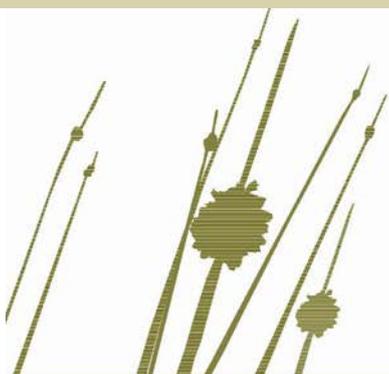


AUSTRALIAN COLLABORATIVE RANGELANDS INFORMATION SYSTEM BIODIVERSITY MONITORING TRIAL – BIMBOWRIE CONSERVATION PARK

May 2013



Government
of South Australia

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Preferred Citation

Jay, J., Ryan, K., Armstrong, D., Bevan, K., Page, B. (2013). AUSTRALIAN COLLABORATIVE RANGELANDS INFORMATION SYSTEM BIODIVERSITY MONITORING TRIAL – BIMBOWRIE CONSERVATION PARK. Department of Environment, Water and Natural Resources, Adelaide

Photography: Cover – David Armstrong, DEWNR.

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ACKNOWLEDGEMENTS

The authors acknowledge the Australian Government Department of Sustainability, Environment, Water, Population and Communities, and the SA Department of Environment, Water and Natural Resources (DEWNR) for funding the project and the South Australian Arid Lands Natural Resources Management Board for supporting this project. Further support was also provided by the SA Museum and the SA Herbarium. We greatly appreciate the technical support of Rob Brandle and Matt Royal and the reviews by Dr Phil Pisanu. Thanks to Tony Latz, Graham Armstrong, Julia Haska, Tony Robinson and Jean Turner and the other DEWNR Northern and Yorke Regional staff for their help with the project.



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INTRODUCTION

A report by the Australian Collaborative Rangelands Information System (ACRIS) on change in Australian rangelands concluded that Australia's ability "to report change in biodiversity is limited due to inadequate data", because data directly relating to biodiversity were sparse, while indicators for which there was more comprehensive data were only tenuously linked to biodiversity (Bastin and the ACRIS-MC 2008). Based on the findings of that report and a review of biodiversity monitoring activity in the rangelands (Day 2007), a discussion paper was commissioned to identify issues and develop a framework for a systematic, comprehensive and integrated rangelands biodiversity monitoring program, including responsibilities for implementation (Kutt *et al.* 2009; Eyre *et al.* 2011).

The Rangeland Biodiversity Monitoring Framework is a hierarchical framework comprising three components that operate at different spatial (and possibly temporal) scales: targeted monitoring, surveillance monitoring and landscape-scale monitoring (Figure 1).

The advantage of a hierarchical framework is that it incorporates quantifiable objectives relevant to national and state/territory agencies. It also acknowledges that biodiversity attributes must be described in terms of the focal scale, but will interact with ecological dynamics of scales above and below it for consideration during analysis and interpretation of change at the field scale (Ludwig *et al.* 2007). Each component in the hierarchy varies in the spatial and temporal extent assessed, the level of detail collected, and the efficacy by which data can be collected. Typically:

- targeted monitoring programs are guided by well articulated, a priori hypotheses, have a narrow scope (e.g. single species or specific ecosystem), are localised and are remeasured often, or remeasured based on the temporal scale according to the ecological dynamics of the target species or ecosystem;
- surveillance monitoring is broad in scope (many species and covariates measured across many ecosystems), is geographically and temporally wide ranging and may or may not be focussed on a particular management issue or problem, but can help detect unknown phenomena and corroborate emerging hypotheses relating to the effects of management pressure (Wintle *et al.* 2010). The temporal scale of operation will be guided by early data but is likely to be limited by logistics;

- landscape-scale monitoring is typically based on remotely obtained or extrapolated data that can be mapped, and will use temporal scales appropriate to the indicator (Ludwig *et al.* 2007). The advantage of landscape-scale monitoring is that it is often relatively cheap to undertake over space and time and provides a broader context for national reporting.

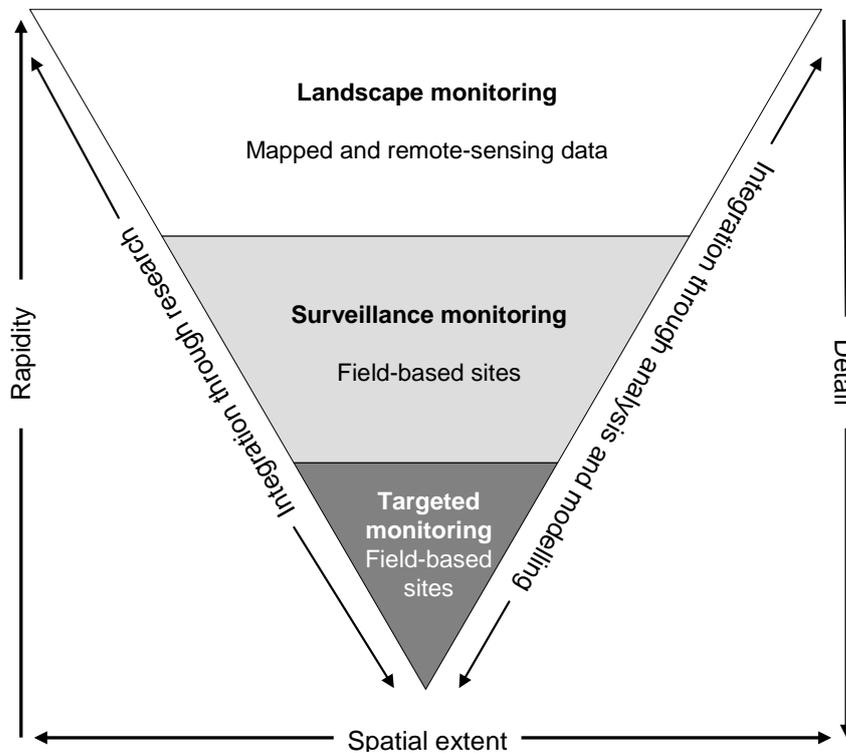


Figure 1. Hierarchical framework proposed by ACRIS for national monitoring of biodiversity in the Rangelands.



The primary aim of the ACRIS rangeland biodiversity monitoring project is to implement a trial of the surveillance monitoring component of the Rangeland Biodiversity Monitoring Framework, as it is this component that is least likely to be implemented at a national scale without prior demonstration of worth. The focus of the trial is to test the achievability of the surveillance component of the monitoring framework, document resources and costs, and demonstrate its potential value by:

- Being collaborative and cross-jurisdictional at the national scale;
- Collecting data useful both to the project and participating jurisdictions;
- Maximising synergies with other relevant initiatives e.g. TERN, WARMS; and
- Using an explicit framework and methods for showing change over time at regional and national scales, as agreed by all rangeland jurisdictions.

In South Australia, the ACRIS trial involved sampling fauna and flora in the Broken Hill Complex bioregion. This report provides the data collected during the ACRIS trial and summarises the methods used to collect those data to enable analyses at the national scale as part of a separate project.

METHODS

SITE SELECTION

The ACRIS trial required that the sampling sites be stratified as summarised below:

- Level 1: Bioregion. In South Australia, all sampling was undertaken in the Broken Hill complex.
- Level 2: Condition (best on offer versus degraded sites) – where ‘condition’ was based on the pressure relevant to the region/ecosystem being sampled e.g. grazing pressure. In South Australia, the eight best on offer sites and two of the degraded sites were selected in the Bimbowrie Conservation Park (Figure 2, Table 1). The other six degraded sites were sampled in the nearby Plumbago pastoral lease (Figure 2, Table 1).

All of the 16 sites were surveyed in November 2012.

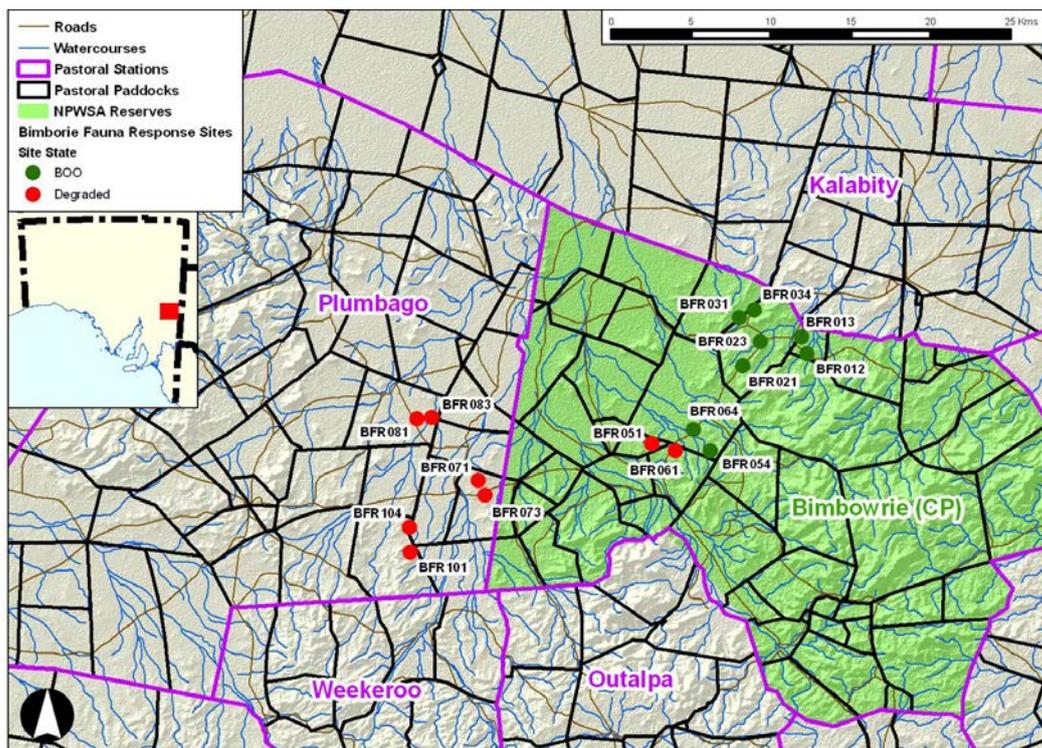


Figure 2. Location of the sampling sites in the recently-declared Bimbowrie Conservation Park and the nearby Plumbago pastoral lease. Sites that were classified as degraded (different states) are shown as red dots and sites that were classified as best on offer are shown as green dots.



Vertebrate taxa were sampled as recommended by Eyre *et al.* (2011), including diurnal birds, reptiles, ground-dwelling mammals (including predators) and vascular plants (perennial and annual). Habitat and vegetation attributes and drivers of faunal response were also targeted, as per Eyre *et al.* (2011). Each of the States involved in the ACRIS trial had existing biodiversity sampling protocols, and the ACRIS project aligned and standardised these methods where possible. The approaches used to sample the target taxa and vegetation attributes for the purposes of the ACRIS Biodiversity Monitoring project are summarised below.

SITE DESCRIPTION

At each site the following information was recorded:

- Location of site (coordinates and map zone).
- Climate condition immediately preceding survey.
- Broad summary of the condition of the vegetation.
- Structural formation description (according to table 3 in Appendix A).
- Date of last fire



Table 1. Details of the sampling locations, including the location, condition of land (best on offer (BOO), degraded and intact), whether there is ongoing commercial grazing and a brief summary of the vegetation community.

Site Name	Location	Condition of land	Ongoing commercial grazing	Vegetation community broad description
Chenopod – Best on offer				
BFR00102	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i> with <i>Maireana pyramidata</i>
BFR00103	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i> and <i>Maireana astrotricha</i>
BFR00201	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i>
BFR00203	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i> and <i>Maireana astrotricha</i> and abundant <i>Maireana astrotricha</i> seedlings
BFR00301	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i> with <i>Maireana pyramidata</i>
BFR00304	Bimbowrie CP	Best on offer	No	<i>Atriplex vesicaria</i> with <i>Maireana pyramidata</i> with some <i>Maireana astrotricha</i> seedling
BFR00501	Bimbowrie CP	Best on offer	No	<i>Maireana pyramidata</i> abundant
BFR00504	Bimbowrie CP	Best on offer	No	<i>Maireana pyramidata</i> abundant also <i>Scleroleana limbata</i>
Chenopod – Degraded				
BFR00601	Bimbowrie CP	degraded	No	<i>Maireana pyramidata</i> very open also <i>Dissocarpus paradoxus</i>
BFR00604	Bimbowrie CP	degraded	No	<i>Maireana pyramidata</i> very open also <i>Scleroleana limbata</i>
BFR00701	Plumbago Station	grazed but intact	Yes	Some death of <i>Atriplex vesicaria</i> , but <i>Maireana astrotricha</i> and <i>Atriplex vesicaria</i> regenerating
BFR00703	Plumbago Station	grazed but intact	Yes	<i>Maireana astrotricha</i> prominent and flowering
BFR00801	Plumbago Station	grazed but intact	Yes	<i>Maireana astrotricha</i> , <i>Atriplex vesicaria</i> , <i>Maireana astrotricha</i> seedlings
BFR00803	Plumbago Station	grazed and recovered	Yes	<i>Maireana pyramidata</i> abundant; remnant <i>Maireana astrotricha</i> and <i>Atriplex vesicaria</i>
BFR01001	Plumbago Station	degraded	Yes	<i>Maireana pyramidata</i> very open <i>Scleroleana limbata</i>
BFR01004	Plumbago Station	degraded	Yes	<i>Maireana pyramidata</i> very open. Some remnant <i>Maireana astrotricha</i>

VEGETATION

Vegetation sampling followed the South Australian biological survey methods, which are detailed in Heard and Channon (1997). Data were recorded to describe the vegetation associations and overstorey plants. For woody species, which were listed as overstorey or understorey dominants, cover measures included:

- Trees and tall shrubs listed as overstorey/tree forms and species that are emergent
- Shrubs and low shrubs listed as overstorey or understorey species

In summary, at each of the 16 sites a 100 x 100 m quadrat was used to sample the surrounding vegetation. Within that quadrat the following variables were recorded:

- percent of bare earth
- percent of litter cover (these two percents do not necessarily sum to 100%)
- habitat is described by indicating the dominant/co-dominant species at structural levels:
 - up to 3 dominant/co dominant species are selected to represent the overstorey.
 - up to 3 dominant/ co dominant species are selected to represent the emergent level.
 - up to 5 dominant/ co dominant species are selected to represent the understorey.
- all vascular plants were recorded to lowest possible taxonomic denomination

For each species of plant:

- cover/abundance was recorded according to table 4 in Appendix A.
- average height class and life form was recorded according to table 5 in Appendix A.
- the life span of the plant (annual or perennial).
- pest plants are automatically identified according to lookup tables within the Biological DataBase of South Australia (BDBSA).

BIRDS

Each site was surveyed on three separate mornings at slightly different times (early, middle and late morning). All sampling occurred in the first 4 hours after sunrise. An area of approximately three hectares was searched at each location for 20 minutes, resulting in a total of 60 minutes observation time at each. The area sampled was inside a 100m radius from the centre of the array. The amount of information recorded was simplified in comparison to a standard biological survey as only species, method, number observed, and on shrub, ground or flying overhead was recorded. Other information of interest was noted in the comments field.

MAMMAL AND REPTILES

To survey mammal and reptiles at each site four pitfalls, three funnel traps and 15 Elliott traps were used, as depicted in figure 2. The trap effort at all sites was based around a three pronged star arrangement of three pit fall traps at 10 meter distance from a central pit trap (Figure 1). The four PVC pipe pits were 16 cm in diameter by 60 cm deep, with a fine aluminium wire base. The aluminium wire drift fence ran 5 m past the radial arm pits. The drift fence started from the centre pit and was pinned into the ground to slightly overhang the centre pit by 2 cm.

To trap animals that may be less likely to enter a pitfall trap, 15 Elliott traps and three funnel traps were used in the arrangement, as depicted indicated in Figure 2. The 15 Elliott traps were set 5 m out from the pit spokes and separated by 10 m each. The three funnel traps were set half way between the centre and radial pits, with one trap placed in each wedge of the array. These were covered with a hessian bag to provide shelter from extreme weather, and secured in place by stones available on site. Traps were checked early morning (preferably before 10:00 hrs) and late afternoons (after 16:00 hrs). There was no physical search of the sites for reptiles or mammal sign. But, any additional animals encountered in the area while trap checking, were recorded as observations rather than captures. Traps were opened and monitored for four nights at each location. Ant powder was put at either end of each Elliot trap during the initial setup. Elliott traps were closed and bait was removed each morning, to discourage attraction of meat ants to the trapping area. These traps were rebaited and reopened late in the afternoon.

**Table 2.** Summary of flora, fauna and habitat sampling approach and effort.

Sampling method	Sampling effort
Vertebrate Fauna (mammals and reptiles)	
Sample plot size (ha)	100 x 100 m
Trap nights	4
Pitfall traps sizes	16cm diameter x 60cm deep
Pitfall traps x trap nights	4 pits x 4 nights
Funnel traps x trap nights	3 funnels x 4 night
pit trap fence length (m)	45 m (Y design)
Elliott traps x trap night	15 Elliot traps x 4 nights
Cage traps x trap night	Nil
Bait type in Elliot traps and cages and cameras	Peanut butter/oats
Active searches diurnal (searches/person mins)	Nil
Active searches nocturnal (person/hr)	Nil
Vertebrate Fauna (Birds)	
Bird sample size	3 ha
Bird survey (surveys x person mins)	3 searches x 20 mins each (over different days) for a total of 60 mins
Camera traps x trap nights	Nil
Vascular flora and habitat	
Prevailing Survey Covariates	Yes
Grass and forb floristics (cover)	Cover abundance* in 100 x 100 m
Litter cover	Percentage cover estimate in 100 x 100 m
Floristics presence	100 X 100 m quadrat
Shrub and tree canopy cover	Cover abundance* in 100 x 100 m
Coarse woody debris	Included with litter cover
Tree density by size, species, hollows, health	Cover abundance* by height class # and upper stratum age class in 100 x 100 m (1 ha)
Shrub density and diversity	Floristics list and Cover Abundance within 100 X 100 m.
Non-native plant species cover	Species recorded for cover abundance* in 100 x 100 m

* Modified Braun Blanquet 100 X 100 m

Modified Muir code 1977

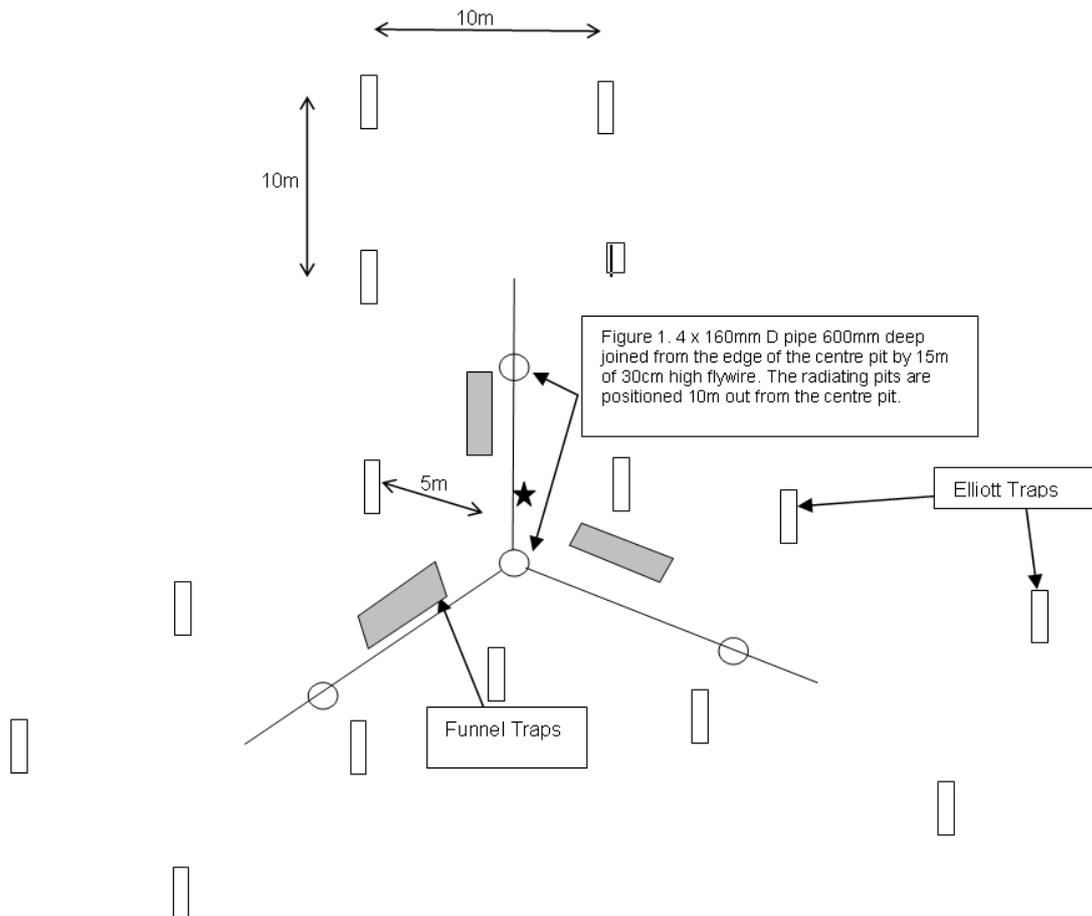


Figure 3. Schematic of the fauna sampling design, showing the funnel traps, pitfall traps and Elliott traps used in this study. The star represents a star picket, which was placed near the centre pitfall trap.

DESCRIPTION OF THE VARIABLES USED TO DESCRIBE IMPACTS AT EACH SITE

Bimbowrie has not been stocked for at least 8 years. Sites on Plumbago pastoral lease are chosen within grazing range of permanent water and in all cases signs of grazing impacts were recorded ranging from Low to Medium.

Subjective and quantitative assessment of impacts were made for each site. Impacts of long term domestic stock grazing on Bimbowrie prior to the dedication of Conservation Park, can be demonstrated by

- the change in plant community structure, changes in cover abundance and density of key *decreaser* species such as those found in *Atriplex vesicaria* and *Maireana astrotricha* low shrublands.
- the presence and cover abundance of increaser species that appear and may proliferate under prolonged or intensive grazing by sheep and feral herbivores.



Definition of ratings

N or None - there are no signs of current disturbance or presence of characteristics associated with that impact, for human impacts, any infrastructure that is permanent and maintained will have an influence on future site disturbances i.e. controlling herbivore movements in the case of fences, water points, tracks that tend to accentuate the presence of all grazers/predators. Absence of herbivore dung or only very old weathered individual pellets. Vegetation showing no signs of contemporary browse, grazing or damage, no weed species present at site or the environs. Soil surfaces are intact, have developed crusts and in the absence of seasonal vegetation have sparse cover of perennial shrubs, scattered overstorey and litter.

L or Low - ranging from a single, limited or scattered signs (e.g. browse on a few plants, fresh animal tracks/pads and runways) and/or affecting a small area of the site, small number of dung pellets counted of recognizable vertebrate species, sightings of vertebrates within site area. Presence of individual weed – plants including grasses, herbs and woody perennials - generally not apparent within the site and immediate environment. Recordings would not include non endemic natives which may be invasive, their presence would be recorded on species list and comments applied. Some minor soil surface e disturbance i.e. access track or fence.

M or Medium – signs of disturbances commonly found across sites and in the immediate environment, impacts on vegetation for cover abundance classes above 5%. Browse and grazing observed on sparsely distributed plants generally the more palatable species with plants displaying reduced foliar cover and biomass. Distinguishing herbivore impacts on soils/vegetations by a combination of bite marks, browse and grazing heights, camps, tracks, pads, sightings and dung type where they are commonly observed throughout the site or many active signs in one small area i.e. plants completely stripped of foliar cover, ringbarked, dug up, browsed back to primary branches and stems. Multiple vehicular tracks, fence intersections/yards, cleared alignments for pipelines and trucking access routes.

S or Severe – impacts that occur over significant areas of the site or within the environs of the same vegetation community, widespread utilisation of vegetation biomass with increased risk of decline in plant health and mortality, lack of age classes of the key

perennial species, evidence of prolonged grazing by herbivores with browse signs on primary plant stems, encroachment of weeds and woody invasive species. In association with depletion of vegetation, dung commonly found throughout site in association with other pads, tracks and camps. Soil surface cover depletion, fragmentation and absence of soil crusts due to loss of vegetative cover of perennial, seasonal species and litter.

PEST ANIMALS

Pellet numbers were counted at each site for recognisable species including sheep, rabbit, macropod and other herbivores. A uniform cross section of the site was sampled by 2 observers walking a straight line and recording individual dung for species every second step. Transects were not marked or location recorded within the site, the alignment in most cases was away from the trapping array/ site marker.

Counts included step number between 0 – 50 was recorded and pellet number for species left and right of the transect alignment extending 2 metres beyond the observer. The transect alignment varied between 70 – 150 metres depending on step length of individuals. Only dung pellets that weren't decomposed due to weathering (bleached and fragmented appearance) were counted. Run on areas where dung could accumulate due to overland flow and wind action were avoided at sites. Typically these areas show accumulation of dung amongst transported litter and soil material and are readily recognisable.

WEEDS

Weed species were recorded/vouchered on plant list along with cover abundance and life stage, which are typically used to determine their impact rating. Weedy grasses include exotic agricultural varieties and prescribed pest plants which are not generally present within the study area. Tall woody shrubs, which are endemic species such as *Eremophila* spp. and *Dodonaea* spp., may be defined as woody weeds within the study area. These woody weeds proliferate in degraded low shrubland and annual forbland and grassland communities. Weedy forbs are typically declared or noxious herbs that appear after rain. The presence of these weedy forbs may be accentuated in disturbed areas such as creeks and spillways into dams on Bimbowrie.



EROSION

Assessment of erosion attributes were derived from the Australian Soil and Land Survey Field handbook (the yellow book pages pp 92 – 96, Second Edition) which can be downloaded from <http://www.publish.csiro.au/nid/22/pid/5230.htm>. The attributes of erosion were rated as: active (A), stabilised (S), partly stabilised (P).

Presence/absence of accelerated Wind erosion (W), Scald erosion (C), Sheet erosion (S), Rill erosion, (R), Gully erosion (G) and Aggradation (A) - see handbook for characteristics and extent of each states scored as follows:

X	not apparent
0	none
1	minor or present
2	moderate
3	severe
4	very severe (not rated at sites and only applies to wind erosion)

All records deal with processes of accelerated erosion rather than natural (type and rate of erosion that occurs in an undisturbed natural environment). Accelerated forms are induced rapid loss of protective ground cover through human intervention on soils, vegetation and landform.

For gully erosion there was 1 record at a site scored as 1 or minor, in this instance a depth of gully is required as a separate field, in this instance the depth was <1.5 m which is the lowest height class.

Scald erosion (common in arid/semi arid landscape) severity related to area affected, that is characteristically devoid of vegetation and some degree of imperviousness to water but areas of natural stone clad scalds are common to the sample vegetation community, these can be distinctly separated from areas of historical scald erosion through vegetative cover depletion.



Fields allocated within the Biological Survey of SA data base include comments under SOI: and DIS : that cover recording erosion were not included in this data collection as there is no quantitative estimation required.

Attributes of erosion scored for each site include what was active or could be accelerated with minimal inputs, specific areas that are susceptible to further transportation/deposition processes. Areas of historical erosion that remain as sealed surfaces through “A” horizon loss and impervious subsoil exposures, were not rated. No sites recorded erosion characteristics rated as severe due to the more contemporary perennial vegetative cover, in spite of some areas showing widespread deflation evidenced by raised bush bases and pedestalling of soil surfaces.

DATA ENTRY – BIOLOGICAL DATABASE OF SOUTH AUSTRALIA

The data collected for this project on the distribution and abundance of flora and fauna and additional variables have been entered, checked for errors and stored in the Biological Database of South Australia (BDBSA). The BDBSA is maintained by the SA Department for Environment and Water.



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APPENDIX A

Table 3. Definitions of structural classes of vegetation. This table includes definitions of life forms and projective foliage cover of the tallest stratum height class.

	Dense (70-100%)	Mid-dense (30-70%)	Sparse (10-30%)	Very sparse (<10%)
Trees > 30m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10-30m	Closed forest	Open forest	Woodland	Open woodland
Trees 5-10m	Low closed forest	Low open forest	Low woodland	Low open woodland
Trees <5m	Very low closed forest	Very low open forest	Very low woodland	Very low open woodland
Mallee (>3m)	Closed mallee	Mallee	Open mallee	Very open mallee
Low Mallee (<3m)	Closed low mallee	Low mallee	Open low mallee	Very open low mallee
Shrubs > 2m	Tall closed shrubland	Tall shrubland	Tall open shrubland	Tall very open shrubland
Shrubs 1- 2m	Closed shrubland	Shrubland	Open shrubland	Very open shrubland
Shrubs < 1m	Low closed shrubland	Low shrubland	Low open shrubland	Low very open shrubland
Mat plants	Closed mat plants	Mat plants	Open mat plants	Very open mat plants
Hummock grasses	Closed Hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland
Tussock grasses	Closed (tussock) grassland	(Tussock) grassland	Open (tussock) grassland	Very open (tussock) grassland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Ferns	Closed fernland	Fernland	Open fernland	Very open fernland

Table 4. Definitions of the life forms in Table 3.

Trees	woody; perennial; erect; canopy raised well above the ground. Depth of canopy is usually less than or equal to two thirds of the total tree height. Single stemmed, or if multistemmed, fewer than five individual trunks resulting from branching of a single short trunk, that is not a mallee-like lignotuber. Height usually >2m.
Mallees	genus <i>Eucalyptus</i> ; multi-stemmed, trunks arising from lignotuber. Low mallee - < 3m. Mallee - > 3m
Shrubs	woody; perennial; erect, procumbent or weeping; foliage occupies all or part of total plant height; multiple stems and branches arising from a rootstock or very short common trunk; generally <5m tall.
Mat Plants	Herbaceous or woody plants of prostrate habit, with major stems growing along the ground. Rarely exceeds 10 cm in height. Examples of mat plants are <i>Kunzea pomifera</i> , <i>Myoporum parvifolium</i> , <i>Carpobrotus rossi</i> and <i>Mimulus repens</i> .
Hummock Grass Grasses (tussock)	Genera <i>Triodia</i> or <i>Plectrachne</i> only. family Poaceae (Graminae); leaf sheath always split.
Sedges	herbaceous, usually perennial, erect, generally tufted; arise from stolons, tubers, bulbs, rhizomes or seeds. Leaf sheath never split. Includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae and Xyridaceae and other sedge-like forms.
Herbs	herbaceous or slightly woody; annual or sometimes perennial; erect or creepers; rarely exceeds 0.5m height.
Ferns	Ferns and fern allies, i.e. non-vascular cryptogams of classes Filicopsida and Lycopsida. This category includes <i>Ophioglossum</i> spp., <i>Lycopodium</i> spp., <i>Selaginella</i> spp. and <i>Isoetes</i> spp.

Source: Adapted from Forward and Robinson (1996).



Table 5. Cover/Abundance description adapted from Braun-Blanquet, J. (1965)

N	not many, 1 - 10 individuals **
T	sparsely or very sparsely present; cover very small (less than 5%)
1	plentiful, but of small cover (less than 5%)
2	any number of individuals covering 5 - 25% of the area
3	any number of individuals covering 25 - 50% of the area
4	any number of individuals covering 50 - 75% of the area
5	covering more than 75% of the area

** where large shrubs or trees are involved choose a category to reflect the cover rather than the number of individuals.

Table 6. Muir's codes that are used to describe life form and height class for each species (for a full description of vegetation definitions see Channon and Heard, 1997)

T	Trees > 30m
M	Trees 15 - 30 m
LA	Trees 5 - 15 m
LB	Trees < 5 m
KT	Mallee *(>3m)
KS	Low Mallee *(<3m)
S	Shrubs > 2m
SA	Shrubs 1.5 - 2.0 m
SB	Shrubs 1 - 1.5 m
SC	Shrubs 0.5 - 1.0 m
SD	Shrubs 0 - 0.5 m
P	Mat plants (single plant)
H	Hummock grass
GT	Grass > 0.5 m
GL	Grass < 0.5 m
J	Herbaceous spp
VT	Sedges > 0.5 m
VL	Sedges < 0.5 m
V	Vines (twiners)
MI	Mistletoes
X	Ferns
MO	Mosses, liverwort
LI	Lichens

Source : Adapted from Muir (1977)

* Adapted from 8m to 3m to suit South Australian vegetation.



APPENDIX B. GLOSSARY OF SELECTED VARIABLES USED TO DESCRIBE SITES, FLORA AND FAUNA

CLIMATE CONDITION (SITE WORKSHEET)

This is to give an indication of the reliability of the data in terms of species diversity and abundance of seasonal vegetation, which depends on preceding weather conditions, such as rainfall. This should be discussed and declared at the commencement of the survey, assuming all sites are surveyed close to the same time in the same year.

The variables used in the spreadsheet are:

- 1 = Wet - Reliable data, good rainfall preceding survey, ensuring the presence of seasonal vegetation in addition to perennial vegetation; in agricultural areas winter rainfall precedes the survey.
- 2 = Dry - Moderately reliable data, recorded during dry conditions making it likely that the seasonal component of vegetation is under represented; in agricultural areas summer conditions precede the survey.

AMG ZONE (SITE WORKSHEET) Australian Map Grid reference.

VEGETATION CONDITION DESCRIPTION (SITE WORKSHEET)

- 1 = bare, virtually no cover
- 2 = undisturbed natural
- 3 = disturbed natural
- 4 = degraded natural
- 5 = highly degraded



ASSOCIATED DOMINANCE (FLORA WORKSHEET)

This field flags the dominant/codominant overstorey, dominant/codominant association understorey and emergent species in this column for:

- up to 3 overstorey species (O)
- up to 3 emergent species (E)
- up to 5 understorey species (U).

Dominant/codominant overstorey species are defined as species that dominate the tallest stratum with a canopy cover >5%. If there are no layers that have a canopy cover >5% then the dominant/codominant overstorey species are defined as species that dominate the tallest layer which has the maximum recorded cover/abundance (check plant list). An emergent species is defined as a species that emerges above the overstorey and occupies a stratum that has a canopy cover less than 5%. Emergents are always in a layer taller than the dominant structure and therefore cannot be a part of the dominant structural layer e.g. *Banksia ornata* shrubland with *Eucalyptus arenacea*.

COV CODE (FLORA WORKSHEET)

"CA" Cover / Abundance Modified Braun-Blanquet scale estimating cover/abundance. For each species present, an estimate is required of both cover and abundance measured on this modified seven point scale.

- N - not many, 1 - 10 individuals*
- T - sparsely or very sparsely present; cover very small (less than 5%)
- 1 - plentiful but of small cover (less than 5%)
- 2 - any number of individuals covering 5-25% of the area
- 3 - any number of individuals covering 25-50% of the area
- 4 - any number of individuals covering 50-75% of the area
- 5 - covering more than 75% of the area

NSXCODE (FAUNA WORKSHEET)

Unique Biological DataBase of South Australia code for each species.

SPECIES TYPE (FAUNA WORKSHEET)

- R = Reptile
- B = Bird
- M = Mammal



APPENDIX C. DATA DESCRIBING SITES, FLORA AND FAUNA AT EACH SITE



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