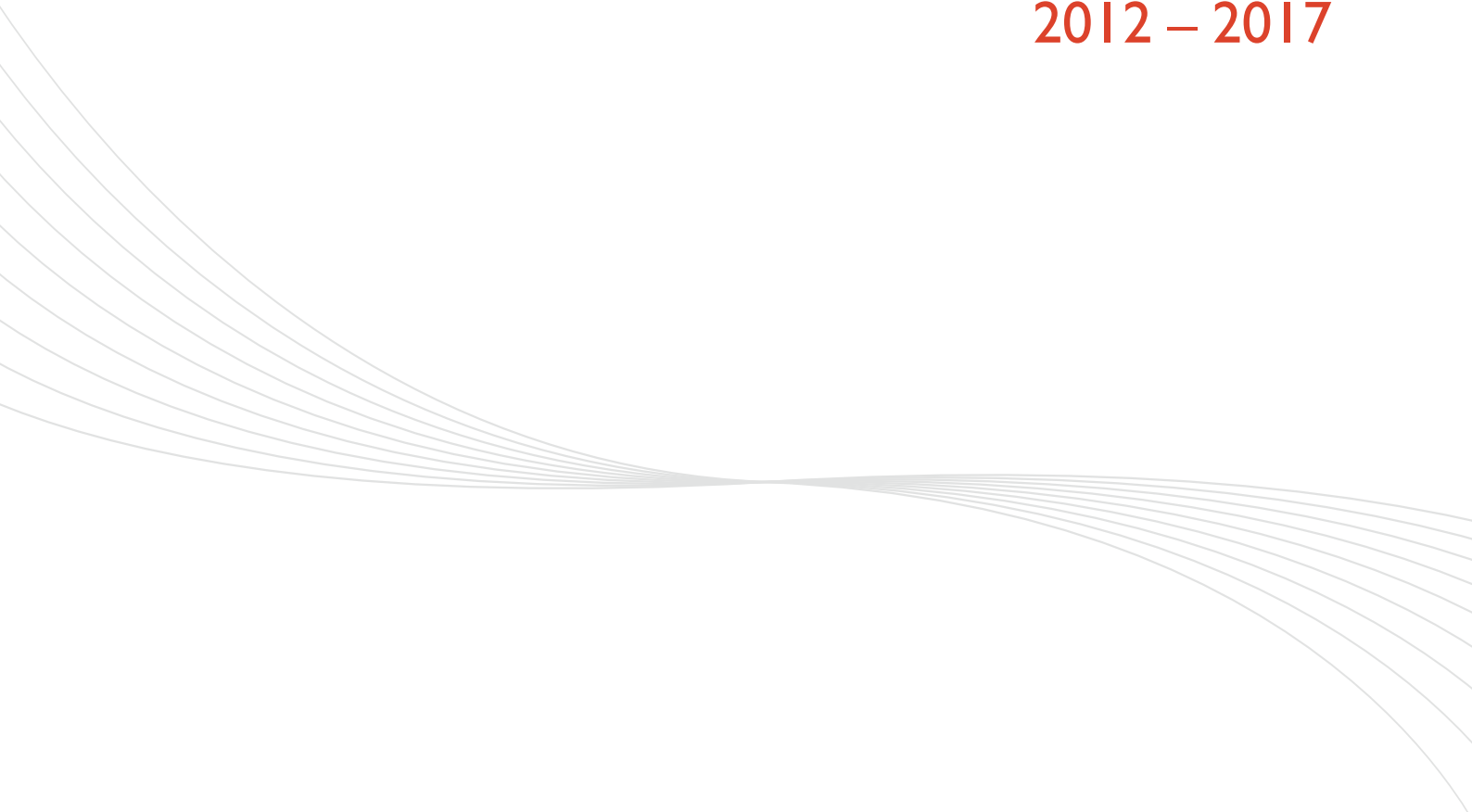




Research Plan

2012 – 2017



1.0 Introduction

This document has been collated after a strategic planning meeting of the Arid Recovery Scientific Advisory Committee held in November 2011. The purpose of this meeting was to look at the potential developments in Arid Recovery research over the coming five years and to develop a strategy to assess the current research practices of Arid Recovery including the current monitoring programs. This meeting determined four research outcomes for 2012 and beyond (see 2.3). These outcomes build on the original research priorities of Arid Recovery and have been developed to enable the organisation to maintain a robust scientific program and expand beyond the reserve fenceline.

This document is to be used to align with the new Arid Recovery business plan developed in 2012 to look at the organisation's operations from 2012–2017. The research and conservation programs undertaken at the Arid Recovery Reserve underpin the business plan and all Arid Recovery operations. Outlining the research strategies for the coming five years will assist in creating a sustainable business model for Arid Recovery and to ensure that all operations continue to align with the original vision for the organisation.

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3.0 Purpose

3.1 Mission of Arid Recovery

Arid Recovery is a not-for-profit research and conservation organisation whose primary purpose is to facilitate restoration of arid zone ecosystems through on-ground works, applied research, and industry, community and government partnerships.

3.2 Vision of Arid Recovery

Recognition as a world-class conservation and research program, with research outcomes and management techniques recognised and adopted on regional, national and international scales.

3.3 Arid Recovery Research Objectives

- Arid Recovery provides a research structure that supports and encourages succession, gives direction, and focuses on disseminating what is known.
- The Arid Recovery system is sustainable with multiple trophic levels and the resilience to cope with environmental changes.
- The Arid Recovery Reserve is a demonstrable and usable model that provides net mutual benefits to mining, pastoralists and conservationists.
- Landholders in arid and semi-arid environments use Arid Recovery data to sustain their own environments.

4.0 Background

4.1 Arid Recovery Research to Date

Arid Recovery research has been underpinned by the following research priorities:

- Document and differentiate between the restoration of ecological processes after the removal of feral animals and the reintroduction of locally extinct species.
- Research the ecology of threatened and significant species and formulate monitoring and re-introduction protocols.
- Explore options for maintaining desired population levels of threatened species within the Reserve including indicators of overstocking.
- Develop and improve methods to control and exclude feral animals.

Staff and students from Arid Recovery and Adelaide University have undertaken a highly successful program of research using Arid Recovery data sets. The current Arid Recovery research bibliography can be found in Appendix I.

4.2 Ongoing Research

Arid Recovery is a world-class science laboratory and reference site for arid zone recovery because of the establishment of permanent monitoring sites and standard monitoring protocols at its inception, and the deliberate experimental design of its layout.

The careful management of herbivory through fencing and pest control over a decade has allowed long-lived plants (such as mulga) to recover, seen an overall increase in vegetation cover within the reserve, has resulted in a significant increase in seed reserves including for some species that have never been recorded previously. There has also been a marked increase in the population of a number of existing mammals within the reserve and higher abundances of bird species inside (compared to outside) the reserve.

Arid Recovery is therefore an ideal site for demonstrating what can be achieved in restoring biodiversity in arid areas, and is a critically important benchmark for identifying the potential to achieve environmental benefits elsewhere in arid environments.

Areas of ongoing research within Arid Recovery include:

- monitoring of treatment areas
- the re-introduction of native species.

4.2.1 Treatment areas

In February 2012 the Arid Recovery Scientific Advisory Committee discussed the types and uses of treatment areas within and around the Arid Recovery Reserve. This discussion included BHP Billiton's monitoring needs for the Olympic Dam development and the overlap of areas of Arid Recovery with BHP Billiton's monitoring sites.

Olympic Dam Development and Research Requirements

A review of the reserves current monitoring requirements in relation to the Olympic Dam mining expansion has led to the following points:

- BHP Billiton's current plans have no effect on the Arid Recovery Reserve boundary, but there is a definite possibility of impacts on the boundary in the future.
- Monitoring the impact of the new development and the rock storage facility is important, including the effects of dust, heavy metals, etc.
- There may be many opportunities to collaborate with BHP Billiton on monitoring treatment areas in and around the reserve.

Summary of treatment areas

Table 1 Arid Recovery treatment areas

Treatment	Usage	Example	Replicates	Mine impact area
1	Re-introduced species / no ferals	Arid Recovery Reserve - Main e	5	High impact
			5	Medium impact
2	No re-introduced species / no ferals	Arid Recovery Reserve -	5	Medium impact
3	No re-introduced species / ferals present	Pastoral lease - no stock	5	High impact
			5	Medium impact
			5	Low impact
4	No re-introduced species / ferals present	Pastoral lease - stock	5	Medium impact
5	Re-introduced species / no predators, with rabbits	Arid Recovery Reserve - Dingo pen (future)	5	Medium impact
6	Re-introduced species / predators only, no rabbits	Arid Recovery Reserve - RLX (future)	5	Medium impact

■ = areas of core BHP

■ = areas of potential SEB monitoring

4.2.2 Long-term Monitoring

One of the features that sets Arid Recovery apart from other fenced reserves is the long-term monitoring of the restoration process. The design of the Reserve provides a unique opportunity to investigate and monitor the effect of different grazing and predation treatments on the local ecosystem. Arid Recovery has data sets spanning more than ten years that are an invaluable management tool for the program and for other restoration program as well. Appendix 2 outlines all current long-term monitoring programs undertaken at Arid Recovery including:

- native fauna
- native flora
- ferals.

The Arid Recovery monitoring practices are currently under review, and assistance is being sought from experts at the University of Adelaide regarding modelling and the statistical analysis of all of Arid Recovery data.

4.2.3 Re-introductions

To date four locally extinct mammal species have been successfully reintroduced and all four are now thriving within the Reserve. These include the:

- Greater Stick Nest Rat, *Leporillus conditor* (100 introduced in 1998, now 670)
- Burrowing Bettong, *Bettongia lesueur* (30 introduced in 1999, now 2,460)
- Greater Bilby, *Macrotis lagotis* (9 introduced in 2000, now 500)
- Western Barred Bandicoot, *Perameles bougainville* (10 introduced in 2001, now 350)

Further species will be reintroduced to encourage a variety of sustainable trophic levels (i.e. both predator and prey species) within the reserve.

The reintroduction of Numbat (*Myrmecobius fasciatus*) and Woma Python (*Aspidites ramsayi*) was trialed, but these were unsuccessful. Further attempts to re-introduce these species are slated for future years, along with other native species previously found within the region.

5.0 Arid Recovery Research 2012-2017

The following strategies and initiatives have been identified for Arid Recovery Research for 2012-2017 which follow on from the 2012 research outcomes outlined in 3.3.

Strategies and Initiatives	Measures of Success
Define and replicate key treatment areas	<ul style="list-style-type: none"> • The treatments (inside/outside) are defined • Areas where treatments can be replicated identified • New partnerships created to replicate, collaborate and build knowledge
Develop a 10 year reintroduction plan	<ul style="list-style-type: none"> • Risk assessment (vegetation and habitat related) completed and information obtained to support the priority list (research vs conservation) • Native predators introduced
Build the scale and focus of adaptive management (<i>longer term, landscape scale, conservation gain</i>)	<ul style="list-style-type: none"> • Treatment areas and adaptive management include all trophic levels (including invertebrates, reptiles, birds, and predators) • Long-term monitoring includes: <ul style="list-style-type: none"> – trends across treatment areas – reintroduced species – key vegetation – ferals – trophic patterns – bio-indicators • On-going research into feral interactions and eradication
Development of a five-year plan for external release of re-introduced species	<ul style="list-style-type: none"> • All data regarding releases and management of target species to date compiled • Vegetation and habitat restored to support an outside release
Focus on the productivity of the landscape	<ul style="list-style-type: none"> • Monitoring of seed and new plant material • A document outlining potential need for and implementation of seed bank developed
Development of training program for monitoring and conservation management	<ul style="list-style-type: none"> • Priorities and strategy document for implementation developed

Appendix 1 Arid Recovery Research Bibliography

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1999

Theses

Reseigh, J. (1999) Correlation of the age and index of size with life stage classes, and the effect of herbivory on *Acacia aneura* (mulga) in northern eastern South Australia. Honours Thesis, University of South Australia.

Ryan, S. (1999) A comparison of foraging preferences of the Greater Stick-nest Rat (*Leporillus conditor*) and the European Rabbit (*Oryctolagus cuniculus*) and implications for regeneration of Arid Lands at the Arid Recovery Project site, Roxby Downs, South Australia. Honours Thesis, University of Adelaide.

O'Neill, S. (1999) The habitat preferences and behaviour of re-introduced *Leporillus conditor* (greater stick-nest rat) Roxby Downs, South Australia. Honours Thesis, University of South Australia.

Appendix 2 Arid Recovery Long-term Monitoring

NATIVE FAUNA

Method	Objective	Pros	Cons	Resources needed
Re-introduced species				
Quarterly native track transects (incl. Kangaroos and RLX)*	Monitor activity and population trends of re-introduced species	<ul style="list-style-type: none"> Population health in response to conditions i.e. weather extremes, mining impacts Id of adaptive management triggers i.e. roo/BB numbers Feral checks 	<ul style="list-style-type: none"> No longer have access to quads Revision of implementation needed 	<ul style="list-style-type: none"> Two or three fully trained people in native and feral track id for one week Two quad bikes and draggers
Annual cage trapping*	Determine population fluctuations and animal condition	<ul style="list-style-type: none"> Demographic, health, breeding info collected Population estimates with CMR method implemented 	<ul style="list-style-type: none"> Consistency of processors no longer guaranteed 	<ul style="list-style-type: none"> 3-4 fully trained processors 3-4 4WD vehicles One week 200+ cage traps
Annual warren/burrow and SNR nest monitoring	Monitor activity and observe changes to bettong warrens and bilby burrows (activity and measurements) over time	<ul style="list-style-type: none"> Activity levels Population health in response to conditions 	<ul style="list-style-type: none"> Frequency of data collection, time 	<ul style="list-style-type: none"> 1x4WD One week 1-2 people competent in native track id
Nest and warren monitoring for Mine Impact Study	Observe changes (particularly activity levels) to bettong warrens and stick-nest rat nests over time in response to expanded mining operations.	<ul style="list-style-type: none"> Activity levels Population health in response to conditions 	<ul style="list-style-type: none"> Sites need to be finalised in high, inter and low impact zones 	<ul style="list-style-type: none"> 1x4WD One week 1-2 people competent in native track id.
Small vertebrates				
Annual pitfall and elliott trapping*	Investigate response of small mammals and reptiles to removal of introduced herbivores and predators	<ul style="list-style-type: none"> Unique monitoring inside/outside/control feral free reserve Information could aid in broadscale management Excellent training opportunity for students 	<ul style="list-style-type: none"> Consistency of processors no longer guaranteed Accommodation not guaranteed 	<ul style="list-style-type: none"> In the past John or Katherine have been contracted to assist as team leaders and processors At least four dual cab 4WD's Up to 12 volunteers Accommodation to accommodate up to 12 volunteers in summer Elliott traps/excluders Ability to use laboratory at Charlton Road

Method	Objective	Pros	Cons	Resources needed
Birds				
Annual mist netting *	Investigate site fidelity, longevity, and habitat preference of native bird species	<ul style="list-style-type: none"> • Unique bird data inside/ outside feral free reserve • Potential to be used to monitor impacts of mining on birds 	<ul style="list-style-type: none"> • Only four sites inside Main? 	<ul style="list-style-type: none"> • Completed by DC Paton at no expense to Arid Recovery
Annual bird search transects*	Investigate response of birds to removal of cats and rabbits including increases in structure and vegetation cover and lower predation levels	<ul style="list-style-type: none"> • Unique bird data inside/ outside feral free reserve 	<ul style="list-style-type: none"> • No longer able to access SML for outside bird searches. Replacement sites sub-optimal. 	<ul style="list-style-type: none"> • Completed by DC Paton at no expense to Arid Recovery
Opportunistic monthly bird monitoring	Document bird sightings inside and outside the Arid Recovery Reserve	<ul style="list-style-type: none"> • Species list compilation 		<ul style="list-style-type: none"> • Arid Recovery staff that know birds

NATIVE FLORA

Method	Objective	Pros	Cons	Resources needed
Jessop transects, step point, species list (Every five years or during exceptional years)*	Monitor vegetation changes in response to different grazing regimes	<ul style="list-style-type: none"> • Unique vegetation data inside/outside/control feral free reserve • Variety of uses 	<ul style="list-style-type: none"> • Consistency of data collector no longer guaranteed • Consistency of species identification 	<ul style="list-style-type: none"> • 1–2 x 4WD vehicles • Experienced botanists, at least AR Ecologist for two full weeks to complete, and Arid Recovery student
Seedling damage measurements (Every 12–18 months)	Investigate damage to seedlings and larger plants by burrowing bettongs	<ul style="list-style-type: none"> • Data used to identify overgrazing indicators and to develop threshold limits to ensure sustainable populations 	<ul style="list-style-type: none"> • Data can be subjective if collected by more than one person 	<ul style="list-style-type: none"> • 1 x 4WD • One trained staff member
Annual photopoints*	Investigate regeneration of native plants after removal of rabbits and domestic stock	<ul style="list-style-type: none"> • Visuals changes to vegetation over time or in response to extreme weather conditions 	<ul style="list-style-type: none"> • Frequency, time 	<ul style="list-style-type: none"> • 1 x 4WD • Camera • One person, 10 days
Seedling monitoring (last done in 2005)	A study of vegetation regeneration			? Established in 2000. See "Seedling Monitoring" procedure.

FERALS

Method	Objective	Pros	Co	Resources needed
Quarterly external feral transects*	Determine the efficacy of baiting trials around the outside of the AR Reserve	<ul style="list-style-type: none"> Broadscale feral animal data for region 	<ul style="list-style-type: none"> Access to transects has changed, limited, or is unavailable, i.e. no data from SML since Feb 10 No environmental officers to undertake transects on SML (ed-is that what you mean?) No baiting since late 2009 	<ul style="list-style-type: none"> 1 x 4WD vehicle Trained staff member in feral track id One person able to drive 4WD Coordinated effort of all landholders during monitoring One week
Quarterly internal feral checks*	Monitor the presence of feral animals within the AR Reserve	<ul style="list-style-type: none"> Maintain a feral-free reserve 	<ul style="list-style-type: none"> No longer have access to quad bikes Revision of implementation needed 	<ul style="list-style-type: none"> One person trained in id of feral tracks amongst native tracks One quad bike One week
Quarterly external spotlight transect	Investigate the temporal changes in feral animals around the reserve fence line	<ul style="list-style-type: none"> Long-term feral animal data 	<ul style="list-style-type: none"> Doesn't include Dingo Pen at present Purpose of data Time 	<ul style="list-style-type: none"> 1 x 4WD Spotlighters trained in distinguishing cat, fox, dingo eye shine Eight hours Experienced shooter
Daily perimeter trapping*	Create a buffer around the Arid Recovery fence line.	<ul style="list-style-type: none"> Reduces feral pressure on fence (especially cats, foxes and rabbits) Reduces chance of feral animal incursion Feral animal weight and diet data 	<ul style="list-style-type: none"> Much improved on previous system but still labour intensive with respect to maintenance 	<ul style="list-style-type: none"> Observant system 1 x 4WD to check traps Staff member or volunteer with shooting requirements Foot hold traps/lures etc
Opportunistic perimeter shooting		<ul style="list-style-type: none"> Reduces feral pressure on fence (esp especially cats, foxes and rabbits) Reduces chance of feral animal incursion Feral animal weight and diet data 	<ul style="list-style-type: none"> Time 	<ul style="list-style-type: none"> Keen volunteers willing to use own vehicles, firearms with no reimbursement from Arid Recovery Eight hours If no volunteers, AR will need resources outlined for quarterly spotlight
Opportunistic and bi-annual weed monitoring	To monitor weed presence in order to manage and remove	<ul style="list-style-type: none"> Proactive local weed management to reduce larger infestations Not a huge issue compared to other areas 		<ul style="list-style-type: none"> Person trained in weed identification and control ChemCert Vehicle

(*denotes established at inception 1997/8)

