnhem Land plus Bradshaw Training Area;
26.Land tenure change/land use	Lands office records	No systematic monitoring programme
27. Landscape pattern metrics	No systematic monitoring programme	No systematic monitoring programme
28. Average stocking rate	National data from ABARE – statistical sample	
29. Percentage of land area remote from water points (by land type?)	Refer ACRIS (Biograze project)	No systematic monitoring programme
30. Number and output of free-flowing bores	(No uncapped bores in NT)	(No uncapped bores in NT)
31. Density of artificial water points	Pastoral lands Board – has all Infrastructure data.	Pastoral lands Board – has all Infrastructure data.
32. Water quality, including concentration of pesticides and nutrient pollutants	No systematic monitoring programme in Rangelands - NT Focus is Darwin Harbour	No systematic monitoring programme in Rangelands - NT Focus is Darwin Harbour
MANAGEMENT ACTION INDICATORS		
33. Progress toward CARRS	Planning section of NRETA	Planning section of NRETA
34. Infrastructure to protect special areas	Pastoral lands Board – has all infrastructure data.	Local Information held by regional facilitators and in NHT reports
35. Property environmental plans (eg biodiversity friendly grazing strategies	No systematic monitoring programme	Local records: company owned pastoral properties, conservation management groups eg CLMA; regional DPI officers

SUMMARY OF CURRENT BIODIVERSITY MONITORING IN QLD

Does not include programmes/projects just starting or short term (< 3 years) programmes.
No systematic monitoring programme: Response received indicating no widespread systematic monitoring programme.
Information not found: No response to direct queries, no contact details available or unable to contact in time allocated.
Refer ACRIS Committee: ACRIS committee working with State contacts on this data.

BIOTIC RESPONSE INDICATORS	**QLD - widespread**	**QLD – regional/local/baseline**
FAUNA		
Composition and abundance of waterbirds	Eastern Australian Water bird survey	Wildnet; Birds Australia; Wetlands Oceania; individual surveys (eg Roger Jaensch, Julian Reid)
Composition and abundance of terrestrial birds	Information not found	Wildnet Birds Australia
Composition of terrestrial fauna [birds, mammals, reptiles and ants]	Information not found	Wildnet
Composition of aquatic invertebrates	Information not found	NRM&W
Kangaroo abundance	No systematic monitoring programme	Macropod Harvesting Quota surveys
FLORA		
Composition of perennial terrestrial vegetation	TRAPS Grasscheck	Herbarium inventories (not monitoring)
Cover and structure of perennial terrestrial vegetation	TRAPS, Grasscheck; EPA Rangeland Ground Cover Disturbance Assessment (1988 – 2004)	Information not found
Vegetation greenness indices	SLATS	EPA work in Desert Uplands DPI (VegMachine – tool)
Abundance and distribution of aquatic and semi-aquatic vegetation	EPA Wetland Mapping and Classification	Corveg (inventory) EPA wetlands mapping
FLORA & FAUNA		
Status of threatened species and communities	Back on Track (EPA); EPA Biodiversity Planning Assessments	Hairy Nosed Wombat
Number of threatened species and communities	Back on Track (EPA); EPA Biodiversity Planning Assessments	Information not found
Distribution and abundance of significant fauna and flora eg status of iconic plant or animal species	Back on Track (EPA)	Ad hoc iconic species
LANDSCAPE		
Extent and distribution of floodwaters	Information not found	DNR&W
Flow of perennial streams	Information not found	DNR&W
Landscape function	EPA Rangeland Ground Cover Disturbance Assessment (1988 – 2004)	NRM&W land use mapping
Riparian/aquatic condition	State of the Rivers (DNRM&W) ??coastal focus??	Information not found

Appendix 4 QLD p2

PRESSURE OR THREAT INDICATORS	QLD - widespread	QLD – regional/local/baseline
FAUNA		
Abundance and distribution of feral pest carnivores (especially foxes)	No systematic monitoring programme	NRM&W
Density and distribution of feral and native herbivores	No systematic monitoring programme	NRM&W
FLORA		
Distribution and abundance of terrestrial and aquatic weed species	No systematic monitoring programme	Central Highlands NRM Group at shire level
Extent of clearing of remnant native vegetation (by land type?)	Herbarium SLATS	Information not found
Number and extent of listed weed species	NRM&W QLD Herbarium CORVEG database	Information not found
Distribution and abundance of ecologically significant introduced plants (those not listed as weeds)	Information not found	Information not found
Localised grazing pressure on sensitive areas (eg mound springs)	Information not found	Information not found
LANDSCAPE		
Fire frequency and extent across landscape	Refer ACRIS Committee	Information not found
Fire frequency and exent in fire sensitive communities	Refer ACRIS Committee	Information not found
Land tenure change	NRM&W – land tenure database	Information not found
Landscape pattern metrics (patch size, connectivity)	EPA Biodiversity Planning Assessments	Information not found
Average stocking rate	NRM – land tenure	DPIF
Percentage of land area remote from water points (by land type?)	GABSI Water Remote Area Analysis	Desert Uplands – EPA mapping
Number and output of free-flowing bores	NRM – bore-capping project	NRM&W
Density of artificial water points	NRM – bore-capping project	NRM&W Desert Uplands – EPA mapping
Water quality, including concentration of pesticides and nutrient pollutants	Information not found	NRM&W Emerald irrigation area – Integrated wide area management group

MANAGEMENT ACTION INDICATORS	QLD - widespread	QLD – regional/local/baseline
Progress toward CARRS	Information not found	EPA; Central West EPA region – local database.
Infrastructure to protect special areas	Information not found	Information not found
Property plans (containing environmental measures eg biodiversity friendly grazing strategies)	Information not found	Nature Refuges

SUMMARY OF CURRENT BIODIVERSITY MONITORING IN SA

Does not include programmes/projects just starting or short term (< 3 years) programmes.

No systematic monitoring programme: Response received indicating no widespread systematic monitoring programme.

Information not found: No response to direct queries, no contact details available or unable to contact in time allocated.

Refer ACRIS Committee: ACRIS committee working with State contacts on this data.

RESPONSE TYPE INDICATORS	SA - widespread	SA - local, regional or baseline
FAUNA		
Composition and abundance of waterbirds	No systematic monitoring programme	EDBSA-Survey (some resampling); Olympic Dam Mine; ARIDFLO
Composition and abundance of terrestrial birds	Survey but not monitoring	EDBSA-Survey (some resampling); Local and regional surveys eg Olympic Dam Mine, ARP, Paton bird data, Flinders Ra Bushbird Monitoring
Composition of terrestrial fauna [birds, mammals, reptiles and ants]	Survey but not monitoring	EDBSA-Survey (some resampling); Local and regional surveys eg Flinders Ra NP, Olympic Dam Mine, ARP.
Composition of aquatic invertebrates	Information not found	ARIDFLO, Olympic Dam Mine,
Kangaroo abundance	SA Pastoral Zone Surveys (aerial)	Flinders & Gawler Ra surveys (ground) Olympic Dam Mine, ARP
FLORA		
Composition of perennial terrestrial vegetation	PMIS (ALIS) (Pastoral lands only), Refer ACRIS Committee	Floristic Veg mapping (some resampling); Local/ regional surveys eg ARP, Olympic Dam, Veg Monitoring on NPs (Flinders & Gawler Ra, Vulkathunha-Gammon Ra,
Cover and structure of perennial terrestrial vegetation	PMIS (ALIS), (Pastoral lands only), Refer ACRIS Committee	Floristic Veg mapping (some resampling); Local & regional surveys eg ARP, Flinders & Gawler Ra NP, Elliot-Price, Arcoona Ck Veg Exclosures, Strezlecki,.
Vegetation greenness indices	Monthly Green Cover Index Maps	ARP
Abundance and distribution of aquatic and semi-aquatic veg	Information not found	Floristic Veg mapping (some resampling); Local survey eg Olympic Dam Mine.
FLORA & FAUNA		
Status of threatened species and communities	Threatened Species and Communities listings - DLWBC	ARP; Yellow-footed Rock-wallaby aerial survey & trapping programmes; rare rodent grids, threatened plant monitoring
Number of threatened species and communities	Threatened Species and Communities listings - DLWBC	Threatened plant monitoring (GA)
Distribution and abundance of significant fauna and flora eg status of iconic plant or animal species	No systematic monitoring programme	ARP *A kochiana* surveys
LANDSCAPE		
Extent and distribution of floodwaters	No systematic monitoring programme	ARIDFLO
Flow of perennial streams	Flow gauging DLWBC	ARIDFLO
Landscape function	No systematic monitoring programme	Land Condition Assessment in Flinders and Gawler Ranges NPs, ARP
Riparian/aquatic condition	No systematic monitoring programme	Baseline mapping of ground water resources, water holes in Fl & Gaw Ra; Condition index for riparian springs in Fl Ra; ARIDFLO, Dalhousie fish (Kodric-Browns).

Appendix 4 SA p2

PRESSURE/THREAT TYPE INDICATORS	**SA - widespread**	**SA - local, regional or baseline**
FAUNA		
Abundance and distribution of feral pest carnivores (especially foxes)	No systematic monitoring programme	Flinders Feral Predator Monitoring (on and off park), Olympic Dam Mine, ARP
Density and distribution of feral and native herbivores	See kangaroo data above;	Olympic Dam Mine; ARP, FRNP Rabbit monitoring, aerial & ground-based goat control; feral monitoring in Witjira and Simpson CP
FLORA		
Distribution and abundance of terrestrial and aquatic weed species	No systematic monitoring programme**;** distribution list only	Part of NP vegetation monitoring; Witjira weeds, weeds on the Cooper, Olympic Dam Mine, ARP.
Extent of clearing of remnant native vegetation	Clearance applications monitored	Information not found
Number and extent of listed weed species	No systematic monitoring programme	Local data available but not systematic.
Distribution and abundance of ecologically significant introduced plants (those not listed as weeds)	No systematic monitoring programme	Witjira weeds; ARP
Localised grazing pressure on sensitive areas (eg mound springs	No systematic monitoring programme	Strezlecki Grazing Monitoring; NP aerial survey for ferals in Witjira and Simpson Desert CP; Olympic Dam Mine; Dalhousie Springs fish data
LANDSCAPE		
Fire frequency and extent across landscape	**Refer ACRIS Committee**	
Fire frequency and exent in fire sensitive communities	No systematic monitoring programme	Information not found
Land tenure change	PMIS – refer ACRIS	
Landscape pattern metrics (patch size, connectivity)	Information not found	Information not found
Average stocking rate	PMIS - Refer ACRIS Committee	Information not found
Percentage of land area remote from water points	PMIS - Refer ACRIS Committee	Information not found
Number and output of free-flowing bores	PMIS - Refer ACRIS Committee	Information not found
Density of artificial water points	PMIS - Refer ACRIS Committee	Information not found
Water quality, including concentration of pesticides and nutrient pollutants	No systematic monitoring programme	Olympic Dam Mine (at tailings dams)
MANAGEMENT ACTION TYPE INDICATORS	**SA – widespread**	**SA - local, regional or baseline**
Progress toward CARRS	Protected Area Mgt System	NA
Infrastructure to protect special areas	PSLIS	Information not found
Property plans (containing environmental measures eg biodiversity friendly grazing strategies)	Heritage Agreements - applications monitored	Information not found

SUMMARY OF CURRENT BIODIVERSITY MONITORING IN WA

Does not include programmes/projects just starting or short term (< 3 years) programmes.
No systematic monitoring programme: Response received indicating no widespread systematic monitoring programme.
Information not found: No response to direct queries, no contact details available or unable to contact in time allocated.
Refer ACRIS Committee: ACRIS committee working with State contacts on this data.

BIOTIC RESPONSE INDICATORS	**WA - widespread**	**WA – regional/local/baseline**
FAUNA		
Composition and abundance of waterbirds	No systematic monitoring programme	Site-specific counting is occurring on ad-hoc basis
Composition and abundance of terrestrial birds	No systematic monitoring programme	Site-specific regional and local biodiversity surveys
Composition of terrestrial fauna [birds, mammals, reptiles and ants]	No systematic monitoring programme	Site-specific regional and local biodiversity surveys; WA flora and fauna database
Composition of aquatic invertebrates	No systematic monitoring programme	AusRivAS/FNARH baseline data Halse; some other ad-hoc wetland surveys
Kangaroo abundance	Annual kangaroo aerial survey program	Information not found
FLORA		
Composition of perennial terrestrial vegetation	WARMS (pastoral rangelands)	Site-specific regional and local biodiversity surveys
Cover and structure of perennial terrestrial vegetation	WARMS (pastoral rangelands)	Site-specific regional and local biodiversity surveys
Vegetation greenness indices	NDVI through MODIS and old AVHRR	Information not found
Abundance and distribution of aquatic and semi-aquatic vegetation	Information not found	Pilbara Biological Survey riparian & submerged vegetation, diatoms macrophytes, planktonic algae
FLORA & FAUNA		
Status of threatened species and communities	Threatened Flora, Fauna & Ecological Communities Databases	Individual threatened species recovery and monitoring programmes
Number of threatened species and communities	Threatened Flora, Fauna & Ecological Communities Databases	Individual threatened species recovery and monitoring programmes
Distribution and abundance of significant fauna and flora eg effective recruitment in populations of special biota; status of iconic plant or animal species	Threatened Flora, Fauna & Ecological Communities Databases Some iconic sp mulga and bluebush in WARMS	Information not found
LANDSCAPE		
Extent and distribution of floodwaters	No systematic monitoring programme	Information not found
Flow of perennial streams	No systematic monitoring programme	Information not found
Landscape function	Formal CSIRO LFA collected as part of WARMS	Information not found
Riparian/aquatic condition	No systematic monitoring programme	Information not found

Appendix 4 WA p2

PRESSURE OR THREAT INDICATORS	WA - widespread	WA – regional/local/baseline
FAUNA		
Abundance and distribution of feral pest carnivores (especially foxes)	No systematic monitoring programme	Work at local scale (specific Conservation estate), primarily focussed on cats & dogs Variable – good information available but not part of formal monitoring system
Density and distribution of feral and native herbivores	Annual kangaroo aerial survey program	Variable – good information available but not part of formal monitoring system
FLORA		
Distribution and abundance of terrestrial and aquatic weed species	Information not found	Regional initiatives at the local scale eg Goldfields Environmental Management Group have a weeds database. Some good information available but not part of formal monitoring system
Extent of clearing of remnant native vegetation (by land type?)	Mapping through Soil Conservation Act (very little in RL)	Information not found
Number & extent of listed weed spp	DAFWA data base	Information not found
Distribution and abundance of ecologically significant introduced plants (those not listed as weeds)	No systematic monitoring programme	Variable – good information available but not part of formal monitoring system
Localised grazing pressure on sensitive areas (eg mound springs)	Information not found	Information not found
LANDSCAPE		
Fire frequency and extent across landscape	Fire Watch (DOLA)	Information not found
Fire frequency and extent in fire sensitive communities	No systematic monitoring programme	Information not found
Land tenure change	Yes – DPI, DAFWA and Pastoral Lands Board Information	Information not found
Landscape pattern metrics (patch size, connectivity)	Information not found	May not be relevant for rangelands as landscape pattern is generally not altered although landscapes may be degraded
Average stocking rate	DPI, DAFWA and Pastoral Lands Board Information	Information not found
Percentage of land area remote from water points		DPI DAFWA: not monitoring – part of lease information infrastructure mapping
Number and output of free-flowing bores	Information not found	Information not found
Density of artificial water points		DPI and DAFWA: not regular monitoring – part of lease infrastructure mapping
Water quality, including concentration of pesticides and nutrient pollutants	Information not found	Information not found

c. MANAGEMENT ACTION INDICATORS

	WA - widespread	WA – regional/local/baseline
Progress toward CARRS system	collated annually by DCE.	Information not found
Infrastructure to protect special areas	Information not found	Information not found
Property plans (containing environmental measures eg biodiversity friendly grazing strategies)	Interim management Guidelines and management plans are produced for much of the conservation estate in the Rangelands.	Information not found

APPENDIX 5

SUMMARY TABLE FOR NEW SOUTH WALES – collation of responses to Question 2

Key to sections in Appendices 5-10 (details of data sets for NSW, NT, QLD, SA and WA)		
Section	**Contains indicators**	**Types of data sets included**
A	**1-5**	**RESPONSE TYPE - FAUNA:** Composition and abundance of waterbirds, terrestrial fauna [birds, mammals including kangaroos, reptiles and ants], composition of aquatic invertebrates.
B	**6-9**	**RESPONSE TYPE – FLORA:** Composition, cover and structure of perennial terrestrial vegetation, vegetation greenness indices, abundance and distribution of aquatic and semi-aquatic vegetation
C	**10-12**	**RESPONSE TYPE - FLORA & FAUNA:** Status and number of threatened species and communities; distribution and abundance of significant fauna and flora.
D	**13-18**	**RESPONSE TYPE - LANDSCAPE:** Extent and distribution of floodwaters, flow of perennial streams, landscape function, riparian/aquatic condition.
E	**17-18**	**THREAT TYPE - FAUNA:** Abundance and distribution of ferals (cats, foxes, goats, rabbits etc)
F	**19-23**	**THREAT TYPE - FLORA:** Distribution and abundance of terrestrial and aquatic weed species, number of listed weed species, extent of clearing of remnant native vegetation, distribution and abundance of ecologically significant introduced plants (not listed weeds), localised grazing pressure on sensitive areas.
G	**24-32**	**THREAT TYPE - LANDSCAPE:** Fire frequency and extent across landscape (especially in fire sensitive communities), land tenure change, average stocking rate,% of land area remote from water points, number and output of free-flowing bores, density of artificial water points, water quality.
H	**33-35**	**MANAGEMENT ACTION TYPE:** Progress toward CARRS; infrastructure to protect special areas; property plans (containing environmental measures eg biodiversity friendly grazing strategies).

NSW SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

App 5: Section A: BIOTIC RESPONSE TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds	Eastern Australian Waterbird Survey	Up to 50 taxa of waterbirds	Eastern Australia at the wetland scale	Most regions in eastern Australia	10 30km wide transects surveyed each October	1983 - Annual	University of NSW and NSW DEC	Lats and longs for each wetland surveyed
2 Comp & Abund birds								
3 Comp & abund terr fauna	Fauna survey – Tarawi Nature Reserve	Reptiles, small mammals	local	Tarawi Nature Reserve	Pitfall trapping, spotlighting (62,000 trap nights)	1997 - 2004	Ray Dayman DEC Ranger Buronga 03 5021 8922 ray.dayman@environment.nsw.gov.au	Excel
	Fauna survey – Mallee Cliffs National Park	Reptiles, small mammals	local	Mallee Cliffs National Park	Pitfall trapping, spotlighting (62,000 trap nights)	2001 - present	Ray Dayman (see box above)	Excel
	Fauna survey – Mungo National Park	Reptiles, small mammals	local	Mungo National Park	Pitfall trapping, spotlighting (19,200 trap nights)	2003 – present	Ray Dayman (see box above)	Excel
4 Comp aquatic inverts	MDBC Sustainable Rivers Audit (MP via RA)	River Health (Fish, hydrology, macroinvertebrates)	MDBC	All inland CMAs	Talk with project manager for DNR.	Varies according to parameter measured	Bruce.chessman@dnr.nsw.gov.au	
5 Kangaroo abundance	Aerial survey of kangaroos	Density of kangaroos and goats	Regional – commercial kangaroo harvest zones. Goat data only collected for Western Plains of NSW	See map	Fixed wing aircraft– 100m wide transects along 15 and 45 minute lines of one degree blocks; Helicopters for tablelands areas	Fixed-wing surveys: early 1980's; annual. Helicopters: since 2001; 3 yearly.	Nicole Payne 02 6883 5322	Fixed wing – customised database built in MS Access; spatially enabled; data for helicopter held by contractor.
	Kangaroo survey – Mungo National Park	Western, Eastern and Red kangaroos	local	Mungo National Park	Ground based density transects (3 days/yr)	Annual 2001 - present	Ray Dayman (see box above)	Excel and Distance4

App 5: Section B: BIOTIC RESPONSE TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
6 Comp Terr Per Veg	Rangelands Assessment program (RA) **Current acris project**	Vegetation condition over time	Regional	Western NSW (Western CMA, Lower Murray Darling CMA, Lachlan CMA (?))	I am not involved – ask Russell Grant or Ian Cole		Ian Cole (Ian.Cole@dnr.nsw.gov.au)	
	Mallee Cliffs Salt Interception Scheme vegetation monitoring	Plant frequency, biomass, comparative yield, perennial plant cover, composition, soil EC, cover of groundcover (litter, cryptogam, vegetation, bare ground, erosion)	Local-subregional	Lower Murray Darling Catchment	Intention is annual (although some years have been missed)	1992	James Val james.val@dnr.nsw.gov.au	Reports/ xls database, some of the data is spatial (location of transects)
7 Cover & struct Terr Per Veg	Rangelands Assessment program (RA) **CURRENT ACRIS PROJECT**	Vegetation condition over time	Regional	Western NSW (Western CMA, Lower Murray Darling CMA, Lachlan CMA (?))	I am not involved – ask Russell Grant or Ian Cole		Ian Cole (Ian.Cole@dnr.nsw.gov.au)	
	Mallee Cliffs Salt Interception Scheme vegetation monitoring	Plant frequency, biomass, comparative yield, perennial plant cover, composition, soil EC, cover of groundcover (litter, cryptogam, vegetation, bare ground, erosion)	Local-subregional	Lower Murray Darling Catchment	Intention is annual (although some years have been missed)	1992	James Val james.val@dnr.nsw.gov.au	Reports/ xls database, some of the data is spatial (location of transects)
	Lake Victoria Vegetation Monitoring	Plant cover, ground cover (litter/cryptogam/ bare soil/ erosion), tree health, Soil EC	Sub regional (Lake Victoria area)	Lower Murray Darling Catchment	Intention is annual (although some years have been missed)	1992	James Val james.val@dnr.nsw.gov.au	Reports/ xls database, some of the data is spatial (location of transects)
8;Veg greenness								
9 Aq and semi aq veg								

App 5: Section C: BIOTIC RESPONSE TYPE INDICATORS – FLORA AND FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
10 Status thrt spp & comms	Monitoring undertaken by NSW DEC Biodiversity Conservation Unit (RA)	Threatened Species populations	State	State, but only some species are seriously monitored, eg annual Yellow-footed Rock Wallabies at Mutawingee NP			Peter Christie peter.christie@environment.nsw.gov.au	
11 Number thrt sp & comms								
12 Dist & abund sig flora & fauna	Malleefowl surveys – Tarawi Nature Reserve	Malleefowl mound status	local	Tarawi Nature Reserve	Annual aerial mound to mound surveys (107 mounds)	1997 - present	Ray Dayman	Excel, Mapmaster, Ozi Explorer
	Malleefowl surveys – Mallee Cliffs National Park	Malleefowl mound surveys	Local	Mallee Cliffs National Park	Annual aerial mound to mound surveys (149 mounds) Annual aerial transect surveys (10,000ha)	1989 – present 2001 – present	Ray Dayman	Excel, Mapmaster, Ozi Explorer
	Malleefowl surveys – Wamberra Station	Malleefowl mound surveys	local	Wamberra Station	Annual aerial transect survey (10,000 ha)	2003 - present	Ray Dayman	Excel, Mapmaster, Ozi explorer

App 5: Section D: BIOTIC RESPONSE TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
13 Ext & dist floodwatrs								
14 Perenn stream flow	DNR Salinity Monitoring network (RA)	EC, flow, temp	Local State	Barwon-Darling and intersecting streams	In-stream loggers.	Multiple times per day	DNR (unsure of custodian)	
15 Land Scape fn								
16 Rip/aq condition	MDBC Sustainable Rivers Audit (MP via RA)	River Health (Fish, hydrology, macroinvertebrates)	MDBC	All inland CMAs	Talk with project manager for DNR.	Varies according to parameter measured	Bruce.chessman@dnr.nsw.gov.au	
	DNR blue-green algae (RA)	Blue green algae – cell counts	Local	Barwon-Darling	Grab sample	Monthly in winter, weekly in summer, fortnightly in shoulder seasons	Chris.knight@dnr.nsw.gov.au	Cell counts – regular reporting in summer
	DNR GAB monitoring (RA)	Flow, pressure, temperature, conductivity, pH.	56 GAB sites	GAB region			Neil.eigeland@dnr.nsw.gov.au	

App 5: Section E: PRESSURE/THREAT TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
17 D/A feral pest preds	Fox control – Tarawi nature Reserve	1080 baiting and bait take monitoring	local	Tarawi Nature Reserve	309 stations baited 4 x yr	1996 - present	Lower Darling Area office	Excel, Arcview
	Fox control – Mungo National Park	1080 baiting and bait take monitoring	local	Mungo National Park	202 stations baited 4 x yr	1997 - present	Lower Darling Area office	Excel, Arcview
	Fox control – Mallee Cliffs National Park	1080 baiting and bait take monitoring	local	Mallee Cliffs National Park	214 stations baited 4 x yr	1998 - present	Lower Darling Area office	Excel, Arcview
18 D/D feral & native hrbivrs	See kangaroo survey info above – includes goats							

App 5: Section F: PRESSURE/THREAT TYPE INDICATORS - FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
19 D&A terr/aq Weed spp								
20 Clearing of remnant native veg	**CURRENT ACRIS PROJECT**							
	PVP Database (PAMS)	Vegetation areas cleared, managed by agreement	State	State	Variable		DNR _ Try Terry Brill (terry.brill@dnr.nsw.gov.au)	
	DNR Lower Murray Darling Land-use database	Landuse change/ clearing/ conservation reserves	Regional	Lower Murray Darling Catchment		Adhoc- 1999 review/ 2006 review	GIS officer DNR Buronga	all is spatial data in ArcGis Format
21 #/ext listed weed spp								
22 D&A ecol signif introd plants								
23 Graz P on sensitv areas	PhD on Mound springs (RA)	PhD starting on quantifying seed bank at spring sites, the vegetation community on and nearby springs, and investigation of the impact of grazing exclusion on spring habitats	regional	Western CMA Artesian mound springs	Greg Mills (greg.mills@cma.nsw.gov.au) will know about this – he is on the project steering committee	**Not yet started		

App 5: Section G: PRESSURE/THREAT TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
24 Fire freq and extent across landscape	**Current acris project**							
	Fire history mapping – Tarawi Nature Reserve	Fire history	local	Tarawi Nature Reserve	Satellite image interpretation	mid 70's - present	Lower Darling Area office	Arcview
	Fire history mapping – Mungo National Park	Fire history	local	Mungo National Park	Satellite image interpretation	mid 70's - present	Lower Darling Area office	Arcview
	Fire history mapping – Mallee Cliffs National Park	Fire history	local	Mallee Cliffs National Park	Satellite image interpretation	mid 70's - present	Lower Darling Area office	Arcview
25 Fire freq/ext fire sens comms								
26 Land use change	Crown Lands Information Database (CLID) (TM)	Not monitoring. Data is maintained on: Tenure type Lease purpose Lease conditions Ownership Rental status	Regional	Western Division of NSW.	data is updated on a regular basis as ownership details change		Western lands Commissioner. PO Box 1840 Dubbo NSW 2830. 02 6883 3000	Data is held in an Oracle database and can be viewed spatially.
	DNR Lower Murray Darling Land-use database	Landuse change/ clearing/ conservation reserves	Regional	Lower Murray Darling Catchment	Adhoc- 1999 review/ 2006 review		GIS officer DNR Buronga	all is spatial data in ArcGis Format
27 Landscape pattern metrics								
28. Average stocking rate								

App 5: Section G contin

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
29. % land area remote from water points								
30 Number and output of free-flowing bores								
31Density of artificial water pts								
32 Water qual, (conc of pesticides, nutrient pollutants								
32A OTHER								

App 5: Section H: MANAGEMENT ACTION TYPE INDICATORS

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
33 Prog to CAR	Building the NSW State Reserve System	Progress towards a Comprehensive, Adequate and Representative reserve system	• National (via CAPAD), • State, • Bioregion and Sub-region (IBRA) • Vegetation Formation, AND "Statewide Vegetation Map Units" (Kieth 2002), • Landsystem (SCS) • "Landscape" (Mitchell, 2002)	All – can be cut to any region using GIS.	N/A	Start date: as desired (from date of first reserve gazettal) Frequency: as desired but CAPAD is updated annually.	DEC – David Robson (in first instance) 02 6883 5336 dave.robson@environment.nsw.gov.au	Numeric Statistics Spatial (GIS)
34 Infrstr to protect sp areas								
35 Prop env plans	Enterprise Based Conservation (RA)	Stewardship program to manage private land for conservation	Regional	Western NSW (Western CMA, Lower Murray darling CMA, part of Lachlan CMA)	Still to be determined	**PROGRAM YET TO START**	Yet to be determined – Heidi Doyle (heidi.doyle@cma.nsw.gov.au) is setting up the business side of it	

APPENDIX 6

SUMMARY TABLE FOR NORTHERN TERRITORY – collation of responses to Question 2

Key to sections in Appendices 5-10 (details of data sets for NSW, NT, QLD, SA and WA)		
Section	**Contains indicators**	**Types of data sets included**
A	**1-5**	**RESPONSE TYPE - FAUNA:** Composition and abundance of waterbirds, terrestrial fauna [birds, mammals including kangaroos, reptiles and ants], composition of aquatic invertebrates.
B	**6-9**	**RESPONSE TYPE – FLORA:** Composition, cover and structure of perennial terrestrial vegetation, vegetation greenness indices, abundance and distribution of aquatic and semi-aquatic vegetation
C	**10-12**	**RESPONSE TYPE - FLORA & FAUNA:** Status and number of threatened species and communities; distribution and abundance of significant fauna and flora.
D	**13-18**	**RESPONSE TYPE - LANDSCAPE:** Extent and distribution of floodwaters, flow of perennial streams, landscape function, riparian/aquatic condition.
E	**17-18**	**THREAT TYPE - FAUNA:** Abundance and distribution of ferals (cats, foxes, goats, rabbits etc)
F	**19-23**	**THREAT TYPE - FLORA:** Distribution and abundance of terrestrial and aquatic weed species, number of listed weed species, extent of clearing of remnant native vegetation, distribution and abundance of ecologically significant introduced plants (not listed weeds), localised grazing pressure on sensitive areas.
G	**24-32**	**THREAT TYPE - LANDSCAPE:** Fire frequency and extent across landscape (especially in fire sensitive communities), land tenure change, average stocking rate,% of land area remote from water points, number and output of free-flowing bores, density of artificial water points, water quality.
H	**33-35**	**MANAGEMENT ACTION TYPE:** Progress toward CARRS; infrastructure to protect special areas; property plans (containing environmental measures eg biodiversity friendly grazing strategies).

NT SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

App 6: Section A: RESPONSE TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds	Waterbirds affected by hunting	Magpie Geese; Jabirus; Burdekin ducks	regional	??	Aerial survey	??	NTG (NRETA) Keith Saalfeld	??
	Magpie goose monitoring	Goose and nest numbers in particular floodplain systems (as per management plan)	Subregional	Top End	Aerial surveys along repeatable transects	Some annual, others less frequent	Wildl. Manage. Biodiv. Cons. NRETA Keith Saalfeld 8944 8470	Spreadsheets; include location data
	Wetlands and waterbirds of the Barkly and other NT savannah regions [no long term funding and no official name]	Waterbird breeding colonies and (secondarily) waterbird composition and abundance. Also, developing an understanding of broad wetland characteristics including locations and inundation extent. Not formal monitoring, better described as surveillance.	Bio-Regional (better described as at catchment level)	Barkly Tableland (Mitchell Grass Downs and Lake Woods); and Sturt Creek system (Ord-Victoria Plains); also some work in northern Tanami Desert.	Surveys are opportunistic (1993-5, 2001-2, 2006), usually after major Wet season floods. Aerial inspections of breeding colonies in wetlands and ground checks of colonies and shore areas. Often only a few days of survey per event. Some replication but limited.	Start 1993, latest in May 2006. Long gaps between surveys. Most effort since 1995 has been in March-June period.	Wetlands International at Brisbane office: 07 3406 6047 email roger.jaensch@wetlands-oceania.org	Spreadsheets of waterbird counts, aerial transect data, & colony data, by location (wetland or property); photo-image library, part hard copy and (from 2003) part digital. Partially completed spreadsheet of colonies by Lat Long, easily completed.
2 Comp & Abundance of birds	NRETA flora and fauna database	distribution and abundance data records for all NT flora and fauna	Territory	All NT	records from regional surveys, monitoring programs, useum specimens permit returns, other verified records from the public		Biodiv. Cons. NRETA Greg Connors 8944 8456	Access database linked to GIS

App 6: Section A continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
3 C&A ter fauna	NRETA flora and fauna database	distribution and abundance data records for all NT flora and fauna	Territory	All NT	records from regional surveys, monitoring programs, museum specimens permit returns, other verified records from the public		Biodiv. Cons. NRETA Greg Connors 8944 8456	Access database linked to GIS
	Bioregional surveys	Regional surveys of flora and fauna	subregional	Currently finishing Cobourg Penisula, surveying in Burt Plains and Anindilyakwa archipelago	standardised quadrat-based sampling stratified across habitat types	Surveys over 2-3 years, then move to next area	Biodiv. Cons. NRETA Alaric Fisher 8944 8454	All records stored in NRETA flora and fauna database. Summarised in NRETA reports
	Uluru Fauna Survey	Terrestrial birds, reptiles, small mammals, invertebrates, vegetation	Local	UKTNP	8 permanent sites; 3 d at each site during month long field trips. 750 Elliot trap nights per site, 108 pit trap days/nights and 15km of bird transects per site	1987; 15th survey Nov 2006. Initial block of 7 surveys in 3 years, then 8 since 1994	UKTNP – Mim Jambrecina [J. Reid maintained vertebrate dataset to 2002.]	Dbase & excel spreadsheets Specific programme designed for survey. Yes
	NP Fire plots	Fauna	Local			2000?	NTG (NRETA)	
	Tanami Biodiversity Monitoring Project	Birds, reptiles, mammals, predators/feral hebivores, vegetation (also Sangster's Bore Predator Monitoring – see indicator 17)	Subregional	Tanami IBRA	96 sites	April 2005, bi-annually; Proposed for LOM and hope to continue	CLC	Access Database with site locations
4 comp aq inverts	AUSRIVAS	Aquatic macroinvertebrates				1995; Baseline only; no repeat	DEH	AUSRIVAS
5 Kangaroo abundance	Not done in NT							

App 6: Section B: RESPONSE TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
6 comp Terr Per Veg	NRETA flora and fauna database	distribution and abundance data records for all NT flora and fauna	Territory	All NT	records from regional surveys, monitoring programs, herbarium records, permit returns, other verified records from the public		Biodiv. Cons. NRETA Greg Connors 8944 8456	Access database linked to GIS
	Bioregional surveys	Regional surveys of flora and fauna	subregional	Currently finishing Cobourg Penisula, surveying in Burt Plains and Anindilyakwa archipelago	standardised quadrat-based sampling stratified across habitat types	Surveys over 2-3 years, then move to next area	Biodiv. Cons. NRETA Alaric Fisher 8944 8454	All records stored in NRETA flora and fauna database. Summarised in NRETA reports
	Fire plots on parks	Composition of TPV	*Local*	Parks in the NT			Parks Div NRETA	
	Tier 1 Pastoral Monitoring Refer ACRIS	Comp of dominant TPV	Regional; local	NT lands used for pastoral production	Plot data – 2235 sites on 223 properties	resampled every 3 years	NTG – NRETA	Photos plus ???
	Tanami Biodiversity Monitoring Project	vegetation (+Birds, reptiles, mammals, predators/feral herbivores)	Subregional	Tanami IBRA	96 sites	April 2005, bi-annually; Proposed for LOM and hope to continue.	CLC	Access Database with site locations
7 cover & struct Terr Per Veg	Tier 1 Pastoral Monitoring Refer ACRIS	Cover & struct of TPV	Regional; local	NT lands used for pastoral production	Plot data; 2235 sites on 223 properties	resampled every 3 years	NTG – NRETA	Photos plus ???
7	Tier 2 Past Monit Refer ACRIS				Remote sensing			
8 Veg greenness	Refer ACRIS							
9 aq and semi aq veg	Inventory data in arid wetlands report;							

App 6: Section C: RESPONSE TYPE INDICATORS – FLORA AND FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
10 status Thrt sp & comms (+ 4 projects started in 06)	Carpentarian rock rats	Population size and structure. Habitat assessment	local	Coastal Gulf	Trapping along set transects	Annual	Anne Walters Wildl Manage. NRETA 8973 8857	spreadsheets & reports. data included in NRETA flora & fauna database
	Gouldian finches	Population size and structure. Habitat assessment	Subregional	Katherine Region	Annual counts at predetermined water points	Annual in August/Sept.	Anne Walters Wildl Manage. NRETA 8973 8857	spreadsheets & reports; data in NRETA flora & fauna database
	Purple-crowned fairy wrens	Population size and structure. Habitat assessment	Subregional	Katherine Region			Anne-Marie van Doorn	
	Carpentarian grasswren	Population size and structure. Habitat assessment	local	Coastal Gulf			Anne Walters Wildl Manage. NRETA 8973 8857	
	Yellow-snouted geckos	population size and distribution	local	Mary River	Pitfall trapping at sites of previous records	Annual trapping at 3 sites since 2005, 4th site started 2006	Ted Johansen 0439 730 367 c/- Bio. Cons. NRETA	spreadsheets & reports. data included in NRETA flora & fauna database
	Darwin Palm *Ptychosperma macarthurii*	population size and distribution	local	Darwin rural	monitoring of fixed plots surveys for new populations		Dave Liddle Biodiv. Cons. NRETA 8944 8492	
	Threatened mammals in the Sir Edward Pellews group of islands	population size and distribution	local	Gulf	small mammal surveys in 2003, 2004 and 2005 on each of the five main islands	started 2003	Simon Ward Biodiv. Cons. NRETA 8944 8462	spreadsheets & reports; data in NRETA flora & fauna database

App 6: Section C continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
	threatened acacias (?*Acacia pickardii*, *A peuce ??)*						Biodiv. Cons. NRETA Catherine Nano 8951 8222	
	Acacia latzii population monitoring	Survivorship and growth and recruitment events	2 localised sites on Henbury Station, Finke bioregion	Finke bioregion	Seedling recruits from only recorded recruitment event in 2000 measured at least twice pa. Growth data recorded over 5 year intervals for mature plants w/in exclosures and control sites. Rainfall data and flowering events recorded opportunistically (at least twice pa)	Program began in 1993, but more rigorous population monitoring initiated in 1998. Monitoring twice yearly (at least)	Australian Plants Society Alice Springs. Contact Colleen O'Malley curatoropbg@internode.on.net TSN Arid Rangelands is also monitoring program partner	Data is currently being converted to excel spreadsheet. No spatial data.
	Slater's skink	Population size	Local	Owen Springs	summer	2006	Biodiv. Cons. NRETA Chris Pavey	spreadsheets
	Central Rock Rat monitoring	Abundance	Local	Ormiston	Elliott trapping	Commenced 1998, frequency varies but at least once annually	Glenn Edwards	Excel. No.
	Mulgara monitoring	Size of borefield population as indicator of regional population	Local	UKTNP	750 Elliot trap nights in suitable habitat	1999; annual	UKTNP – Mim Jambrecina	Excel spreadsheet; yes
	Tjakura monitoring	Great Desert Skink population size, location, habitat use and breeding success of population	Local	UKTNP	C 100 hrs per year spent monitoring known burrows and mapping new burrows	1997; annual	UKTNP – Mim Jambrecina	Excel spreadsheet; yes

App 6: Section C continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
11 number Thrt sp & comms	Review of TS list for the NT	review of threatened status of all plant and animal species in the NT	Territory	All NT	Applied IUCN criteria to recent data on species of concern	review every 3-5 years. Finalising most recent review November 2006	Threatened Species Unit, Bio. Cons. NRETA Simon Ward 8944 8462 http://www.nt.gov.au/nreta/wildlife/threatened/	website & pdf files
12 Dist & abund sig F&F	Crocodile monitoring	Crocodile numbers and sizes along major river systems (as per management plan)	Subregional	Top End & Katherine	Spotlighting from boat along repeatable transects	Built on Harry Messel surveys in 1970's each river every 3-5 years	Wildl. Manage. Biodiv. Cons. NRETA Robyn Delaney 8944 8464	Spreadsheets includes location data
	Kakadu crocodile monitoring	Crocodile numbers along rivers and nesting information	Local	Kakadu NP			Kakadu, Parks Australia North Garry Lindner	
	Flock bronzewing pigeons	Population size and structure. Movement patterns. Habitat assessment. Diet					Peter Dostine Biodiv. Cons. NRETA 8944 8475	spreadsheets, papers & reports. data included in NRETA flora and fauna database
	Australian Bustards	Population size and structure. Movement patterns. Habitat assessment. Diet	NT	DDRF; Kidman Springs	Vehicle-based surveys along transects Satellite telemetry		Mark Ziembicki Biodiv. Cons. NRETA 8944 8461	spreadsheets, papers & reports. data included in NRETA flora and fauna database
	Arid small mammals	Population numbers	Local	Simpson Desert	2-3 times per year	1999	Biodiv. Cons. NRETA Chris Pavey	spreadsheets
	Common Brushtail Possum (rare in CA)	Presence/absence	Local	West MacDonnells NP	2 times per year	2004	Biodiv. Cons. NRETA Chris Pavey	reports

App 6: Section D: RESPONSE TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
13 Ext & dist floodwatrs								
14 Perenn stream flow	Stream height	Water height (index of flow)	local		Gauge to measure water height		NTG – NRETA	???
15 Land Scape fn	Tier 1 (of limited use)		regional	All NT IBRA				
	Tier 2	Land condition	regional	Good info for VRD and Sturt Plateau only				
16 Rip/aq condition	AUSRIVAS	River health	regional	Katherine, Roper, Vic and Daly R	See DEH	Detailed baseline	DEH/NRETA	
	Inventory of Arid wetlands	All aspects of wetlands	regional		Aerial survey; ground survey	2001-2; **Baseline only**	NTG – NRETA Angus Duguid	
	aerial survey of lower Finke	Water levels	local	Lower Finke R	Aerial survey, photos & video record; no standardised methodology	2001; once only; no intention to repeat	NTG – NRETA	Hard copy; no

App 6: Section E: PRESSURE/THREAT TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
17 D/A feral pest preds	Sangster's Bore Predator Baiting Project	Bilby, great desert skink, mulgara, goannas, small mammals, foxes, cats, dingos, bustards, emus	Local	Tanami IBRA	2 x 10-20km tracking transects Elliot trapping (8 sites)	April 2005, bi-annually until 2008 (3 years NHT funds)	CLC	Excel spreadsheet with site locations
18 D/D feral & native hrbivrs	Aerial survey used to monitor feral and native herbivores at approx 8 year intervals	Abundance and distribution	Regional	IBRA	Aerial survey at 1-3%	Frequency varies between 3 and 8 years	Keith Saalfeld	Arcview. Yes.

App 6: Section F: PRESSURE/THREAT TYPE INDICATORS - FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
19 D&A terr/aq Weed spp	No centralised database. Each NP has a data base							
20 Clr'g of rem native veg	NDVI data	Cover by remote sensing; applications to NRETA for clearing of native vegetation	All NT	By IBRA or veg type	25m and 50m landsat imagery; NDVI and difference imaging	Annual for clearing permits; satellite imagery every 10 days.	NRETA	??
21 #/ext listed weed spp	WONS; NT lists (no formal monitoring)							
22 D&A ecol signif introd plants	Herbarium data base	species	regional	all	Systematic and opportunistic collecting	No systematic resampling	NTG - NRETA	
23 Graz P on sensitv areas	No SMP							

App 6: Section G: PRESSURE/THREAT TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
24 Fire freq and extent across landscape	Fire History Derived from NOAA AVHVR	Fire frequency and extent	All the NT	All the NT	1 km² resolution; with minimum mapping area of 4 km²;	1993; every 2-6 weeks for first few years; every 10 days since 1997	NT Bushfires Council; Scientific officer (Grant Allan)	Shape files and Grids; Yes
	Fire History Derived from Landsat (Four smaller more detailed projects)	Fire frequency and extent	Regional: Up to 30,000 km² area (single Landsat scene areas)	Uluru region including UKTNP, West MacDonnells, Yuendumu, Tanami	30 m resolution; with minimum mapping area approx 1 ha	Roughly 1980-2005 (annual updates with potential for monthly dating of fires)	NT Bushfires Council; Scientific officer (Grant Allan)	Shape files and Grids; Yes
	On parks		local		250m		NRETA	
	Western Arnhem Land		regional		250m		NTG – NRETA (Indig custodians)	
25 Fire freq/ext fire sens comms	Fires on parks		regional	parks	250m		NTG - NRETA	
26 Land use change	Lands office records							
27 Landscape pattern metrics	Not done -could extract from clearing data base)							
28. Average stocking rate	Not known; Nat data avail from ABARE – statistical sample							
29. % land area remote from water points	Refer ACRIS (Biograze etc)							

App 6: Section G continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
30 Number & output of free-flowing bores	No uncapped bores in NT							
31Density of artificial water pts	JC – Pastoral lands Board – has all infrastructure data				bore data for ALL bores drilled ie duds are listed			
32 Water qual, (conc of pesticides, nutrient pollutants	No; Dwn Hbr focus; prelim sediment load work in Daly R							

App 6: Section H: MANAGEMENT ACTION TYPE INDICATORS

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
33 Prog to CAR	Yes; Planning section of NRETA (AF for Qs)	CA and R of reserves	regional	All NT			NTG - NRETA	
34 Infrstr to protect sp areas	Local info held by regional facilitators and in NHT reports	No SMP						
34	GA and UKTNP are fencing off some waterholes from camels and some riparian areas were fenced from stock under NHT1.							
35 Prop env plans	Local regional info only (DPI officers, cons mgt groups, pastoral co's)	NO SMP						

APPENDIX 7

SUMMARY TABLES FOR QUEENSLAND – collation of responses to Question 2

Key to sections in Appendices 5-10 (details of data sets for NSW, NT, QLD, SA and WA)		
Section	**Contains indicators**	**Types of data sets included**
A	**1-5**	**RESPONSE TYPE - FAUNA:** Composition and abundance of waterbirds, terrestrial fauna [birds, mammals including kangaroos, reptiles and ants], composition of aquatic invertebrates.
B	**6-9**	**RESPONSE TYPE – FLORA:** Composition, cover and structure of perennial terrestrial vegetation, vegetation greenness indices, abundance and distribution of aquatic and semi-aquatic vegetation
C	**10-12**	**RESPONSE TYPE - FLORA & FAUNA:** Status and number of threatened species and communities; distribution and abundance of significant fauna and flora.
D	**13-18**	**RESPONSE TYPE - LANDSCAPE:** Extent and distribution of floodwaters, flow of perennial streams, landscape function, riparian/aquatic condition.
E	**17-18**	**THREAT TYPE - FAUNA:** Abundance and distribution of ferals (cats, foxes, goats, rabbits etc)
F	**19-23**	**THREAT TYPE - FLORA:** Distribution and abundance of terrestrial and aquatic weed species, number of listed weed species, extent of clearing of remnant native vegetation, distribution and abundance of ecologically significant introduced plants (not listed weeds), localised grazing pressure on sensitive areas.
G	**24-32**	**THREAT TYPE - LANDSCAPE:** Fire frequency and extent across landscape (especially in fire sensitive communities), land tenure change, average stocking rate,% of land area remote from water points, number and output of free-flowing bores, density of artificial water points, water quality.
H	**33-35**	**MANAGEMENT ACTION TYPE:** Progress toward CARRS; infrastructure to protect special areas; property plans (containing environmental measures eg biodiversity friendly grazing strategies).

QLD SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

App 7: Section A: BIOTIC RESPONSE TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds	Waterbird surveys by Julian Read		Regional	Lake Eyre Basin	Aerial & ground surveys	decade	Part ARIDFLO see below for custodian; Own surveys as well	Yes, some
	waterbirds	Roger Jaensch (Wetlands International)	State		Aerial & ground surveys	decade	??Part of ARIDFLO see below for custodian	Yes?
2 Comp & Abund birds								
3 C&A ter fauna	WILDNET	Fauna & flora	State	QLD bioregions (13)	All different types	No particular start date for monitoring – aim to hold relevant information; research	EPA/QPWS (07) 3227 7815	yes
	Individuals within EPA/QPWS	Eg Gary Porter	Central QLD		Fauna , flora	decade	EPA/QPWS	Yes, some
	Field research	Terrestrial verts, inverts (+ vascular plants)	Small scale (5x5 m plots), local (1 ha), up to region (~6000 sq km)	Simpson Desert bioregion	Vertebrates: 1 ha grids (n = ~30 sampled regularly); Inverts: 12 pits / vertebrate grid. Sampling 4 times a year.	March 1990, but full sampling program up and running by 1996. Sampling 4 times a year since then.	Chris Dickman, University of Sydney	Access databases, spatially enabled.
4 comp aq inverts								
5 Kangaroo abundance	**CURRENT ACRIS PROJECT**							

App 7: Section B: BIOTIC RESPONSE TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
6 comp Terr Per Veg	WILDNET	Fauna & flora	State	QLD bioregions (13)	All different types	No particular start date for monitoring – aim to hold relevant information; research	EPA/QPWS (07) 3227 7815	yes
	TRAPS							
	Grasscheck							
	Mapping by EPA						EPA	
	Field research	Vascular plants (+Terrestrial verts, inverts)	Small scale (5x5 m plots), local (1 ha), up to region (~6000 sq km)	Simpson Desert bioregion	Plants: 5x5 m plots (n = 240); Sampling 4 times a year.	March 1990, but full sampling program up and running by 1996. Sampling 4 times a year since then.	Chris Dickman, University of Sydney	Access databases, spatially enabled.
7 cover & struct Terr Per Veg	TRAPS,							
	Grasscheck							
	EPA Rangeland Ground Cover Disturbance Assessment	Rangeland Ground Cover Disturbance		QLD Bioregions & sub-regions	Remote sensing by sub-region	1988 (annual since 2000)	NRM&W and EPA	ESRI ArcInfo GRIDs
	Mapping by EPA						EPA	
	Field research	Vascular plants (+Terrestrial verts, inverts)	Small scale (5x5 m plots), local (1 ha), up to region (~6000 sq km)	Simpson Desert bioregion	Plants: 5x5 m plots (n = 240); Sampling 4 times a year.	March 1990, but full sampling program up and running by 1996. Sampling 4 times a year since then.	Chris Dickman, University of Sydney	Access databases, spatially enabled.
8;Veg greenness	SLATS							
	EPA work in Desert Uplands						EPA	
9 aq and semi aq veg	Corveg						QLD Herbarium	
	EPA Wetland Mapping and Classification Programme							

App 7: Section C: BIOTIC RESPONSE TYPE INDICATORS – FLORA AND FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
10 status Thrt sp & comms	EPA Biodiversity Planning Assessments	Biodiversity		QLD Bioregions & sub-regions	Regional Ecosystem based assessment	Varies between bioregions	EPA	ESRI coverage and shape files
	Back on Track	Status of threatened species	State	All			EPA	
11 number Thrt sp & comms	EPA Biodiversity Planning Assessments	Biodiversity		QLD Bioregions & sub-regions	Regional Ecosystem based assessment	Varies between bioregions	EPA	ESRI coverage and shape files
	Back on Track						EPA	
12 Dist & abund sig F&F	Hairy Nosed Wombat							

App 7: Section D: BIOTIC RESPONSE TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
13 Ext & dist floodwatrs								
14 Perenn stream flow	DNR&W							
15 Land Scape fn	EPA Rangeland Ground Cover Disturbance Assessment	Rangeland Ground Cover Disturbance		QLD Bioregions & sub-regions	Remote sensing by sub-region	1988 (annual since 2000)	NRM&W and EPA	ESRI ArcInfo GRIDs
16 Rip/aq Condition	QLD WETLAND *INFO;* Wetland mapping & classification	Under construction	State	QLD bioregions (13)	All different types	No particular start date for monitoring – aim to hold relevant information; research	EPA Mike Ronan 07 3327 6147	Yes some is
	State of the Rivers (DNRM&W)							
	ARIDFLO data	unpublished	Lake Ere Basin	QLD Mitchell Grass Downs, QLDChannel Country & into SA bioregions	Water quality, some flora, fish, macroinvertebrates zooplankton, algae	2001 Over 3 years approx 3 surveys per year (2weeks in length)	Michael Good Ph (08) 8463 6939 Senior Policy Officer Strategic Policy Division DWLBC	yes
	fish	Janet Pritchard & Vanessa Bailey	Lake Eyre Basin		netting	2001 Over 3 years approx 3 surveys per year (2weeks in length)	Part ARIDFLO see row above for custodian Own surveys as well	yes

App 7: Section E: PRESSURE/THREAT TYPE INDICATORS – FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
17 D/A feral pest preds	NRM&W							
18 D/D feral & native hrbivrs	NRM&W							

App 7: Section F: PRESSURE/THREAT TYPE INDICATORS - FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
19 D&A terr/aq Weed spp	NRM&W							
20 Clr'g of rem native veg	EPA Rangeland Ground Cover Disturbance Assessment (1988 – 2004)	Rangeland Ground Cover Disturbance	QLD	Bioregions & sub-regions	Remote sensing by sub-region	1988 (annual since 2000)	NRM&W and EPA	ESRI ArcInfo GRIDs
	SLATS **CURRENT ACRIS PROJECT**							
	AGO data **CURRENT ACRIS PROJECT**							
21 #/ext listed weed spp	NRM&W							
	CORVEG database						QLD Herbarium	
22 D&A ecol signif introd plants								
23 Graz P on sensitv areas	GABSI (Springs data)							

App 7: Section G: PRESSURE/THREAT TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
24 Fire freq and extent across landscape	**National fire mapping - CURRENT ACRIS PROJECT**							
25 Fire freq/ext fire sens comms								
26 Land use change	NRM&W – land tenure database							
27 Landscape pattern metrics	EPA Biodiversity Planning Assessments	Biodiversity		QLD Bioregions & sub-regions	Regional Ecosystem based assessment	Varies between bioregions	EPA	ESRI coverage and shape files
28. Average stocking rate	NRM&W – land tenure database							
29. % land area remote from water points	GABSI Water Remote Area Analysis							

App 7: Section G continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
30 Number and output of free-flowing bores	NRM – bore-capping project							
31Density of artificial water pts	NRM – bore-capping project							
32 Water qual, (conc of pesticides, nutrient pollutants								

App 7: Section H: MANAGEMENT ACTION TYPE INDICATORS

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
33 Prog to CAR								
34 Infrstr to protect sp areas								
35 Prop env plans								

APPENDIX 8
SUMMARY TABLE FOR SOUTH AUSTRALIA – collation of responses to Question 2

Key to sections in Appendices 5-10 (details of data sets for NSW, NT, QLD, SA and WA)		
Section	**Contains indicators**	**Types of data sets included**
A	**1-5**	**RESPONSE TYPE - FAUNA:** Composition and abundance of waterbirds, terrestrial fauna [birds, mammals including kangaroos, reptiles and ants], composition of aquatic invertebrates.
B	**6-9**	**RESPONSE TYPE – FLORA:** Composition, cover and structure of perennial terrestrial vegetation, vegetation greenness indices, abundance and distribution of aquatic and semi-aquatic vegetation
C	**10-12**	**RESPONSE TYPE - FLORA & FAUNA:** Status and number of threatened species and communities; distribution and abundance of significant fauna and flora.
D	**13-18**	**RESPONSE TYPE - LANDSCAPE:** Extent and distribution of floodwaters, flow of perennial streams, landscape function, riparian/aquatic condition.
E	**17-18**	**THREAT TYPE - FAUNA:** Abundance and distribution of ferals (cats, foxes, goats, rabbits etc)
F	**19-23**	**THREAT TYPE - FLORA:** Distribution and abundance of terrestrial and aquatic weed species, number of listed weed species, extent of clearing of remnant native vegetation, distribution and abundance of ecologically significant introduced plants (not listed weeds), localised grazing pressure on sensitive areas.
G	**24-32**	**THREAT TYPE - LANDSCAPE:** Fire frequency and extent across landscape (especially in fire sensitive communities), land tenure change, average stocking rate,% of land area remote from water points, number and output of free-flowing bores, density of artificial water points, water quality.
H	**33-35**	**MANAGEMENT ACTION TYPE:** Progress toward CARRS; infrastructure to protect special areas; property plans (containing environmental measures eg biodiversity friendly grazing strategies).

SA SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

App 8: Section A: BIOTIC RESPONSE TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds	Olympic Dam Mine internal database	Number and composition of waterbirds	Local	Olympic Dam Mine and Roxby Downs Township	recorded on all permanent water bodies in immediate region of Olympic Dam Mine.	1999 Monthly	Environment Section Billiton, Olympic Da	MS Access database
	ARIDFLO	**Waterbirds,** (plus Fish, Macroinvertebrates, Zooplankton, Algae)	Local to Regional	Channel Country IBRA region; Lake Eyre Basin (SA & Qld ie incl MGD).	7 samples in 3 years; fieldwork finished. 6-9 days spent in each of 5 regions on each visit. *c.* 40 sites.	March 2000. Last fieldtrip Feb-March 2003.	M. Good, SA DWLBC	All data in excel spreadsheets, and submitted to ANLIC website. Yes.
2 Comp & Abund birds	Flinders Ranges Bushbird Monitoring	Changes in abundance & species composition of bushbirds in 6 vegetation communities as indicators of vegetation recovery; Habitat parameters in selected veg communities	Local	Flinders Ranges NP and adjacent properties	Bushbirds: belt transects (2x 500 metres in each veg community, 21 sites in total) Habitat: Point sampling at 1m intervals on above transects)	Bushbirds:Mar 2000-Nov 2004 4 times per year Habitat: Mar 2000-Nov 2004 Once per year	Nicki de Preu DEH Hawker has detailed bird spp and habitat data[#]; Bird species for partic sites also entered to Bird Atlas and BDBSA	Excel Files[#] Access Database (BDBSA) Site locations only on GIS
	Olympic Dam Mine internal database	Bird species composition and abundance	Local	Olympic Dam Mine	Surveys are conducted at 45 permanent sites which radiate out from the mine site.	1998 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
	Olympic Dam Mine internal database	Bird species composition	Local	Olympic Dam Mine and surrounding areas	Opportunistic records of all birds in immediate area, greater region and Wellfields (Great Artesian Basin water extraction area)	1989 Monthly	Environment Section, BHP Billiton, Olympic Dam	MS Access database

App 8: Section A continued

Indicator from Q1 (source)	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
	Census/mapping of arid zone birds at Arid Recovery	Distribution and abundances of birds assessed annually inside and outside a predator-free enclosure	Ca 10 square km; about 6 km2 inside; 4 km2 outside	Around Arid Recovery , ca 15 km N of Roxby Downs SA	Mapping of individual birds done once a year (in April). Locations and numbers of all birds seen during a systematic area search mapped by recording GPS locations for each sighting.	1999 but area surveyed increased over next 2 years.	David Paton david.paton@adelaide.edu.au	Currently excel, but will be loading into a Access data base in due course, that matches other databases on temperate and coastal systems.
3 Comp & abundance terr fauna	EDBSA	Fauna and flora	State	All	Varies; most commonly point data records of presence/absence; some from surveys, some opportunistic observations	Veg surveys: May 75-present; Ongoing Vert surveys: May 75-present; ongoing	No restrictions subject to licence agreement;DEH Biological Survey and Monitoring; Biological Survey Co-ordinator 08 8222 9470 foulkes.jeff@saugov.sa.gov.au	ORACLE, MS Access, ESRI, dBase.
	Flinders Ranges Small Vertebrate Monitoring	Response of small vertebrates to rabbit control and fox-baiting	Local	Flinders Ranges NP/Gum Creek Station; Vulkathunha-Gammon Ranges NP/Wertaloona Station	Total of 8 trap sites consisting of 120 pitfalls at each site	1997-2004 2 times per year	Nicki de Preu DEH Hawker has all capture data with periodic updates to BSDBSA	Access Databases & Excel Files Site locations only on GIS
	Olympic Dam Mine internal database	Small mammals and reptiles	Local	Olympic Dam Mine	Pitfall trapping in summer on mine site; 16 permanent pitfall trapping sites & a 1 ha grid containing approx 400 pits for monitoring home range size, longevity etc.	1991 Annual	Environment Section, BHP Billiton, Olympic Dam	MS Access database

App 8: Section A continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
	Annual pitfall and Elliott trapping at Arid Recovery	Small native mammals and reptiles	Local	Roxby Downs	Annual	1998	AR	Access
	Quarterly native track counts at Arid Recovery	Reintroduced species and kangaroos	Local	Roxby Downs	Quarterly	2000	AR	Excel
	Quarterly spotlight counts	Native animals	Local	Roxby Downs	Quarterly		AR	Excel
4 comp aq inverts	Olympic Dam Mine internal database	Mound Springs Invertebrates	Regional	Olympic Dam Water Extraction Areas	Sample Great Artesian Basin Springs in collaboration with University of Queensland.	1989 Annual since 1989. 2005 change to triennially	Environment Section, BHP Billiton, Olympic Dam & University of Queensland	MS Access database
	ARIDFLO	(Waterbirds), Fish, Macroinvertebrates, Zooplankton, (Algae)	Local to Regional	Channel Country IBRA region; Lake Eyre Basin (SA & Qld).	7 samples in 3 years; fieldwork finished. 6-9 days spent in each of 5 regions on each visit. *c.* 40 sites.	March 2000. Last fieldtrip Feb-March 2003.	M. Good, SA DWLBC	All data in excel spreadsheets, and submitted to ANLIC website. Yes.
5 Kangaroo abundance	Flinders & Gawler Ranges Kangaroo Surveys (ground)	Trends in abundance of dominant large macropod species	Local	Flinders Ranges NP, Gum Creek & Upalinna Stations & Gawler Ranges NP	6x10km line transects per area FRNP 2 areas Gum Creek 1 Upalinna 1 GRNP 3 areas	1998-present; Once per year	Nicki de Preu DEH Hawker & L Farroway DEH Adelaide	Excel & Distance Output files No spatial data
	SA Pastoral Zone Kangaroo Surveys (aerial)	Trends in abundance of dominant large macropod species	Regional	Former SCB Districts, NRM subregions		1982-present; Once per year	Lisa Farroway DEH Adelaide	
	Olympic Dam Mine internal database	Numbers of kangaroos	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near Olympic Dam Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database

App 8: Section B: BIOTIC RESPONSE TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is data spatially enabled?**
6 comp Terr Per Veg	Vegetation Monitoring on NP Reserves	Vegetation responses to management of total grazing pressure	Local	Flinders Ranges NP, Bunkers CR, Vulkathunha-Gammon Ranges, Arkaroola Sanctuary 7 Gawler Ranges NP	Combination of quantitative (Jessup transect) and observational sites; **FRNP** 31 sites (9 with Jessup trans and 10 exclosures); **VGRNP** 42 sites (8 with Jessup trans and 5 exclosures); **GawRNP** 52 sites (14 with Jessup trans and 3 exclosures)	Start date varies with location and sites; earliest 1957 to present time Frequency variable but mostly biennial at permanent sites	Stuart Pillman, John McDonald & Justin Jay DEH Adelaide	Access Database (PMIS)
	Olympic Dam Mine internal database	Presence and frequency of all perennial woody trees and shrubs	Local	Olympic Dam Mine	Within the mine lease, there are 34 sites on a radial grid. At each site, a 100 x 25m quadrat is sampled.	1989 Annual	Environment Section, BHP Billiton, Olympic Dam	Internal reports
	Annual cover, richness and photopoints at Arid Recovery	Native plants	Local	Roxby Downs	Annual-two yearly	1997	AR	Access
	-Long term seedling survival and growth monitoring study at Arid Recovery	Native plants	Local	Roxby Downs	Three yearly	2000	AR	Access
	Long term condition of perennial plant species and impact of bettong browsing	Native plants	Local	Roxby Downs	Annual	2007	AR	Access
7 cover & struct Terr Per Veg	Arcoona Ck Veg Exclosures		local	Northern Flinders, Outback, Gammon NP	Photographs were taken.	Start 1/10/77 Finish: ongoing; Frequency of monitoring is 6 monthly and ongoing.	Senior Research Officer, Bob Henzell: henzell.bob@saugov.sa.gov.au	

App 8: Section B continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is data spatially enabled?**
	Elliot-Price CP vegetation monitoring	Vegetation	Local	Northern Flinders, Outback, Elliot-Price CP	Photopoints set up to monitor vegetation communities. Mud map localities and print photography; some broad vegetation descriptions.	Start 23/11/76 Finish: ongoing 1976, 1980, 1999	Scientific Officer, Biodiv Survey & Monitoring: John McDonald mcdonald.john@saugov.sa.gov.au Reg Ecologist N Region: G Axford Axford.Geoff@saugov.sa.gov.au	??Reports For 1999 assessments PMIS Access/DTUPA ArcInfo databases
	Strzelecki vegetation monitoring	vegetation	?regional	North East deserts	Photopoint sites established in 2000 for lease assessment with associated data entry, photography, reporting and mapping; additional historic photopoints revisited and some photos repeated, other sites were not visited but could be in the future. 2 sites, originally photographed in 1957/8, comprise old building ruins, new site established in 74 off Moppa Collina channel was repeated in 1979 & 1980	Start 1/11/74 Finish: ongoing	**Contacts:** Scientific Officer, Biodiversity Survey & Monitoring: John McDonald mcdonald.john@saugov.sa.gov.au Regional Ecologist Northern Region: Geoff Axford Axford.Geoff@saugov.sa.gov.au	??reports??
8 Veg greenness	Green Cover Index Maps	Maps of vegetation cover produced from NDVI analysis of NOAA AVHRR satellite imagery	State	All	Monthly; Map resolution 1 km pixels	Start date not known; ongoing	PIRSA Technical Officer 08 8303 9652 michalski.caroline@saugov.sa.gov.au No restrictions.	Digital Arc/Info GRID files plus non-digital printed maps
9 aq and semi aq veg	Olympic Dam Mine internal database	Vegetation cover and species	Local	Olympic Dam Mine	monitored annually in GAB Springs in extraction area.	1989	Environ Section, BHP Billiton, Olympic Dam	MS Access database

App 8: Section C: BIOTIC RESPONSE TYPE INDICATORS – FLORA AND FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale (**ational Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
10 status Thrt sp & comms	DLWBC database							
	Cage trapping	Reintroduced mammals	Local	Roxby Downs	Annual	2001	AR	Excel
	Track counts OS Reserve to record dispersal	Mainly *M. lagotis*	Local	Roxby Downs	Annual	2005	AR	Excel
	Burrow counts for *P. australis*	*P. australis*	Local	Roxby Downs	Annual	2006	AR	Excel
	Nest/burrow monitoring	For reintroduced mammals *B. lesueur,, M. lagotis, L. conditor*	Local	Roxby Downs	Annual	2003	AR	Access
	Spotlight counts	Native animals	Local	Roxby Downs	Quarterly		AR	Excel
11 number Thrt sp & comms	DLWBC database							
12 Dist & abund sig F&F	Yellow-footed Rock-wallaby aerial surveys	Broadscale population estimates across the Flinders & Olary Ranges	Subregional	IBRA	Helicopter line transects of variable length conducted at 6 permanent locations.	Start date varies between locations; earliest 1982 to present time	Roman Urban and Jason van Weenen DEH Adelaide	Excel Files & GIS coverages
	Yellow-footed Rock-wallaby trapping (with	Population parameters (survival, fecundity and mortality) of YFRW	Subregional; across the range of yfrw in SA	IBRA	Number of traps and nights operated varies between sites	Start date varies between sites; earliest 1998 to present time	Dr Mark Lethbridge Flinders University	Excel files, trap locations, YFRW observations
	Rare Rodent Distribution of Arid SA	Distribution, status and ecology of *Pseudomys australis, Notomys fuscus* and *Antechinomys laniger*	Local	N of Pt Augusta and E of Stuart Hwy	2 monitoring sites for each species visited twice a year	Start date Jan 1992 (later for *A. laniger*) Ongoing subject to funding	DEH; Internal use; request to manager Biod Conservation programs 08 8124 4845 williams.stephanie@saugov.sa.gov.au	MS Access
	Threatened plant population (Greening Australia NRM Project)	Status of plants of conservation significance. Current work on *Acacia araneosa, Ptilotus bakerii, Eremophila pentaptera*.	Subregional; across the RL – currently at Billa kalina, Hamilton, VGRNP, Tieyon, Evelyn Downs, Arkaroola	NRM & IBRA: current work in Flinders Lofty (FLB5), Stony Plains	Variable: quantitative measurements to general population assessments (~ 1300 pops in database.	Varies - original study 1986 -1992; further work in 1995; plus some in progress; Sampling frequency: one to many visits	D Bickerton DEH Adelaide, J Walton GA (NRM Office Pt Augusta; DEH & DTUPA internal use; applications considered.	Threatened Plant Population database: Digital ORACLE plus several reports
	A. kochiana surv	*A. kochiana*	subregional	Roxby Downs	annual	2006	AR, BHP Billiton	Excel

App 8: Section D: BIOTIC RESPONSE TYPE INDICATORS – LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale:** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**Format of data; Data spatially enabled?**
13 Ext & dist floodwatrs	ARIDFLO		Local to Regional	Channel Country IBRA region; Lake Eyre Basin (SA & Qld).	6-9 days spent in each of 5 regions on each visit. *c.* 40 sites.	March 2000. 7 samples in 3 years Last fieldtrip Feb-March 2003.	M. Good, SA DWLBC	EXCEL; submitted to ANLIC website. Yes.
14 Perenn stream Flow	ARIDFLO		Local to Regional	Channel Country IBRA region; Lake Eyre Basin (SA & Qld).	6-9 days spent in each of 5 regions on each visit. *c.* 40 sites.	March 2000. 7 samples in 3 years Last fieldtrip Feb-March 2003.	M. Good, SA DWLBC	EXCEL; submitted to ANLIC website. Yes.
	Flow gauging - Data stored on Hydstra (DWLBC)	Discharge (interpreted from water level using ratings curve)	Catchment e.g. Cooper Creek at Cullyamurra Waterhole & Diamantina R at Birdsville	Desert Channels Qld; SA Arid Lands	Continuous; water gauges	Instantaneous	DWLBC Craig Walker	Hydstra
15 Land Scape fn	Land Condition Assessment in Flinders and Gammon Ranges NPs;	Land Condition	Subregional	FLB (IBRA)	Land Condition Index data for FRNP taken as part of lease assessment process	Start 1/10/97 Finish1/9/02; Sampled 1997, 1999, 2002	District Ranger Flinders Ra NP Peter Watkins: watkins.peter@saugov.sa.gov.au Project Officer, Biodiversity Assessment Srvcs Craig Balderstone: baulderstone.craig@saugov.sa.gov.au	draft report 1/2003
	Arid Recovery	Landscape Function	Local	Roxby Downs	5 yearly	2004	AR	Access
16 Rip/aq Condition	Mapping ground water resources, wh & dependant ecosystems. SAAL NRM Project Uni SA	Baseline mapping to develop geol & hydro-geol models of systems & prioritise threats eg pest plant & feral animal impacts	Subregional: central and north Flinders Ranges and Gawler Ranges	IBRA	Mapping	2005 to present time	Dr Ian Clark Uni SA	
	Riparian Spring Condition Index (Uni SA Hons)	Water quality , veg cover, spp composition & structure,	Subregional – Flinders Ranges	IBRA		2005-present time; variable frequency	Dr Ian Clark Uni SA (Supervisor for Hons Projects)	??
	Dalhousie Springs fish	Species presence & absence, habitat cond	Sub regional	Dalhousie Sp Witjira NP – 28 active springs	Minnow traps, dip nets to sample fish; temp, depth & dis O_2	1991, 2003	Astrid Kodric-Brown (UNM) kodric@unm.edu	Scientific pap – publ & in preparation

App 8: Section E: PRESSURE/THREAT TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
17 D/A feral pest preds	Flinders Feral Predator Monitoring	The relative abundance of foxes and cats	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges	Spotlight counts in areas with and without broadscale fox baiting programs; began as part of the National Monitoring and Surveillance Program for RCD	1996 to present; 4 times per year.	DEH Nicki de Preu	Excel files
	Olympic Dam Mine internal database	Numbers of cats and foxes	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near Olympic Dam Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
	Track counts-cats/foxes	Cats, foxes, rabbits, emus, kangaroos	subregional	Roxby Downs	Quarterly	2002	AR	Excel
	Spotlight transects-cats/foxes	Cats, foxes, kangaroos	Local	Roxby Downs	Quarterly	1999	AR	Excel
18 D/D feral & native hrbivrs	Flinders Rabbit Haemorrhagic Disease Monitoring	Changes in relative abundance of rabbits and virus activity	Local	Flinders Ranges NP/Gum Creek Station	Spotlight transects at 10 sites 2-3 times per year; opportune trapping of rabbits	1996 to present time	Greg Mutze DWLBC	Excel files
	Flinders Rabbit Monitoring	The relative abundance of rabbit numbers.	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges.	Spotlight counts in areas with and without rabbit control programs; began as part of National RCD Monitoring and Surveillance Program	1996 to present; 4 times per year	DEH Nicki de Preu	Excel files
	Quarterly track counts-rabbits	rabbits	Local	Roxby Downs	Quarterly	1989	AR, BHP Billiton (??same as BHP)	Excel
	Flinders Ranges Aerial and Ground-based Goat Control	Numbers of goats shot	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges.	Ground-based and aerial culls by Sporting Shooters Association of Australia and DEH accredited shooters;	1992 to present; Annual for aerial culling; variable for ground based operations	DEH Nicki de Preu	Excel files

App 8: Section E continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
	Feral and native fauna monitoring in Witjira NP and Simpson Desert CP		Regional	Central Deserts, Outback, Witjira and Simpson Desert NP	Count feral animals using Flystat software downloaded onto Excel files and dropped into ArcView spatial coverage depicting transects and distribution data, other native animals included in data collection	Start 1/06/01 Finish: ongoing Frequency??	**Contacts:** Senior Ranger , Desert Parks – Bill Ryan ryan.bill@saugov.sa.gov.au Regional Ecologist Northern Region: Geoff Axford Axford.Geoff@saugov.sa.gov.au	EXCEL and Arcview
	Olympic Dam Mine internal database	Numbers of rabbits	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near Olympic Dam Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
	Quarterly spotlight transects-rabbits	rabbits	Local	Roxby Downs	Quarterly	1989	AR, BHP Billiton	Excel

App 8: Section F: PRESSURE/THREAT TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
19 D&A terr/aq Weed spp	Component of Parks vegetation monitoring projects above							
	Weeds on the Cooper	Distribution of *Parkinsonia*	subregional	Cooper Creek	Helicopter survey	Nov 01; (to be repeated in future).	Geoff Axford DEH Pt Augusta	
	Olympic Dam Mine internal database	Distribution and abundance of terrestrial weed species	Local	Olympic Dam Mine and surrounds	Monitored on an ongoing basis as weeds are controlled.	2002	Environment Section, BHP Billiton, Olympic Dam	MS Access database
20 Clearing of rem native veg	Vegetation Clearance	Applications for clearance of native vegetation	local	State	Information entered as applications lodged;	1981; whenever applications lodged.	Written request to Manager of M&E section in DEH; (08) 8204 8888	MS Access; Hard copy
21 # & ext listed weed spp								
22 D&A ecol signif introd plants	Olympic Dam Mine internal database	Distribution and abundance of terrestrial weed species	Local	Olympic Dam Mine and surrounds	Monitored on an ongoing basis as weeds are controlled.	2002	Environment Section, BHP Billiton, Olympic Dam	MS Access database
	Annual weed survey and mapping (add to Enviro Dept Olympic Dam database)		subregional	Roxby Downs	Annual		BHP Billiton	Excel
	Witjira weeds	*Acacia farnesiana*, date palms, buffel grass, Athel pine	Sub regional	Witjira NP	Aerial survey both fixed wing and helicopter; photographs	Opportunistic but about every 5 years; Af checked after rain	Geoff Axford DEH Pt Augusta	???
23 Graz P on sensitv areas	Olympic Dam Mine internal database	Occurrence and intensity of grazing	Local	Olympic Dam Mine	Occurrence and intensity of grazing is monitored on Great Artesian Basin Mound Springs in water extraction area.	1989; annual	Environment Section, BHP Billiton, Olympic Dam	MS Access database

App 8: Section G: PRESSURE/THREAT TYPE INDICATORS – LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
24 Fire freq and extent across landscape)								
25 Fire freq & ext in fire sens comms								
26 Land use change	PMIS Refer ACRIS							
27landscape pattern metrics								
28. Average stocking rate	PMIS Refer ACRIS							
29. % land area remote from water points	PMIS Refer ACRIS							
30 Number and output of free-flowing bores	PMIS Refer ACRIS							
31Density artificial water pts	PMIS Refer ACRIS							
32 Water quality - eg pesticides, nutrient pollutants								

App 8: Section H: MANAGEMENT ACTION TYPE INDICATORS

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
33 Progress towards CAR reserve system	Protected Area Mgt System PAMS	Natural and cultural resources and management of protected areas	All protected areas in the State	All protected areas in all regions	As appropriate to attribute; continuously updated; horizontal positional accuracy 200m	1993; Ongoing	Internal use; written applications for external use. DEH: project leader of Protected Areas Systems 08 8124 4746 bond.tim@saugov.sa.gov.au	MS Access database
34 Measures to protect special areas	PMIS Refer ACRIS							
35 Property environment plans	Heritage Agreements	Applications for protection of areas of native vegetation in private ownership; plant data cross referenced into EDBSA(Reserves).	local	State	Information entered as applications lodged;	1981; whenever applications lodged.	Written request to Manager of M&E section in DEH; (08) 8204 8888	MS Access; Hard copy

APPENDIX 9

SUMMARY TABLE FOR WESTERN AUSTRALIA – collation of responses to Question 2

Key to sections in Appendices 5-10 (details of data sets for NSW, NT, QLD, SA and WA)		
Section	**Contains indicators**	**Types of data sets included**
A	**1-5**	**RESPONSE TYPE - FAUNA:** Composition and abundance of waterbirds, terrestrial fauna [birds, mammals including kangaroos, reptiles and ants], composition of aquatic invertebrates.
B	**6-9**	**RESPONSE TYPE – FLORA:** Composition, cover and structure of perennial terrestrial vegetation, vegetation greenness indices, abundance and distribution of aquatic and semi-aquatic vegetation
C	**10-12**	**RESPONSE TYPE - FLORA & FAUNA:** Status and number of threatened species and communities; distribution and abundance of significant fauna and flora.
D	**13-18**	**RESPONSE TYPE - LANDSCAPE:** Extent and distribution of floodwaters, flow of perennial streams, landscape function, riparian/aquatic condition.
E	**17-18**	**THREAT TYPE - FAUNA:** Abundance and distribution of ferals (cats, foxes, goats, rabbits etc)
F	**19-23**	**THREAT TYPE - FLORA:** Distribution and abundance of terrestrial and aquatic weed species, number of listed weed species, extent of clearing of remnant native vegetation, distribution and abundance of ecologically significant introduced plants (not listed weeds), localised grazing pressure on sensitive areas.
G	**24-32**	**THREAT TYPE - LANDSCAPE:** Fire frequency and extent across landscape (especially in fire sensitive communities), land tenure change, average stocking rate,% of land area remote from water points, number and output of free-flowing bores, density of artificial water points, water quality.
H	**33-35**	**MANAGEMENT ACTION TYPE:** Progress toward CARRS; infrastructure to protect special areas; property plans (containing environmental measures eg biodiversity friendly grazing strategies).

WA SUMMARY TABLE OUTLINING BASIC FEATURES OF RELEVANT ACTIVITIES OR DATABASES

App 9: Section A: BIOTIC RESPONSE TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored** (biodiversity aspect?)	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds								
2 Comp & Abund birds								
3 C&A ter fauna	Site-specific regional biodiversity surveys	Vascular flora, Terrestrial vertebrates, invertebrates	Regional	Regional scale assessment undertaken for Pilbara, Carnarvon Basin, Little Sandy Desert, Eastern Goldfields, Nullarbor	Sampling primarily undertaken across bioregions with each site assessed on at least 2 occasions	1970's to present for the Pilbara Survey	Norman McKenzie, Alan Burbidge, Greg Keighery, Neil Gibson, Stephen Van Leeuwen DEC	Spatially referenced and databased as well as published in a number of reports
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Murchison, Gascoyne	Sampling undertaken at Landsystem scale	2001; 3 stations sampled for the purpose of establishing baseline assessment and have been sampled twice per year for two years. Lorna Glen Station between 2-3 samplings per year and ongoing	Mark Cowan 08-94055184	Spatially referenced and in Access database, Published paper
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Pilbara Region	?	?	Peter Kendrick, DEC Karatha	Spatially referenced and in database?
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Murchison, Gascoyne	Sampling undertaken at Landsystem scale	2003	Anthony Desmond, DEC Geraldton	Spatially referenced and in Access database
4 comp aq inverts								
5 Kangaroo abundance	Aerial kangaroo monitoring	Kangaroo numbers	One third of rangeland each year	One third of rangeland each year	One third of rangeland aerially surveyed each year	1981 Annual	Dr Peter Mawson – 08 9423 2421	Oracle - no

App 9: Section B: BIOTIC RESPONSE TYPE INDICATORS – FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
6 comp Terr Per Veg	WARMS (see Attachments 2,3 and 4 of ACRIS pilot project report)	Perennial vegetation and landscape function	Regional (~1620 sites across pastoral rangelands)	Pastoral ragelands	Fixed ground sites. Approx 1 site per 60,000 ha. Three year frequency in Kimberley and Pilbara, 5 yr frequency in the southern rangelands.	Formally – 1993. Four assessments in Kimberley Two assessments in sthn rangelands. Many sites have old data (back to mid 1970s – but not typically used unless specific request).	Ian Watson iwatson@agric.wa.gov.au	Oracle/Access database. Location details for individual sites.
	Site-specific regional biodiversity surveys	Vascular flora, Terrestrial vertebrates, invertebrates	Regional	Regional scale assessment undertaken for Pilbara, Carnarvon Basin, Little Sandy Desert, Eastern Goldfields, Nullarbor	Sampling primarily undertaken across bioregions with each site assessed on at least 2 occasions	1970's to present for the Pilbara Survey	Norman McKenzie, Alan Burbidge, Greg Keighery, Neil Gibson, Stephen Van Leeuwen DEC	Spatially referenced and databased as well as published in a number of reports
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Murchison, Gascoyne	Sampling undertaken at Landsystem scale	2001 3 stations sampled for the purpose of establishing baseline assessment and have been sampled twice per year for two years. Lorna Glen Station between 2-3 samplings per year and ongoing	Mark Cowan 08-94055184	Spatially referenced and in Access database, Published paper
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Pilbara Region	?	?	Peter Kendrick, DEC Karatha	Spatially referenced and in database?
	Site Specific local surveys	Terrestrial Vertebrates, Vascular Flora	Local	Murchison, Gascoyne	Sampling undertaken at Landsystem scale	2003	Anthony Desmond, DEC Geraldton	Spatially referenced and in Access database

App 9: Section B continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
7 cover & struct Terr Per Veg	WARMS (see Attachments 2,3 and 4 of ACRIS pilot project report)	Perennial vegetation and landscape function	Regional (~1620 sites across pastoral rangelands)	Pastoral ragelands	Fixed ground sites. Approx 1 site per 60,000 ha. Three year frequency in Kimberley and Pilbara, 5 yr frequency in the southern rangelands.	Formally – 1993. Four assessments in Kimberley Two assessments in sthn rangelands. Many sites have old data (back to mid 1970s – but not typically used unless specific request).	Ian Watson iwatson@agric.wa.gov.au	Oracle/Access database. Location details for individual sites.
8;Veg greenness	NDVI	raw NDVI and some processing	statewide	all	two weekly cloud free composites	AVHRR data from ~1991	Greg Beeston gbeeston@agric.wa.gov.au	? format. Yes, spatially enabled.
9 aq and semi aq veg								

App 9: Section C: BIOTIC RESPONSE TYPE INDICATORS – FLORA AND FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
10 status Thrt sp & comms	Threatened Flora Database	Threatened or Poorly Known, Flora populations	Individual population (occurrence)	Specific locations	Random or opportunistic when inspections made or survey undertaken	1990 random	Dr Ken Atkins – 08 9423 2425	Oracle database linked to GIS through centroid point
	Threatened Fauna Database	Threatened or Poorly Known, Fauna populations	Individual population (occurrence) – but usually as site record	Specific observations	Opportunistic for observation records, or structured where part of management program	Mid 1990's opportunistic	Dr Peter Mawson – 08 9423 2421	Access database linked to GIS through centroid point
	Threatened Ecological Community Database	Threatened or Poorly Known, Ecological Community occurrences	Individual occurrence	Specific locations	Random or opportunistic when inspections made or survey undertaken	Late 1990's opportunistic	Ms Val English – 08 9423 2409	Access database linked to GIS through centroid point
11 number Thrt sp & comms								
12 Dist & abund sig F&F								

App 9: Section D: BIOTIC RESPONSE TYPE INDICATORS - LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
13 Ext & dist floodwatrs								
14 Perenn stream flow								
15 Land Scape fn	WARMS (see Attachments 2,3 and 4 of ACRIS pilot project report)	Perennial vegetation and landscape function	Regional (~1620 sites across pastoral rangelands)	Pastoral ragelands	Fixed ground sites. Approx 1 site per 60,000 ha. Three year frequency in Kimberley and Pilbara, 5 yr frequency in the southern rangelands.	Formally – 1993. Four assessments in Kimberley Two assessments in sthn rangelands. Many sites have old data (back to mid 1970s – but not typically used unless specific request).	Ian Watson iwatson@agric.wa.gov.au	Oracle/Access database. Location details for individual sites.
16 Rip/aq Condition	No formal wetland/river **monitoring** – what is done is one off or ad-hoc							

App 9: Section E: PRESSURE/THREAT TYPE INDICATORS –FAUNA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
17 D/A feral pest preds	Ferals and weeds	Our biosecurity people have good information on ferals and weeds, esp on pastoral land	pastoral rangelands	pastoral rangelands	expert knowledge gained through management and control work. Point source data stored in CRIS (DAFWA's property based GIS system)	variable	Andrew Woolnough for ferals and weeds awoolnough@agric.wa.gov.au Greg Beeston for CRIS gbeeston@agric.wa.gov.au	variable.
18 D/D feral & native hrbivrs	Ferals and weeds	Our biosecurity people have good information on ferals and weeds, esp on pastoral land	pastoral rangelands	pastoral rangelands	expert knowledge gained through management and control work. Point source data stored in CRIS (DAFWA's property based GIS system)	variable	Andrew Woolnough for ferals and weeds awoolnough@agric.wa.gov.au Greg Beeston for CRIS gbeeston@agric.wa.gov.au	variable.

App 9: Section F: PRESSURE/THREAT TYPE INDICATORS - FLORA

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
19 D&A terr/aq Weed spp								
20 Clr'g of rem native veg	Clearing	Clearing approvals are stored and presumably mapped – but clearing almost non-existent in WA pastoral rangelands	pastoral rangelands	pastoral rangelands	Approvals granted	?	Nick Watson awatson@agric.wa.gov.au	?
21 #/ext listed weed spp								
22 D&A ecol signif introd plants	Ferals and weeds	Our biosecurity people have good information on ferals and weeds, esp on pastoral land	pastoral rangelands	pastoral rangelands	expert knowledge gained through management and control work. Point source data stored in CRIS (DAFWA's property based GIS system)	variable	Andrew Woolnough for ferals and weeds awoolnough@agric.wa.gov.au Greg Beeston for CRIS gbeeston@agric.wa.gov.au	variable.
23 Graz P on sensitv areas								

App 9: Section G: PRESSURE/THREAT TYPE INDICATORS – LANDSCAPE

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
24 Fire freq and extent across landscape	Firewatch			?? all of WA	1km pixel scale		DOLA	
25 Fire freq/ext fire sens comms								
26 Land use change	Pastoral tenure and land use (used in various places throughout ACRIS pilot project report)	Cadastre of pastoral estate and other tenure e.g. conservation reserves	state	state		updated as appropriate	Dept of Planning and Infrastructure are probably official custodians but Greg Beeston within DAFWA manages the mapping gbeeston@agric.wa.gov.au	GIS, yes spatially enabled.
27 Landscape pattern metrics								
28. Average stocking rate	Pastoral stocking rates (see pages 6-3 to 6-5 of ACRIS pilot project report).	Each lessee is required to submit an annual return of stock numbers, sales etc for their lease	pastoral rangelands	pastoral rangelands		early 1980s?; updated as appropriate, typically annually	Dept of Planning and Infrastructure are probably official custodians but Phil Thomas within DAFWA manages access for this sort of purpose pthomas@agric.wa.gov.au	Oracle?/Access. Point data located by lease
29. % land area remote from water pts	[Only as by-product of lease infrastructure mapping]							

App 9: Section G continued

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
30 Number and output of free-flowing bores								
31Density of artificial water pts	Pastoral infrastructure, esp watering points (see Attachment 10 of ACRIS pilot project report)	Infrastructure (e.g. watering points on individual pastoral leases)	pastoral rangelands	pastoral rangelands	updated as appropriate. Mapping in the field a little ad hoc but say every few years.	?	Dept of Planning and Infrastructure are probably official custodians but Greg Beeston within DAFWA manages the mapping gbeeston@agric.wa.gov.au	GIS, yes spatially enabled.
32 Water qual, (conc of pesticides, nutrient pollutants								

App 9: Section H: MANAGEMENT ACTION TYPE INDICATORS

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
33 Prog to CAR	Collation of reserve area by IBRA region	Area of reservation	State wide	IBRA	Annual data collation	1996/97 Annual	Dr Ken Atkins – 08 9423 2425	GIS
34 Infrstr to protect sp areas								
35 Prop env plans								
Other	Interim management Guidelines and Area Management Plans	Conservation Management activities required for specific locations and at regional level	Local/ Regional	Conservation estate across rangelands	n/a	n/a	Regional DEC offices, DEC library	Printed reports

APPENDIX 10

Data sets from Environment Section Olympic Dam Mine BHP Billiton

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA, specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
1 Comp & Abund waterbirds	Olympic Dam Mine internal database	Number and composition of waterbirds	Local	Olympic Dam Mine and Roxby Downs Township	recorded on all permanent water bodies in immediate region of Olympic Dam Mine.	1999 Monthly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
2 Comp & Abund birds	Olympic Dam Mine internal database	Bird species composition and abundance	Local	Olympic Dam Mine	Surveys are conducted at 45 permanent sites which radiate out from the mine site.	1998 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
	Olympic Dam Mine internal database	Bird species composition	Local	Olympic Dam Mine and surrounding areas	Opportunistic records of all birds in immediate area, greater region and Wellfields (Great Artesian Basin water extraction area)	1989 Monthly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
3 C&A ter fauna	Olympic Dam Mine internal database	Small mammals and reptiles	Local	Olympic Dam Mine	Pitfall trapping in summer months on the mine site; 16 permanent pitfall trapping sites & a 1 ha grid containing approximately 400 pits for the purpose of monitoring home range size, longevity etc.	1991 Annual	Environment Section, BHP Billiton, Olympic Dam	MS Access database
4 comp aq inverts	Olympic Dam Mine internal database	Mound Springs Invertebrates	Regional	Olympic Dam Water Extraction Areas	Sample Great Artesian Basin Springs in collaboration with University of Qld	1989 Annual since 1989. 2005 change to triennially	Environment Section, BHP Billiton, Olympic Da & University of Queensland	MS Access database
5 Kangaroo abund-ance	Olympic Dam Mine internal database	Numbers of kangaroos	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near OD Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database

Appendix 10 p2. Data sets from Environment Section Olympic Dam Mine BHP Billiton

Indicator from Q1	**Name of activity or database**	**What is being monitored**	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
6 composit-ion of terrestrial perennial vegetation	Olympic Dam Mine internal database	Presence and frequency of all perennial woody trees and shrubs	Local	Olympic Dam Mine	Within the mine lease, there are 34 sites on a radial grid. At each site, a 100 x 25m quadrat is sampled.	1989 Annual	Environment Section, BHP Billiton, Olympic Dam	Internal reports
9 aquatic and semi aquatic vegetation	Olympic Dam Mine internal database	Vegetation cover and species	Local	Olympic Dam Mine	monitored annually in Great Artesian Basin Springs in extraction area.	1989	Environment Section, BHP Billiton, Olympic Dam	MS Access database
17 D/A feral pest predators	Olympic Dam Mine internal database	Numbers of cats and foxes	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near Olympic Dam Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
18 D/D feral & native herbi-vores	Olympic Dam Mine internal database	Numbers of rabbits	Local	Olympic Dam Mine and surrounds	3 permanent spotlighting transects near Olympic Dam Mine site and Roxby Downs Township.	1989 Quarterly	Environment Section, BHP Billiton, Olympic Dam	MS Access database
19 D&A terr/aq Weed spp; 22 D&A ecol signif introd plants	Olympic Dam Mine internal database	Distribution and abundance of terrestrial weed species	Local	Olympic Dam Mine and surrounds	Monitored on an ongoing basis as weeds are controlled.	2002	Environment Section, BHP Billiton, Olympic Dam	MS Access database
23 Graz P on sensitive areas	Olympic Dam Mine internal database	Occurrence and intensity of grazing	Local	Olympic Dam Mine	Occurrence and intensity of grazing is monitored on Great Artesian Basin Mound Springs in water extraction area.	1989; annual	Environment Section, BHP Billiton, Olympic Dam	MS Access database

APPENDIX 11

Data sets from Arid Recovery project (conservation and research project at Olympic Dam Mine in SA funded jointly by BHP Billiton, SA DEH, University of Adelaide, Friends of Arid Recovery and many other external funding bodies)

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (include contact details)**	**What format is the data in? Is the data spatially enabled?**
Census/mapping of arid zone birds at Arid Recovery	Distribution and abundances of birds assessed annually inside and outside a predator-free enclosure	Ca 10 square km; about 6 km2 inside; 4 km2 outside	Around Arid Recovery , ca 15 km N of Roxby Downs SA	Mapping of individual birds; locations & numbers of all birds seen during a systematic area search mapped by recording GPS locations for each sighting.	1999 but area surveyed increased over next 2 years; Annually in April	David Paton david.paton@adelaide.edu.au	Currently excel, but will be loading into an Access data base in due course, that matches other databases on temperate and coastal systems
Annual pitfall and Elliott trapping: Arid Recovery	Small native mammals and reptiles	Local	Roxby Downs	Annual	1998	AR	Access
Quarterly native track counts: Arid Recovery	Reintroduced species and kangaroos	Local	Roxby Downs	Quarterly	2000	AR	Excel
Annual cover, richness and photopoints: Arid Recovery	Native plants	Local	Roxby Downs	Annual-two yearly	1997	AR	Access
-Long term seedling survival and growth monitoring study: Arid Recovery	Native plants	Local	Roxby Downs	Three yearly	2000	AR	Access
Long term condition of perennial plant species and impact of bettong browsing	Native plants	Local	Roxby Downs	Annual	2007	AR	Access
Comparison of landsat imagery inside and outside Arid Recovery from 1995-2006	Vegetation	Subregional	Roxby Downs	5 yearly	1995	AR/Uni	
-Annual cage trapping	Reintroduced mammals	Local	Roxby Downs	Annual	2001	AR	Excel

Appendix 11 p2. Data from Arid recovery project.

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (include contact details)**	**What format is the data in? Is the data spatially enabled?**
Annual track monitoring outside the Reserve to document dispersal	Mainly *M. lagotis*	Local	Roxby Downs	Annual	2005	AR	Excel
-Annual burrow counts for *P. australis*	*P. australis*	Local	Roxby Downs	Annual	2006	AR	Excel
-Annual nest/burrow monitoring for *B. lesueur,, M. lagotis, L. conditor*	*B. lesueur,, M. lagotis, L. conditor*	Local	Roxby Downs	Annual	2003	AR	Access
Quarterly spotlight counts	Native animals	Local	Roxby Downs	Quarterly		AR	Excel
-LFA sites at Arid Recovery (every 5 years)		Local	Roxby Downs	5 yearly	2004	AR	Access
Quarterly track counts-cats/foxes	Cats, foxes, rabbits, emus, kangaroos	subregional	Roxby Downs	Quarterly	2002	AR	Excel
Quarterly spotlight transects-cats/foxes	Cats, foxes, kangaroos	Local	Roxby Downs	Quarterly	1999	AR	Excel
Quarterly spotlight transects-rabbits	rabbits	Local	Roxby Downs	Quarterly	1989	AR, BHP Billiton	Excel
A. kotchiana surveys	*A. kotchiana*	subregional	Roxby Downs	annual	2006	AR, BHP Billiton	Excel
Quarterly track counts-rabbits		Local	Roxby Downs	Quarterly	1989	AR, BHP Billiton	Excel
Annual weed survey and mapping (contribute to Enviro Dept Olympic Dam database)		subregional	Roxby Downs	Annual		BHP Billiton	Excel

APPENDIX 12: DATA SETS FOR ACTIVITY IN FLINDERS & GAWLER RANGES ASSOCIATED WITH BOUNCEBACK PROGRAMME

(NB Baseline sets removed)

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian**	**What format is the data in? Is the data spatially enabled?**
Flinders Ranges Bushbird Monitoring	Changes in abundance and species composition of bushbirds in 6 vegetation communities as indicators of vegetation recovery; Habitat parameters in selected veg communities	Local	Flinders Ranges NP and adjacent properties	Bushbirds: belt transects (2x 500 metres in each veg community, 21 sites in total) Habitat: Point sampling at 1m intervals on above transects)	Bushbirds:Mar 2000-Nov 2004 4 times per year Habitat: Mar 2000-Nov 2004 Once per year	Nicki de Preu DEH Hawker has detailed bird spp and habitat data[#]; Bird species for partic sites also entered to Bird Atlas and BDBSA	Excel Files[#] Access Database (BDBSA) Site locations only on GIS
Flinders Ranges Small Vertebrate Monitoring	Response of small vertebrates to rabbit control and fox-baiting	Local	Flinders Ranges NP/Gum Creek Station; Vulkathunha-Gammon Ranges NP/Wertaloona Station	Total of 8 trap sites consisting of 120 pitfalls at each site	1997-2004 2 times per year	Nicki de Preu DEH Hawker has all capture data with periodic updates to BSDBSA	Access Databases & Excel Files Site locations only on GIS
Flinders & Gawler Ranges Kangaroo Surveys (ground)	Trends in abundance of dominant large macropod species	Local	Flinders Ranges NP, Gum Creek & Upalinna Stations & Gawler Ranges NP	6x10km line transects per area; FRNP 2 areas Gum Creek 1; Upalinna 1; GRNP 3 areas	1998-present; Once per year	Nicki de Preu DEH Hawker & L Farroway DEH Adelaide	Excel & Distance Output files No spatial data
SA Pastoral Zone Kangaroo Surveys (aerial)	Trends in abundance of dominant large macropod species	Regional	Former SCB Districts, NRM subregions		1982-present; Once per year	Lisa Farroway DEH Adelaide	?
Vegetation Monitoring on NP Reserves	Vegetation responses to management of total grazing pressure	Local	Flinders Ranges NP, Bunkers CR, Vulkathunha-Gammon Ranges, Arkaroola Sanctuary 7 Gawler Ranges NP	Combination of quantitative (Jessup transect) and observational sites; FRNP 31 sites (9 with Jessup trans and 10 exclosures) VGRNP 42 sites (8 with Jessup trans and 5 exclosures) Gawler Ranges NP 52 sites (14 with Jessup trans and 3 exclosures)	Start date varies with location and sites; earliest 1957 to present time Frequency variable but mostly biennial at permanent sites	Stuart Pillman, John McDonald & Justin Jay DEH Adelaide	Access Database (PMIS)

Appendix 12 p2: Data from Flinders and Gawler Ranges

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian**	**What format is the data in? Is the data spatially enabled?**
Yellow-footed Rock-wallaby aerial surveys	Broadscale population estimates across the Flinders & Olary Ranges	Subregional	IBRA	Permanent line transects of variable length conducted from helicopter at 6 locations	Start date varies between locations; earliest 1982 to present time	Roman Urban and Jason van Weenen DEH Adelaide	Excel Files & GIS coverages
Yellow-footed Rock-wallaby trapping programs (Flinders Uni Research Partnership)	Population parameters including survival, fecundity and mortality of YFRW across the species ranges in SA	Subregional	IBRA	Number of traps and nights operated varies between sites	Start date varies between sites; earliest 1998 to present time	Dr Mark Lethbridge Flinders University	Excel files, Trap locations and YFRW observations
Flinders Rabbit Haemorrhaic Disease Monitoring	Changes in relative abundance of rabbits and virus activity	Local	Flinders Ranges NP/Gum Creek Station	Spotlight transects at 10 sites 2-3 times per year; opportune trapping of rabbits	1996 to present time	Greg Mutze DWLBC	Excel files
Flinders Feral Predator Monitoring	The relative abundance of foxes and cats	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges	Spotlight counts in areas with and without broadscale fox baiting programs; began as part of the National Monitoring and Surveillance Program for Calicivirus)	1996 to present; 4 times per year.	DEH Nicki de Preu	Excel files
Flinders Ranges Aerial and Ground-based Goat Control	Numbers of goats shot	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges.	ground-based and aerial culls by Sporting Shooters Association of Australia and DEH accredited shooters;	1992 topresent; Annual for aerial culling; variable for ground based operations	DEH Nicki de Preu	Excel files
Flinders Rabbit Monitoring	The relative abundance of rabbit numbers.	Local Regional	NP Reserves and pastoral properties in the Flinders and Olary Ranges.	Spotlight counts in areas with and without rabbit control programs; began as part of the National Monitoring and Surveillance Program for Calicivirus	1996 to present; 4 times per year	DEH Nicki de Preu	Excel files

APPENDIX 13:

Data sets on waterbirds – EAWS, Wetlands International, NT aerial water birds surveys

Name of activity or database	**What is being monitored**	**Scale** (National Regional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (include contact details)**	**What format is the data in? Is the data spatially enabled?**
EAWS – Eastern Australian Waterbirds Survey (PTO for more information)	Up to 50 taxa of waterbirds	Eastern Australia at the wetland scale	Most regions in eastern Australia	Ten 30km wide transects surveyed each October	1983 - Annual	Richard Kingsford University of NSW and NSW Dept of Environment and Conservation	Lats and longs for each wetland surveyed
Wetlands International ; plus NT NRETA Waterbirds surveys	Waterbird breeding colonies and (secondarily) waterbird composition and abundance. Also, developing an understanding of broad wetland characteristics including locations and inundation extent. Not formal monitoring, better described as surveillance.	Bio-Regional (better described as at catchment level)	Barkly Tableland (Mitchell Grass Downs and Lake Woods); and Sturt Creek system (Ord-Victoria Plains); also some work in northern Tanami Desert.	Surveys are opportunistic (1993-5, 2001-2, 2006), usually after major Wet season floods. Aerial inspections of breeding colonies in wetlands and ground checks of colonies and shore areas. Often only a few days of survey per event. Some replication but limited.	Start 1993, latest in May 2006. Long gaps between surveys. Most effort since 1995 has been in March-June period.	Wetlands International at Brisbane office: 07 3406 6047 email roger.jaensch@wetlands-oceania.org	Spreadsheets of waterbird counts, aerial transect data, & colony data, by location (wetland or property). Also a photo-image library, part hard copy and (from 2003 on) part digital. Partially completed spreadsheet of colonies by Lat Long, easily completed.
Waterbirds affected by hunting	Magpie Geese; Jabirus; Burdekin ducks	regional	Top End	Aerial surveys along repeatable transects	Some annual, others less frequent	Wildl. Manage. Biodiv. Cons. NRETA Keith Saalfeld 8944 8470	Spreadsheets includes location data

ACTIVITY or DATA BASE: Eastern Australian Waterbird Survey; Respondent: Richard Kingsford UNSW	
Current Use and Value of Information	
What is the main use of the information/data base at the moment?	Analysis of waterbird population and the status and condition of wetlands
Was this programme originally developed for purposes other than Biodiversity monitoring?	Developed for monitoring waterbirds as a response to duck shooting
How reliable do you think the data is for the purposes of Biodiversity monitoring? Excellent, Good, Fair, Poor (consider possible errors in technique, expertise of personnel required to collect data accurately, consistency of data collection within and between data collection events etc) .Please note major reasons for your evaluation.	Good – technique is necessarily rapid. Testing of ground to air comparisons indicate reasonable accuracy. Data collection methodology has remained consistent for all of the survey period.
How easy or difficult is it to interpret the data?	Difficult given limited funds for collection of ancilliary data sets (e.g. river flows, river regulation, wetland flooding)
Does the information from this monitoring programme actually affect land management decisions? For example?	Yes – environmental flows and river regulation
Data availability	
Is the data compatible with similar data being collected in other regions or States?	Yes – project covers four states
Is this data used by other jurisdictions? Please specify user category eg State or Commonwealth government department, NGO, NRM group, property owner etc)	Yes – all states and the Commonwealth and various NGOs
Is the data custodian prepared to permit ongoing access to the data?	Trying to develop programs that provide the data to users
Is this data ready for use by external agencies and/or individuals? If NO, please indicate the extent of modification required.	No – requires further correction of a few systemic errors which have been identified.
Capacity to Maintain or Expand Activity	
Does the department/organisation intend to continue this activity? Yes/No **If yes,** will it be at the same, a reduced or an expanded level? **If no**, (or at a reduced level), why not?	Yes Possibly expanded depending on funding
What additional **information** is required for this to become an effective monitoring programme for biodiversity in the rangelands?	Additional long term analyses of wetland frequency of inundation, climate change and river regulation
What additional **resources** would be required for this to become an effective monitoring programme for biodiversity in the rangelands? (if possible, please give a qualitative guesstimate of operational funding and/or staff FTEs)	Currently effective but requires funding for long-term analysis. Could also be expanded to include key wetlands not currently surveyed.

APPENDIX 14: Simpson Desert Ecological Study (Chris Dickman) (possibly complementary to rare rodent grids from SA)

Name of activity or database	**What is being monitored**	**Scale** (National Regional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (include contact details)**	**What format is the data in? Is the data spatially enabled?**
Field research + Q4 below	Terrestrial verts, inverts + vascular plants	Small scale (5x5 m plots), local (1 ha), up to region (~6000 sq km)	Simpson Desert bioregion	Plants: 5x5 m plots (n = 240); Vertebrates: 1 ha grids (n = ~30 sampled regularly); Inverts: 12 pits / vertebrate grid. Sampling 4 times a year.	March 1990, but full sampling program up and running by 1996. Sampling 4 times a year since then.	Chris Dickman, University of Sydney	Access databases, spatially enabled.

ACTIVITY or DATA BASE: Long term Simpson Desert study – Dr Chris Dickman U of Syd	
Current Use and Value of Information	
What is the main use of the information/data base at the moment?	ARC – funded research
Was this programme originally developed for purposes other than Biodiversity monitoring?	Yes – to ask targeted questions about factors that influence biodiversity
How reliable do you think the data is for the purposes of Biodiversity monitoring? Excellent, Good, Fair, Poor (consider possible errors in technique, expertise of personnel required to collect data accurately, consistency of data collection within and between data collection events etc) .Please note major reasons for your evaluation.	Good to excellent. The same researcher (Dickman) has carried out the sampling from 1990, and has trained others who have themselves been part of the research for 5-10 years. On-site training given to all new personnel and volunteers, with trained and experienced personnel part of every field team.
How easy or difficult is it to interpret the data?	Easy, when codes for trap sites are understood
Does the information from this monitoring programme actually affect land management decisions? For example?	Yes. Our field data influenced the decision of Australian Bush Heritage to purchase two of the properties on which the work occurs: Ethabuka and Cravens Peak.
Data availability	
Are the data compatible with similar data being collected in other regions or States?	Perhaps – not sure how others collect their data
Are these data used by other jurisdictions? Please specify user category eg State or Commonwealth government department, NGO, NRM group, property owner etc)	No other users, although research results are shared with Aust Bush Heritage
Is the data custodian prepared to permit ongoing access to the data?	Yes, to a point. Summary data go to Qld Nat Parks as part of licence requirements, and to Bush Heritage. Happy to enter into collaborative research using the data with other parties.
Are these data ready for use by external agencies and/or individuals? If NO, please indicate the extent of modification required.	Raw data can be used by Qld Nat Parks for their reporting requirements.
Capacity to Maintain or Expand Activity	
Does the department/organisation intend to continue this activity? Yes/No **If yes,** will it be at the same, a reduced or an expanded level? **If no**, (or at a reduced level), why not?	Yes. However, our ability to get to the desert is critically dependant on continued ARC funding. No State or university resources are provided to assist.
What additional **information** is required for this to become an effective monitoring programme for biodiversity in the rangelands?	I think it is already effective, but better transfer of info is probably needed to managers
What additional **resources** would be required for this to become an effective monitoring programme for biodiversity in the rangelands? (if possible, please give a qualitative guesstimate of operational funding and/or staff FTEs)	More personnel – assuming continued ARC funding for the present 2 Research Assistants and 4 PhD students, at least 2 FTE positions are really needed. The current personnel (Dickman + Dr Glenda Wardle) occupying these positions and driving the program are continuously stretched and at breaking point to carry on the present level of activity.

APPENDIX 15: Information received on monitoring programmes (3 yrs or more) for threatened or iconic species

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
NSW							
Malleefowl surveys	Malleefowl mound status	local	Tarawi Nature Reserve, NSW	Aerial mound to mound surveys (107 mounds)	1997 – present Annual	Ray Dayman DEC Ranger Buronga 03 5021 8922 ray.dayman@environment.nsw.gov.au	Excel, Mapmaster, Ozi Explorer
Malleefowl surveys	Malleefowl mound surveys	Local	Mallee Cliffs National Park NSW	Aerial mound to mound surveys (149 mounds) Aerial transect surveys (10,000ha)	1989 – presen Annual 2001 – present Annual	Ray Dayman DEC Ranger Buronga 03 5021 8922 ray.dayman@environment.nsw.gov.au	Excel, Mapmaster, Ozi Explorer
NT							
Magpie goose monitoring	Goose and nest numbers in particular floodplain systems (as per management plan)	Subregional	Top End	Aerial surveys along repeatable transects	Some annual, others less frequent	Wildl. Manage. Biodiv. Cons. NRETA Keith Saalfeld 8944 8470	Spreadsheets; include location data
Acacia latzii population monitoring	Survivorship and growth and recruitment events	2 localised sites on Henbury Station, Finke bioregion	Finke bioregion NT	Seedling recruits from only recorded recruitment event in 2000 measured at least twice pa. Growth data recorded over 5 year intervals for mature plants w/in exclosures and control sites. Rainfall data and flowering events recorded opportunistically (at least twice pa)	Program began in 1993, but more rigorous population monitoring initiated in 1998. Monitoring twice yearly (at least)	Australian Plants Society Alice Springs. Contact Colleen O'Malley curatoropbg@internode.on.net TSN Arid Rangelands is also monitoring program partner	Data is currently being converted to excel spreadsheet. No spatial data.
Central Rock Rat monitoring	Abundance	Local	Ormiston	Elliott trapping	Commenced 1998, frequency varies but at least once annually	Glenn Edwards	Excel. No.
Arid small mammals	Population numbers	Local	Simpson Desert	2-3 times per year	1999	Biodiv. Cons. NRETA Chris Pavey	spreadsheets

Appendix 15 p2

Name of activity or database	**What is being monitored**	**Scale** (National Regional Subregional Local Enterprise Paddock)	**Regions covered** (NRM, NAP, IBRA or specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
NT cont							
Mulgara monitoring	Size of borefield population as indicator of regional population	Local	UKTNP	750 Elliot trap nights in suitable habitat	1999; annual	UKTNP – Mim Jambrecina	Excel spreadsheet; yes
Tjakura monitoring	Great Desert Skink population size, location, habitat use and breeding success of population	Local	UKTNP	C 100 hrs per year spent monitoring known burrows and mapping new burrows	1997; annual	UKTNP – Mim Jambrecina	Excel spreadsheet; yes
SA (see also Appendix 11 – Arid Recovery Project)							
Rare Rodent Distribution of Arid SA	Distribution, status and ecology of *Pseudomys australis, Notomys fuscus* and *Antechinomys laniger*	Local	N of Pt Augusta and E of Stuart Hwy	2 monitoring sites for each species visited twice a year	Start date Jan 1992 (later for *A. laniger*) Ongoing subject to funding	DEH; Internal use; request to manager Biod Conservation programs 08 8124 4845 williams.stephanie@saugov.sa.gov.au	MS Access
Yellow-footed Rock-wallaby aerial surveys	Broadscale population estimates across the Flinders & Olary Ranges	Subregional	IBRA	Permanent line transects of variable length conducted from helicopter at 6 locations	Start date varies between locations; earliest 1982 to present time	Roman Urban and Jason van Weenen DEH Adelaide	Excel Files & GIS coverages
Yellow-footed Rock-wallaby trapping programs (Flinders Uni Research Partnership)	Population parameters including survival, fecundity and mortality of YFRW across the species ranges in SA	Subregional	IBRA	Number of traps and nights operated varies between sites	Start date varies between sites; earliest 1998 to present time	Dr Mark Lethbridge Flinders University	Excel files, Trap locations and YFRW observations
Threatened plant population (Greening Australia NRM Project)	Status of plants of conservation significance. Current work on *Acacia araneosa, Ptilotus bakerii, Eremophila pentaptera.*	Subregional; across the RL – currently at Billa kalina, Hamilton, VGRNP, Tieyon, Evelyn Downs, Arkaroola	NRM & IBRA: current work in Flinders Lofty (FLB5), Stony Plains	Variable: quantitative measurements to general population assessments (~ 1300 pops in database).	Varies - original study 1986 -1992; further work in 1995; plus some in progress; Sampling frequency: one to many visits	D Bickerton DEH Adelaide, J Walton GA (NRM Office Pt Augusta; DEH & DTUPA internal use; applications considered.	Threatened Plant Population database: Digital ORACLE plus several reports.

Appendix 16. Information for UKTNP Fauna Survey, ARIDFLO and MDBC-SRA (minimal information received for latter 2 projects).

	What is being monitored	**Scale** National Regional Subregional Local, Enterprise	**Regions covered** (NRM, NAP, IBRA, specific location/s)	**Sampling intensity and/or method**	**Start date of monitoring record and frequency of assessment**	**Data custodian (Dept, contact name or position)**	**What format is the data in? Is the data spatially enabled?**
Terrestrial							
Uluru Kata Tjuta National Park Fauna Survey	Terrestrial birds, reptiles, small mammals, invertebrates, vegetation	Local	UKTNP	8 permanent sites; 3 d at each site during month long field trips. 750 Elliot trap nights per site, 108 pit trap days/nights and 15km of bird transects per site	1987; 15th survey just completed. Initial block of 7 surveys in 3 years, then 8 since 1994	UKTNP – Mim Jambrecina [J. Reid maintained vertebrate dataset to 2002.]	Dbase & excel spreadsheets Specific programme designed for survey. Yes
Aquatic							
ARIDFLO	Waterbirds, fish, macro-invertebrates, zooplankton, algae	Local to regional	Channel Country IBRA region; Lake Eyre Basin (SA & Qld).	7 samples in 3 years; fieldwork finished. 6-9 days spent in each of 5 regions on each visit. *c.* 40 sites.	March 2000. Last fieldtrip Feb-March 2003.	M. Good, SA DWLBC 08 8463 6939	All data in excel spreadsheets, & submitted to ANLIC website. Yes. 800pp report now released; CD available.
MDBC pilot: Sustainable Rivers Audit	River Health - fish, hydrology, macro-invertebrates	MDB	All inland CMAs	Talk with project manager for DNR.	Varies according to parameter measured	bruce.chessman @dnr.nsw.gov.au	

APPENDIX 17: KNOWLEDGE of ACRIS AND the ACRIS BIODIVERSITY WORKING GROUP

Question	ACRIS (# = nothing in box)				
	NSW	**QLD**	**NT**	**SA**	**WA**
Are you aware of the existence of this group?	Yes Yes Yes Yes Yes No Yes no	No Y Y no	yes Yes Yes Yes Yes Yes	No No Yes Yes	Yes
How often have you contacted any members of the group?	# Never Nil Never never never no no	No Never Occasionally No contact specifically re this entity.	Never Not often Never # Never No	NA Never to my knowledge Never Never	Never
What was the nature of your query or request?	# # # # # NA # NA	# NA Use of remote sensing to assess rangeland biodiversity NA	# # NA # # general	NA # # #	NA
Have you ever been contacted by a member of the group?	# # # Yes No. No # No (not knowingly)	N Y Y No contact specifically re this entity.	No (apart from this questionnaire) No Yes Yes No No	NA Don't know No No	Yes
What was the nature of their query or request?	# # # Access to aerial survey data # NA # NA	# Information Use of remote sensing to assess rangeland biodiversity NA	# # Invited to give a presentation to an ACRIS meeting in Alice Springs. Input into strategy for Aboriginal lands # #	NA # # #	Meeting attendance

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What was your perception of the function/role of the group when it was set up?	# Not sure Unclear # To provide a network of information for rangeland managers Not sure # NA	? National monitoring standards # Not aware of entity till received this letter.	Don't know Collect and collate information To carry out a comparative assessment of monitoring in the rangelands and examine whether the different methods used by the States can provide useful information at the national level. # To develop and lead implementation of strategic, standardised and targeted biodiversity monitoring in rangelands ecosystems Interesting	NA # # To standardise monitoring systems across the rangelands & provide a central place for the storage of data	#
Is it currently fulfilling this role?	# # Don't know # No, but this project will be a good start NA # Don't know	? Somewhat # Unable to comment	Don't know Seems to be. Yes (assuming they can determine the most appropriate methods for use at a national level). # No idea ?	# # # No idea; we do not receive feedback	#
Do you have any recommendations for change in the function/role of the group?	# Identify key programs that can deliver information on landscape change # # # No # NA	Information dispersal on role, then may comment Need more contact with those in the field collecting data # No	No Liaise more closely with people involved in the national audit and CRCs. No Support development of strategy for aboriginal lands # Grant oriented	NA # # Involve more people on the ground and local landholders & conservation groups who are doing the monitoring rather than just relying on Govt employees who visit the region but don't live in it.	#
Any other comments?	# Funding is a major issue # # # # # I'd like more info!	# # # No	# The IA CRC has summarised state/territory invasive animal and abundance monitoring No # Clearly need to get collaborative and strategic approach to rangelands biodiversity monitoring especially in light of likely additional pressures being put on rangelands environments as climate change and knee-jerk management responses kick in (eg added development pressure intensification of agriculture & horticulture in northern rangelands) #	# # # # 	#

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Question	BWG NB: # = nothing in box				
	NSW	**QLD**	**NT**	**SA**	**WA**
Are you aware of the existence of this group?	Yes Yes Yes Barely No No No No	No N N No	Yes (but not prior to this questionnaire!) Yes No No Yes Yes	No No No Sort of	Yes
How often have you contacted any members of the group?	6-10 Never Nil Never # Never # NA	No Never N No contact specifically re this entity.	Never Never NA # Never Occasionally	NA No Never Never	Never
What was the nature of your query or request?	Fauna monitoring # # # # NA # NA	# NA N NA	# # NA # # general	NA # # #	NA
Have you ever been contacted by a member of the group?	Yes # Yes No # No # No (not knowingly)	Y N N No contact specifically re this entity. Occasional contact with NRETA staff, Alice Springs	No No NA # No No	NA # No No	No
What was the nature of their query or request?	fauna monitoring # Nature of monitoring activities # # NA # NA	Information # N Occasional discussion with NRETA staff re survey of wetlands in the semi-arid and arid NT	# # NA # # # 	NA # # #	NA

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What was your perception of the function/role of the group when it was set up?	Establishing standards Not sure Standardise monitoring # # Not sure # NA	Don't know not had any information on it # N Not aware of entity till received this letter.	# Unsure. NA # Advisory group to Minister #	NA # # #	#
Is it currently fulfilling this role?	Only introductory material so far # Don't know # # NA # Don't know	? # N Unable to comment	# # NA # Hard to know – not easy to see what group does. EA site not very forthcoming ?	NA # # No idea	#
Do you have any recommendations for change in the function/role of the group?	Produce part 2 of the monitoring work # # # # No # NA	Information dispersal on role, then may comment # N No	# # NA # Is great need for a federal ministerial advisory group on biodiversity issues that was accessible (proactively) to community interest groups as well as to agencies University oriented	NA # # Disseminate ideas/findings more widely so people are aware of the existence of these groups. Ask for people's opinion on issues/ideas	#
Any other comments?	# # # # # # # more info would be good	# # N No	# # No # # #	# # # Can this group work in with the local SAAL region NRM biodiversity advisory group??	#