A BIOLOGICAL SURVEY OF THE MARALINGA TJURATJA LANDS, SOUTH AUSTRALIA

2001 - 2007

By

J. N. Foulkes & D. S. Thompson

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December 2008

The Biological Survey of the Maralinga Tjarutja Lands, South Australia was carried out with funding provided by the National Heritage Trust through the Alinytjara Wilurara Natural Resources Management Board.

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The report may be cited as:

Foulkes, J. N. and Thompson, D. S. (Eds.) (2008). ***A Biological Survey of the Maralinga Tjarutja Lands, South Australia, 2001-2007*****. (Department for Environment and Heritage, South Australia).**

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ISBN 978 1 21466 40 3

Cover Photograph: View south from Vokes Hill toward the Ooldea Range (Photo: D. Thompson).

Abstract

The biological survey covering the Maralinga Tjarutja Lands (MT Lands) of South Australia was carried out between 2001 and 2007 funded by the Natural Heritage Trust via the Alinytjara Wilurara Natural Resources Management Board. Before the present survey work, biological studies over the Maralinga Tjarutja Lands had been scattered and opportunistic and were biased toward bird observations and plant collections. This report therefore documents the first systematic attempt to collect comparable biological data across this very significant area of the State. The Maralinga Tjarutja Lands cover an area of 105 667 km ^{2} (or approximately 11% of the land area of SA) across three IBRA (Interim Biogeographical Regionalisation of Australia) regions (Great Victoria Desert, Nullarbor and Gawler). The Aboriginal people (Anangu) living on the lands were involved with the survey from its earliest days and worked with the scientists on field trips during the survey.

The seven-year biological survey sampled 160 quadrats in 17 separate areas distributed across the accessible areas of the Maralinga Tjarutja Lands. This represents approximately 1 site per 400 km^2; however some large areas (approximately 30% of the total area) in the Maralinga Tjarutja Lands were not sampled due to remoteness and inaccessibility.

The total number of records contributed to the Biological Survey Databases of SA as a result of this survey were: 6, 398 plants (2, 000+ samples sent to the State Herbarium), 4, 392 mammals, 14, 967 birds, 4, 217 reptiles and 18 amphibians.

A total of 916 flowering plant, fern and conifer species were recorded within the Maralinga Tjarutja Lands from 59 families. Of these, 8 were species not previously recorded in South Australia, and several appear to represent the discovery of new undescribed species. Another 173 species represent new plant records for the Maralinga Tjarutja Lands, which is a significant addition to our knowledge of the plants of the region.

The Maralinga Tjarutja Lands are remarkable for the low incidence of weeds, with only 8 introduced species recorded on survey quadrats or as opportunistic sightings. This number is 0.8% of the total number of plant species recorded in the Maralinga Tjarutja Lands, and reflects the relatively intact vegetation in the Maralinga Tjarutja Lands compared to most other regions of the State. Nevertheless, a few of the weed species found in the Maralinga Tjarutja Lands are of concern and Buffel Grass (*Cenchrus ciliaris*) in particular is considered to be a serious management issue.

Twenty three vegetation mapping communities comprising woodlands, mallee, shrublands and grasslands have been identified in the Maralinga Tjarutja Lands. Seventeen of which are Great Victoria Desert bioregion communities which are largely unique to the Great Victoria Desert, three are communities that occur on the Nullarbor bioregion communities and three are Gawler bioregion communities. There are no vegetation communities of national or state significance, however there are particular communities containing species such as the Ooldea Range Mallee and Beadell's Mallee which occur only occur in the Maralinga Tjarutja Lands.

Marble Gum over spinifex grasses on sandplain and dunes, Great Victoria Desert Mallee over spinifex grasses on sandplain, Umbrella Wattle and Horse Mulga dunes and Black Oak on stony rises were the best habitat for animals across the Maralinga Tjarutja Lands. Uncontrolled fire can have severe impact on the plants and animals across the Maralinga Tjarutja Lands, particularly those in habitats with a high cover of spinifex grasses.

In common with the rest of the Australian arid zone, about half of the mammal fauna has become extinct since European settlement. This wave of extinctions occurred relatively early in the Maralinga Tjarutja Lands, and many species became extinct in the 1930's, which corresponds to a major drought following the

preceding years of high rabbit, fox and cat numbers. Approximately 44 native and 6 introduced mammal species were known to inhabit the region. This survey, and other recent observations, has recorded 27 native mammal species still remaining across the Maralinga Tjarutja Lands. At least 17 mammal species are now confirmed extinct. Nine mammal species collected or recorded on this survey represent additions to the previously known mammal fauna of the Maralinga Tjarutja Lands.

Feral Camels were common and widespread through the Maralinga Tjarutja Lands and present an increasing management issue across the region as a whole. The Fox and Cat were uncommon; however they have the capacity to impact populations of threatened species such as the Malleefowl and Sandhill Dunnart.

The survey and previous observations have recorded 133 species of birds across the Maralinga Tjarutja Lands. The northern form of the Grey Currawong (*Strepera versicolor plumbea*) appear to have become extinct since European settlement, however other rated species such as the Australian Bustard appear to be quite widespread. The variety of bird life is restricted due to the lack of permanent water sources that many species of birds need to survive in the desert. The survey added five new bird species for the Maralinga Tjarutja Lands.

There are now 94 species of reptiles and a single species of frog known for the Maralinga Tjarutja Lands, making it one of the most reptile rich regions in Australia. The survey added 10 new reptile species and one new frog to the previous known reptile fauna of the Maralinga Tjarutja Lands. New reptile records included one new reptile species for South Australia, the Plain-backed Two-lined Dragon (*Diporiphora reginae*), the first time scientists have seen this species in SA.

Many of the plant and animal species now known from the Maralinga Tjarutja Lands are at their southern or south eastern limits in South Australia and are more common or have a much more extensive distribution in adjacent areas of Western Australia and the Northern Territory. It is still very important to manage the South Australian populations of these species at the limits of their natural distribution.

Many species with both national and State conservation ratings occur on the Maralinga Tjarutja Lands with 2 plants rated nationally (Ooldea Guinea-flower and Club Spear-grass) and 36 on the State list. Two nationally rated mammal species; Southern Marsupial Mole and Sandhill Dunnart and 4 State-rated mammals (Sandhill Dunnart, Hairy-footed Dunnart, Burrowing Bettong, Mulgara occur/occurred on the Maralinga Tjarutja Lands. Two nationally (Malleefowl and Princess Parrot) and 15 State-rated birds occur in the Maralinga Lands. Four State-rated reptile species were found, however no nationally rated species were recorded.

The highest priority management recommendations arising from the survey are;

- Control of Buffel Grass
- Management of uncontrolled fire by blending traditional and contemporary fire practices and knowledge
- Control of camel numbers to assist in protection of natural water sources and threatened species (particularly plants)
- Control of foxes and cats in localised high value areas around Malleefowl nesting sites
- Evaluation of species and communities at risk from climate change

Finally, a series of broader conservation management recommendations are provided covering: fire, introduced herbivores, weeds, water, introduced predators, hunting pressure, threatened species recovery, monitoring and reporting and training and education.

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Acknowledgements

This project was funded by the Alinytjara Wilurara Natural Resource Management Board from Natural Heritage Trust and contributes to the Biological Survey of the Sandy Deserts (Maralinga Tjarutja Lands). Additional field survey work for this project contributing to the vegetation mapping was run in conjunction with the Gawler Craton vegetation mapping project funded by through the Primary Industries and Resources South Australia (PIRSA) PACE program.

The following people assisted with the biological survey work: (B)-birds, (M)-mammals, (R)-reptiles, (V)-vegetation, (I)-invertebrates, (G)-general assistance.

K. Bellchambers (B), A. Black (B), B. Blaylock (B), J. Blaylock (B), K. Blaylock (M), T. Bradley (B), R. Brandle (M,R), A. Camp (V), P. Canty (V), J. Cooper (B), J. Foulkes (M, R,V), J. Gates (M), K, Graham (V), J. Haska (V), L. Heard (V), D. Hopton (B), M. Hutchinson (R), J. Jay (V), L. Kajar (M, V), G. Kluske (B, R), E. Krahnert (G), P. Lang (V), D. Matthews (M), J. McDonald (V), N. Neagle (V), L. Pedler (B), L. Queale (M, I), T. Robinson (M, V), A. Skinner (R), B. Sparrow (V), E. Stephens (G), H. Stewart (B), J. Thiessen (B), J. Turpin (B), H. Vonow (V).

Brett Dalzell, Andy Causebrook, Robbie Sleep and Tammy Leggett from Ceduna NPWS provided valuable logistical support and assistance in the field throughout the survey, including a fuel and supplies run to Serpentine Lakes.

Ian Hopton (PIRSA) kindly provided access to accommodation facilities in Coober Pedy on a number of occasions. Similarly, Leon Ashton provided access to accommodation, showers and fuel at Maralinga Village during the April 2006 and September 2007 survey trips.

Archie Barton from Maralinga Tjarutja Inc. in Ceduna facilitated communication with Oak Valley community members during the initial preparation for the survey. Chris Dodd (Land Management Officer, Oak Valley) coordinated members of Oak Valley Community to assist with site clearance and field work throughout the survey. We are grateful especially to Jeffrey Queama, Peter Pepper, Herbert Queama, Mabel Queama, HueyWindlass and Roger Williams for their assistance in cultural site clearance.

Chris Dodd and Alan Coe provided us access to additional water supplies and accommodation at Oak Valley during various stages of the survey. We would also like to thank the Oak Valley community for making us welcome during our visits and supporting us undertaking the survey.

Vegetation Mapping
An additional vegetation only survey was conducted within the vegetation mapping region over a two-week period in October 2005. The following personnel were involved; S. Kenny, D. Murfet, L. Heard, B. Pavy, K. Graham, D. Thompson, G. Kluske, D. Wallace-Ward, E. Roberts, and. P.Mahoney.

Specimen identification
The assistance from the State Herbarium of South Australia is gratefully acknowledged, particularly D. Symon and R. Taplin with support from A. Ramsay, H. Vonow and M. O'Leary.

Vertebrate specimen identifications were undertaken at the South Australian Museum by C. Kemper and D. Stemmer (mammals) and M. Hutchinson, A. Skinner and C. Kovach (reptiles). Terry Reardon (SAM) and Dennis Matthews provided confirmation of bat call identifications from Anabat recordings.

Data entry
L.Kajar, E. Roberts, G. Hodder, E. Stephens, G. Kluske and S. Groom with assistance from S. Kenny and D. Thompson.

Mapping and Vegetation Analysis
The vegetation analysis and mapping was conducted by D. Thompson using Earth Resources Mapper (ER Mapper) 7.0 remote sensing software and Environmental Systems Research Institute's (ESRI) geographic information system (GIS) software package ArcGIS 9.1.

Other
Thanks to J. Norman and J. Bolton-Riley from Commercial Helicopters Pty. Ltd. for providing helicopter assistance to this project during the October 2005 survey period. Thanks also to B. Dalzell, District Ranger, Far West District and J. White and I. Hopton, PIRSA, for their advice on access within Yumbarra Conservation Park and Yellabinna Regional Reserve.

The advice, knowledge and experience of P. Canty, R. Brandle, P. Lang, J. McDonald from the Science Resource Centre, DEH, and D. Gibson and J. Cameron from Image and Product Services, DEH, was also invaluable and appreciated.

INTRODUCTION

J. N. Foulkes[1]

BACKGROUND AND AIMS

Over the last twenty five years the Biological Survey of South Australia has been systematically documenting the vascular plants and vertebrate fauna of the various habitats found across the state. To date these surveys have gathered information for South Australia's offshore islands, Kangaroo Island, the eastern agricultural lands and some of the arid zone including the Olary Plains, southern Strzelecki Desert, the Nullarbor Plain, Yumbarra Conservation Park, Yellabinna Region and the Stony Desert regions, the Flinders Ranges and the Simpson, Tirari, Pedirka and Anangu Pitjantjatjara Lands. Areas surveyed purely for vegetation include, Yorke Peninsula and the northern Mt Lofty Ranges. Survey titles and dates are listed in Forward and Robinson (1996) and Playfair and Robinson (1997). More recent published major surveys include the Flinders Ranges (Brandle 2001), the Anangu Pitjantjatjara Lands (Robinson *et al.* 2003) and Mount Willoughby IPA (Brandle *et al.* 2005).

The present survey covered the whole of the Maralinga Tjarutja Lands (MT Lands) in western South Australia, an area approximately 105 667 km^2. Land management over this vast area (c. 11% of the land area of SA) is the responsibility of the Executive Board of Maralinga Tjarutja which holds freehold title under the Maralinga Tjarutja Land Rights Act 1984. Note that throughout this report, Aboriginal people living on the MT Lands will be referred to as Anangu. Anangu live predominantly in Oak Valley, however there is substantial influx of Anangu from Yalata and Tjuntjuntjara in WA, as well as from the APY Lands to the north.

This survey was a joint cooperative project between Alinytjara Wilurara NRM Board, Maralinga Tjuratja and the South Australian Department for Environment and Heritage. Maralinga Tjarutja Land Management (Chris Dodd) and the survey coordinator (Jeff Foulkes) for the Biological Survey represented the interests of the MT community and worked in close association with traditional owner groups that Anangu with intimate knowledge of their country were active participants and shared decision making regarding survey planning and implementation.

The MT Lands covers approximately 105, 667 km^2 across the southern part of the Great Victoria Desert and parts of the Nullarbor and Gawler Bioregions in South Australia (Thackway and Cresswell 1995) (Figure 1).

The Great Victoria Desert forms the bulk of the area of the MT Lands (81.5 %, c 86, 000 km^2) and forms southern part of the anti-clockwise whorl of desert dune-fields of Australia. Three IBRA sub-regions are represented in the MT Lands (GVD3, GVD5 and GVD6: Figure 1). The dominant landforms are dunes and swales. There are local occurrences of playa lakes, lunettes and rocky prominences. Drainage lines are a very minor feature and creeks formed within the swales mostly drain lake-wards. The broad regional relief indicates undulations and local variations that suggest an older palaeoform. These palaeoforms include marine landforms of the Cainozoic (less than 65 my) Eucla Basin.

The bioregion consists of active sand-ridge desert of deep Quaternary (less than 65 my), aeolian sands overlying Permian (251-298 my) and Mesozoic (65-251 my) units of the Officer Basin. The northeast extent of the bioregion lies within the Great Artesian Basin. The majority of the Great Victoria Desert is crown land, conservation reserves and Aboriginal land. The bioregion includes land holdings of the Anangu Pitjantjatjara Yankunytjatjara Lands and part of the Maralinga Tjarutja Lands.

In South Australia, Tallaringa Conservation Park, Yellabinna Regional Reserve, Yumbarra Conservation Park and Mamungari Conservation Park all lie within the bioregion, however Mamungari is the only park within the MT Lands. The traditional Maralinga Lands were the homelands of people linked to the Kokatha, Wirngu and Pitjantjatjara (O'Connors 1997). Aboriginal groups followed well-established routes and special Dreaming tracks marked with rock holes, soaks and dams. These routes led to permanent or semi-permanent water sources in the Great Victoria Desert. A water source at Ooldea Soak, known as Youldeh by Aborigines was important throughout the desert, as it was a principal refuge during severe droughts.

The Nullarbor bioregion comprises the Nullarbor Plain and is the second most common bioregion in the MT Lands (15.6%, c16, 400 km^2) and is represented by two sub-regions (NUL1 and NUL2, Figure 1). It forms the onshore part of the Eucla Basin, one of the world's largest karst regions. The karst landforms are characterised by solution sculpturing of outcrop, underground drainage systems and caverns.

The Eucla Basin formed part of the Miocene (less than 65 my) sea-floor, which was subsequently uplifted to form the present day plateau. The surface is gently

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undulating, and any change in the surface relief is due to karst development. The landscape is dotted with 'dongas', shallow circular depressions with sufficient soil and localised drainage to support scattered small trees or large shrubs. Overgrazing is the main cause of land degradation in the region, which is limited to localised occurrences.

About 17% of the Western Australian portion of the bioregion is conservation reserve. The South Australian portion of the bioregion comprises about 58% conservation reserves (including regional reserves) (Woinarski *et. al*. 2000).

The Gawler Bioregion (sub-region GAW5) is a minor component of the MT Lands (2.9%, c 3050 km^2) (Figure 1), occurring in the south-eastern corner of the MT Lands. The myall-chenopod plains: Western Myall (*Acacia papyrocarpa*) and Pearl Bluebush (*Maireana sedifolia*) and Bladder Saltbush (*Atriplex vesicaria*) shrublands are the most common plant community represented in the Gawler Bioregion in the MT Lands.

CLIMATE

There are two meteorological stations in the MT Lands (Cook and Maralinga). They are both in the southern limits of the lands, so data from Warburton (WA) in the north of the bioregion is included for comparison. The mean maximum summer temperature at Warburton is around 37°C and mean temperature for winter is around 20°C (Figure 2a). The mean annual rainfall is 248 mm but ranges from 35 mm to 691 mm and there is a bias toward summer rainfall.

The mean summer maximum temperature at Maralinga is around 33°C and the mean temperature for winter is around 18°C. The mean annual rainfall is 228mm, but has experienced a range from 94 mm to 434 mm since 1955 (Figure 2b). Rainfall at Maralinga doesn't appear to have a strong seasonal bias compared to that recorded for Warburton.

Cook, on the Nullarbor Plain, has a mean annual rainfall of 182 mm, but has experienced a range of 54mm to 434 mm. Mean temperatures are slightly cooler than at Maralinga. As with Maralinga, rainfall doesn't appear to have a strong seasonal bias (Figure 2c). Generally there is a north-south rainfall and temperature gradient (increasing northward), and decreasing temperature and rainfall west-east.

The fieldwork, which covered 179 sample quadrats in 18 separate campsites, was carried out on 11 field trips between May 2001 and September 2007. The location of these sampling sites is shown in Figure 4 and the timing in relation to rainfall events is shown in Figure 3.

Examples of the range of environments over the MT Lands are shown in Figures 5 - 16. While comprising a rich diversity of habitat and vegetation types, the extreme remoteness of much of the MT Lands meant that, before the present biological survey, very little was known of the biology of this area. Of particular interest were those species generally considered to be threatened throughout their natural range. Did remnant populations of these species still occur in this region, and, if remnant populations still occur in this region, what is their range, abundance and habitat preferences?

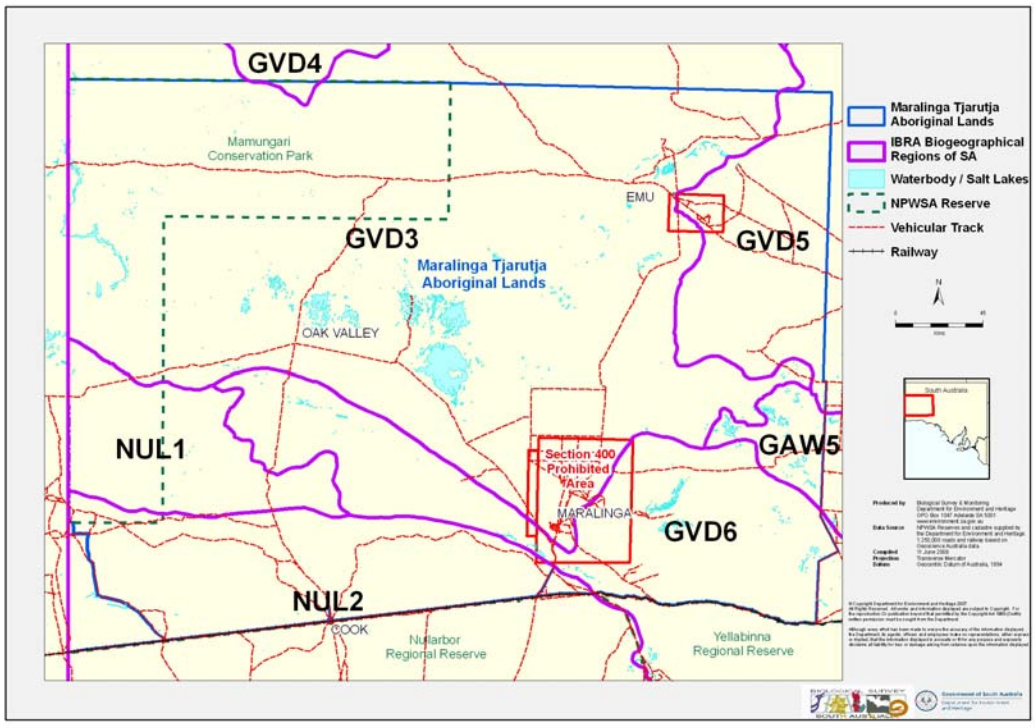
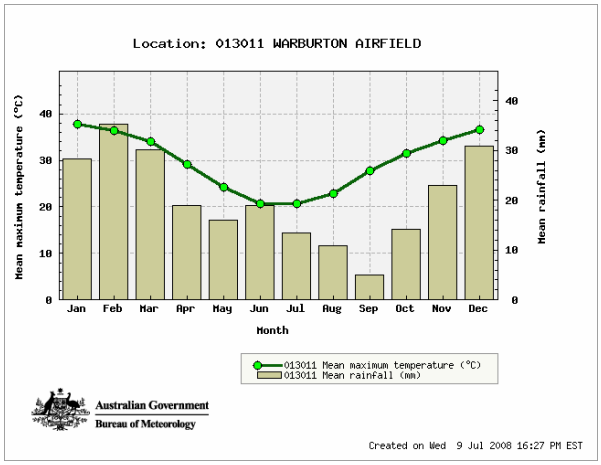


Figure 1: Maralinga Tjarutja Lands showing roads, IBRA sub-region names and boundaries.



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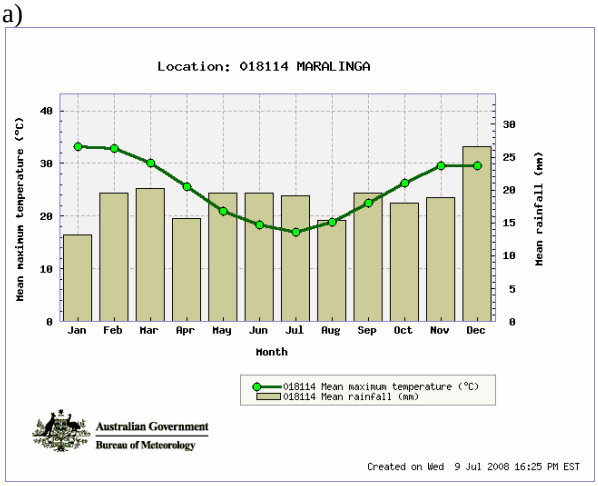

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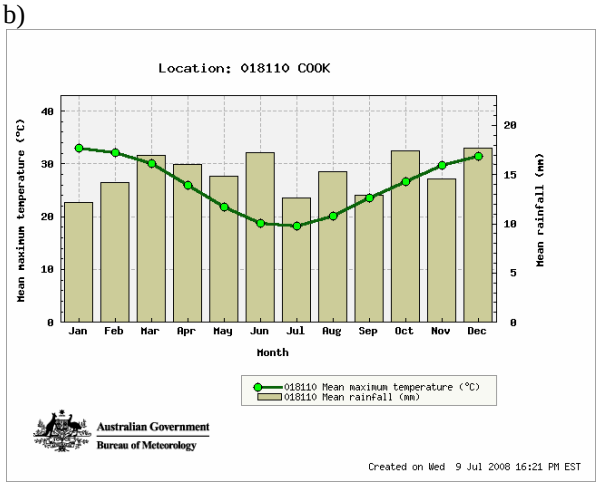

c)

Figure 2: Mean monthly rainfall and mean maximum temperature at a) Warburton, b) Maralinga and c) Cook. Source: Australian Bureau of Meteorology (2008).

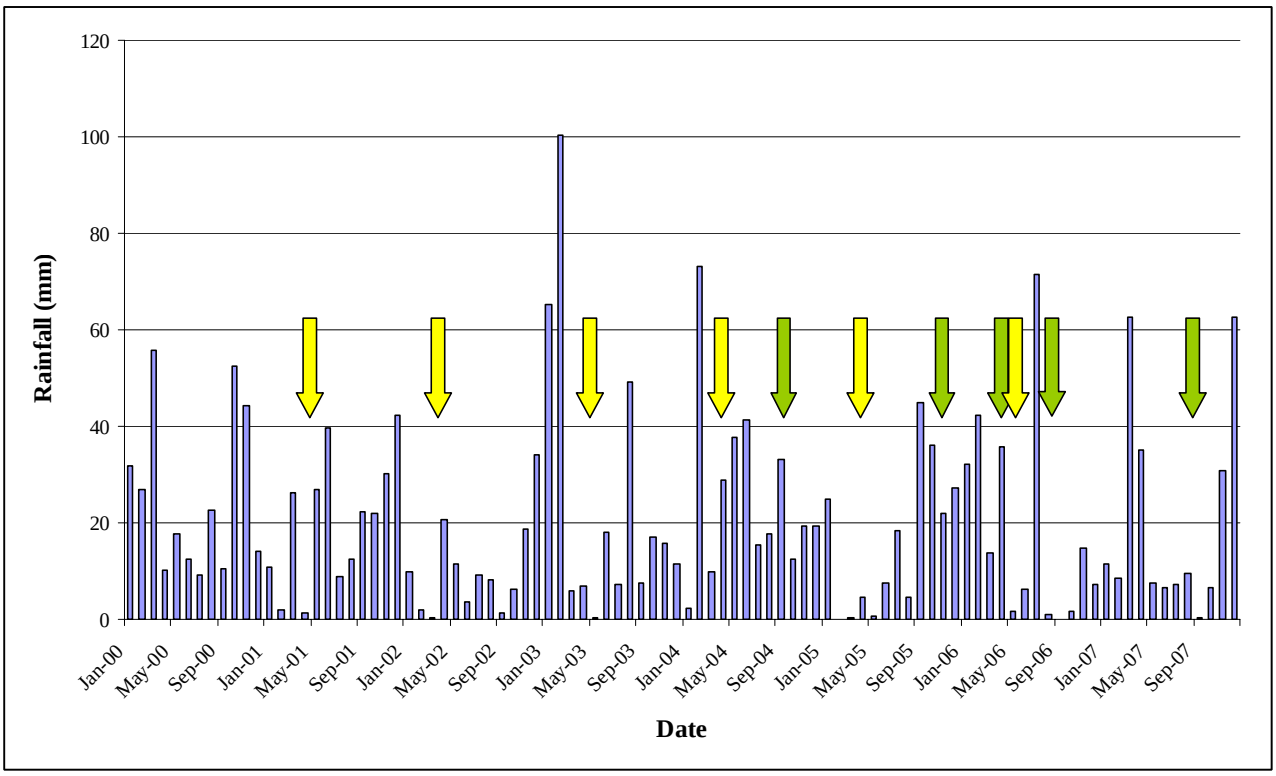

Figure 3: Monthly rainfall for Maralinga Village between 2000 and 2007. Yellow arrows indicate autumn surveys and green arrows indicate spring surveys.

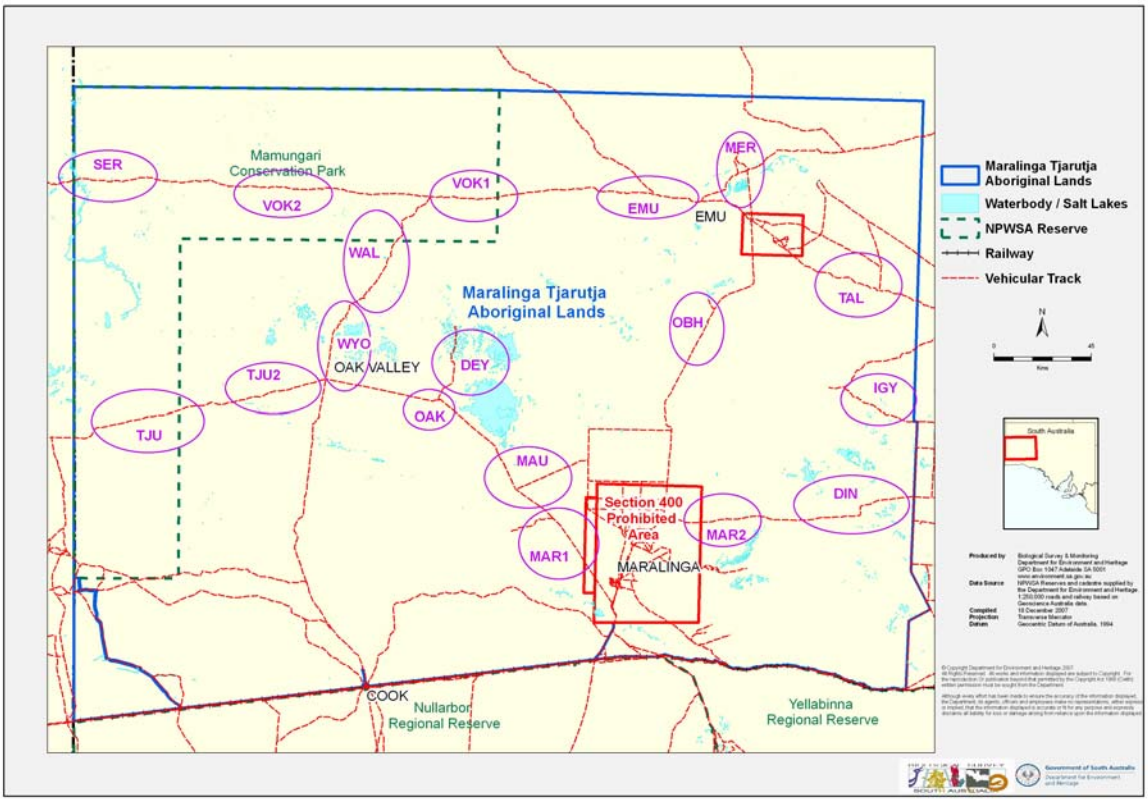

Figure 4: Location and site codes of areas sampled for flora and fauna during the Maralinga Tjarutja Lands Biological Survey (2001-2007).

Figure 5: Mulga dominated community on 'buckshot' soils. Note camel tracks in foreground. (Photo: J. Foulkes).

Figure 6: View looking east from the gypseous bed of Serpentine Lakes. (Photo: J. Foulkes).

Figure 7: Kopi Mallee *Eucalyptus gypsophila* on the eastern edge of Serpentine Lakes. (Photo: J. Foulkes).

Figure 8: Regenerating mallee/*Triodia* association following fire on the Anne Beadell Highway, west of Vokes Hill Corner. (Photo: J. Foulkes).

Figure 9: Marble Gum *Eucalyptus gonglyocarpa* woodland west of Vokes Hill Corner. (Photo: J. Foulkes).

Figure 10: Sparse Mulga over Bluebush in the south western corner of the Maralinga Tjarutja Lands along the Oak Valley to Tjuntjuntjara Track. (Photo: J. Foulkes).

Figure 11: Mulga run-on area with carpet of Paper Foxtail *Ptilotus gaudichaudii* east of Maralinga Village. (Photo: A. Robinson).

Figure 12: Black Oak *Casuarina pauper* woodland on limestone, a common habitat in the Maralinga Tjarutja Lands. (Photo: A. Robinson).

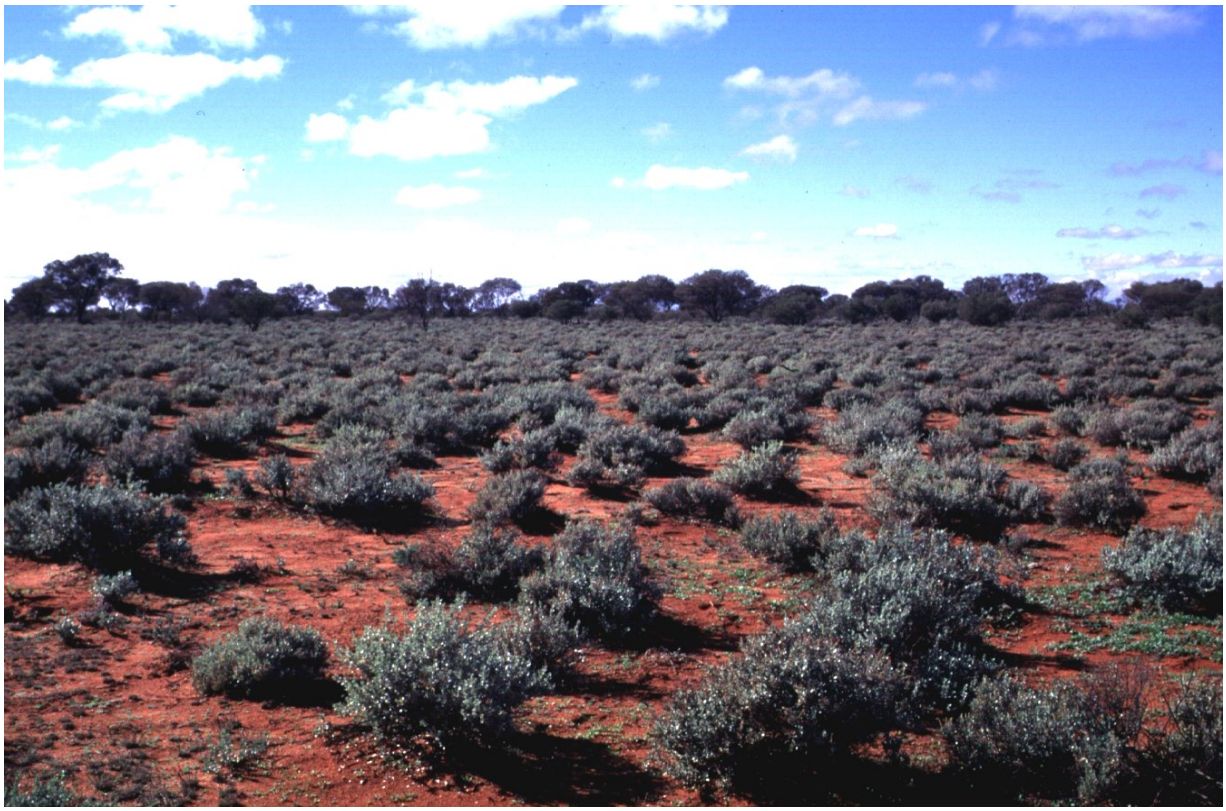

Figure 13: Bladder Saltbush *Atriplex vesicaria* low shrubland. (Photo: A. Robinson).

Figure 14: View across mallee and Mulga swale from *Triodia* dominated dune. (Photo: K. Graham).

Figure 15: Shrubland on low stony hill next to claypan near Observatory Hill. (Photo: R. Brandle).

Figure 16: Sparse Black Oak *Casuarina pauper* on breakaway near Lake Meramangye. (Photo: R. Brandle).

Figure 17: Scrub Cyprus Pine *Callitris verrucosa* woodlands are sparsely distributed in the north-western corner of the Maralinga Tjarutja Lands. (Photo: J. Foulkes).

The rationale behind these regional biological surveys has been explained in detail by McKenzie and Robinson (1987) for combined vegetation and vertebrate surveys in the semi-arid and arid zones. Biological survey work in the Maralinga Tjarutja Lands posed particular challenges and required some changes to standard arid zone survey techniques and these are outlined in the Methods. Nonetheless, like previous arid zone surveys, the biological survey of the MT Lands was designed with the following aims:

1. To observe, collect and identify the species of plants and vertebrates present in the study area in 2001-2007.

2. To document the patterns of species and communities across the study area and their relationships with recorded parameters of the physical environment.

3. To select and sample an array of fixed quadrats representing the biological diversity of the MT Lands and provide data amenable to direct ecological comparisons between quadrats. .

4. To evaluate the conservation status of species and communities typical of the MT Lands as a basis for recommending, where appropriate important areas that could be managed for conservation.

5. To provide the Sate Herbarium and South Australian Museum with collections representative of the diversity of plants and vertebrates in the study area circa 2001-2007 and to provide material for taxonomic and other scientific studies relevant to wildlife protection.

6. To consolidate, in the form of an extensive bibliography, previous biological information on the MT Lands study area within a single report.

7. To detail the biological significance of the study area in relation to the surrounding natural districts.

The theme of this study was to define 'what lived where' in the Maralinga Tjarutja Lands from 2001-2007.

METHODS

By J. N. Foulkes[1] & D. S. Thompson[1]

SITE SELECTION AND NOMENCLATURE

The fundamental concept behind all the regional surveys conducted as part of the Biological Survey of South Australia to date has been that they are based on intensive sampling at a series of sites selected to represent the biological and geographical diversity of the study area. The Maralinga Tjarutja Lands (MT Lands) are a part of the Great Victoria Desert, Nullarbor and Gawler Bioregions (Thackway and Cresswell 1995). Sites were also spaced to give as wide a geographic coverage as possible. These ideal sampling procedures were significantly influenced in the MT Lands by the limited vehicle access to many areas and the necessity to gain access approvals to survey sample sites with the traditional owners.

A map of preferred survey site locations was sent to the Maralinga Tjarutja office in Ceduna where the appropriate people were identified and then consulted regarding the possibility of access to these locations. No places of a sensitive or sacred nature were included. A representative group of Anangu then travelled to the location (if accessible) with the Land Management Officer from Oak Valley and the Survey Coordinator (JNF). This group then selected sites, including the camp-site, based on vegetation associations and cultural accessibility (Figure 23).

Some sites were approved but had strictly defined boundaries due to culturally sensitive sites in the vicinity. On a few occasions, the site location preferred by the survey biologists, was not approved by traditional owners due to the locations proximity to sites of significance, or cultural activities taking place in the area. In these instances, alternative locations were selected. Over the 7 years of the survey from the 18 camp sites chosen, 160 quadrats were sampled (Figure 18, Table 1).

Camps are named after geographical features in their vicinity and are referred to with two or three letter abbreviations e.g. WYO refers to Lake Wyola; VOK refers to Vokes Hill (see Table 1). At each camp a "cluster" of between 8 and 10 quadrats were selected to represent the major habitat types present within a practical working distance (up to 25 km).

Table 1: Survey dates, cluster code and campsite details for locations sampled on the Maralinga Tjarutja Lands Biological Survey between 2001 and 2007.

Survey Dates	Cluster Code	Campsite Name
May 2001	OAK	Oak Valley
April 2002	VOK1	Vokes Hill (east)
April 2002	WAL	Waldana Well
April 2003	TAL	Tallaringa
April 2003	EMU	Emu Junction
April 2004	WYO	Lake Wyola
September 2004	MAU	Lake Maurice
September 2004	MAR1	Maralinga (west)
April 2005	TJU1	Tjuntjuntjara Track (west)
April 2005	TJU2	Tjuntjuntjara Track (east)
November 2005	DIN	Dingo Flat Gate
November 2005	IGY	Igy Corner
April 2006	MER	Lake Meramangye
April 2006	OBH	Observatory Hill
September 2006	SER	Serpentine Lakes
September 2006	VOK2	Vokes Hill (west)
September 2007	MAR2	Maralinga (east)
September 2007	DEY	Lake Dey Dey

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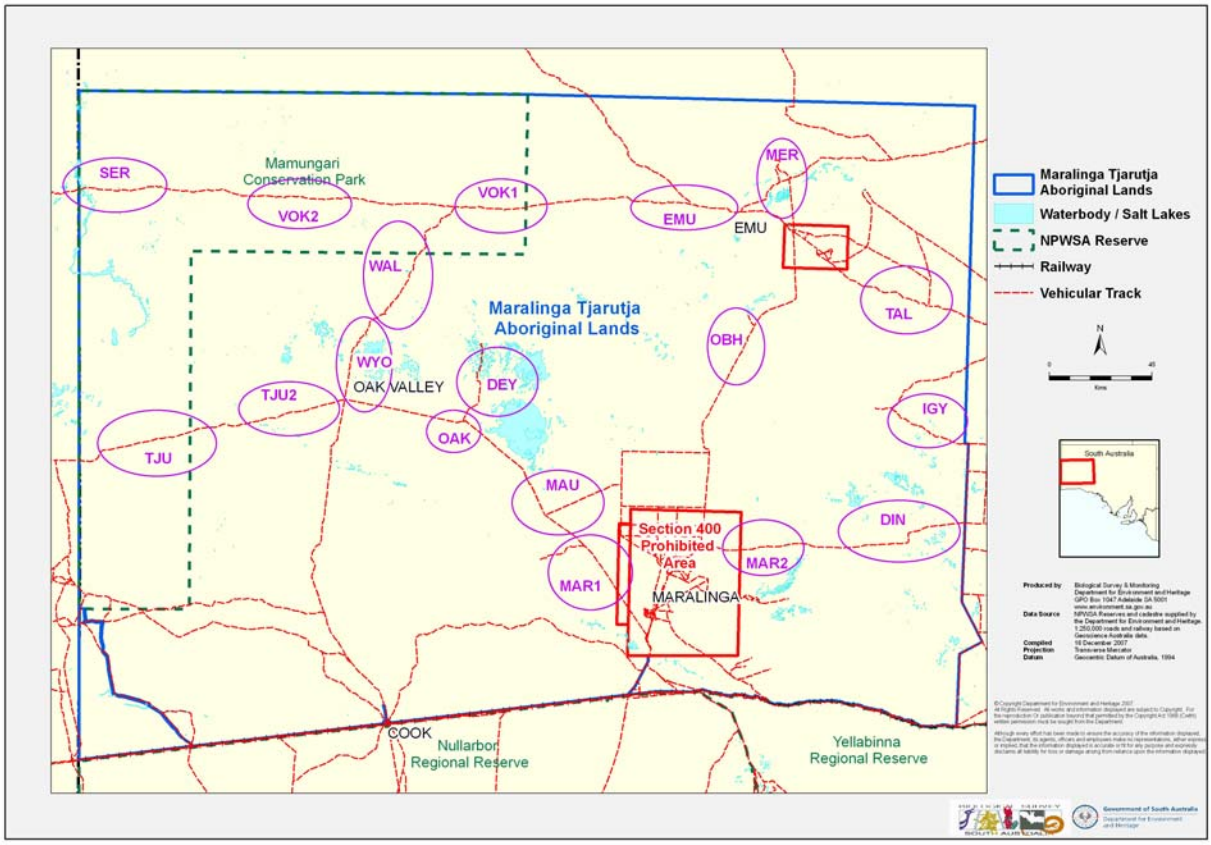

Figure 18: Location of areas sampled in the Maralinga Tjarutja Lands during this survey and their site cluster prefix.

SAMPLING TEAMS

Because of the size and biological complexity of the Maralinga Tjarutja Lands 18 campsites were covered in over 12 separate survey trips. Two trips were primarily aimed at obtaining data for vegetation mapping. These two trips involved a moving camp and, while contributing some extra quadrat-based data, they added significantly to the set of opportunistic records.

The Anangu survey team generally comprised between 2 and 4 people, who stayed for varying durations during the survey. In total 15 Anangu participated in the surveys with all of these Anangu having worked on two or more surveys or site clearance trips (Figure 21, 22).

Where possible, DEH survey team members visited Anangu school children at Oak Valley to show some of the animals caught on the survey (Figure 24)

DATA COLLECTION

Vegetation

At each quadrat the primary habitat 'patch' type was surveyed for vegetation over an approximate 100 m x 100 m area consistent with the methods section in the *Guide to a Native Vegetation Survey: Using the Biological Survey of South Australia* (Heard and Channon 1997).

After defining the parameters of the primary habitat patch type over the 1 km^2 quadrat, the botanist had the responsibility for defining secondary patches as well as sampling and numbering them (up to 3 patches were sampled in particularly diverse areas). The approximate location and extent of each patch type was drawn onto a quadrat map. Photopoints were taken at all patches, and the primary patch was marked with permanent photopoint posts. Interesting plant species which were observed outside of patches and quadrats were recorded as opportunistic records with precise location details for inclusion into the opportune database.

At each camp area a representative collection of all species was vouchered, pressed and dried (Figure 30), for later verification and retention at the Plant Biodiversity Centre. All data collected was entered into the Biological Survey of South Australia 'Survey Database' which is located and maintained at the Department for Environment and Heritage.

Fauna

Fauna sampling took place at all eight of the primary patch types at each site except where extra vegetation quadrats were introduced. A detailed description of the fauna survey methods can be found in *Guidelines for Vertebrate Surveys in South Australia: Using the Biological Survey of South Australia* (Owens 2000).

Sampling at each quadrat involved establishing two sets of pitfall trap-lines consisting of six pits (38 cm deep, 15 cm diameter), 10 m apart and joined by 50m of 30cm high flywire drift-fence (Figure 26). The two trap-lines were separated by at least 200m. These were then used for trapping ground-dwelling vertebrates and macro-invertebrates over four nights. Associated with each pitfall trap-line was a line of 15 baited metal box treadle traps (Elliott Scientific Equipment type A) (Figure 25) and two baited wire cage treadle traps (15 cm x 15 cm x 50 cm). Elliott traps were baited with a mixture of peanut butter and rolled oats. Where the landform and rock was unsuited for full pitfall traps, shallower pits were used. At these sites greater physical search effort and more spotlighting was used to compensate for decreased trap effort.

Birds were sampled through one-hour search efforts in the primary patch type. For the first half-hour a 1 km transect was walked and all birds recorded as either on or off-transect. Species observed in adjacent habitat patches were assigned that patch number. The second half-hour enabled other sectors of the quadrat to be searched. This method was used twice at each primary patch type, in the early morning and late afternoon.

Four nights trapping and one to two hours of searching at each quadrat were used to survey mammals and reptiles. Attempts were made to check all traps twice a day, particularly in hot weather. Searching involved lifting rocks, branches and other objects, raking leaf litter, digging up burrows and recording tracks, scats, bones, skin, fur and bird of prey pellets. Other predator scats were also collected for analysis.

Attempts were made to sample the bat fauna on systematic basis using strategically positioned harp traps (Figure 28) and mist nets. An attempt to systematically sample bat relative abundance was made using Anabat recorders placed at each quadrat (Figure 29). Records were then compared against reference call for each species where available. A high proportion of calls could not be identified due to their short duration, similarity to those of other species or lack of local reference calls. Bat calls were recorded from all survey clusters, however the calls from IGY and DIN clusters were lost.

Hollow trees were also checked for fauna, their signs and bone deposits. Separate quadrat datasheets were filled out for each day of sampling and for each discipline even when no captures were made. Any fauna observed off quadrat was recorded along with an accurate location as opportune records.

At most sites, representative specimens were collected and vouchered for each species recorded at each camp (Figure 27). Usually a male and a female of each species were collected for positive species determination and lodgement with the South Australian Museum. This is a particularly critical part of fauna surveys in remote locations where many species' distributions and taxonomy are not well defined. Species which were difficult to identify (e.g. *Lerista* spp. and *Ctenotus* spp.) were collected in greater numbers to gain representative animals for those locations.

Table 2: Trapping and spotlighting effort for fauna within each cluster of sites during the Maralinga Tjarutja Lands Biological Survey between 2001 and 2007.

Survey Dates	Campsite Name (Cluster Code)	Pit Trap Nights	Elliott Trap Nights	Cage Trap Nights	Spotlight Hours	Mist-net Hours	Harp Trap Nights
May 2001	Oak Valley (OAK)	60	150	20	6	5	10
April 2002	Vokes Hill (VOK1)	96	240	32	8	0	12
April 2002	Waldana Well (WAL)	96	240	32	10	0	10
April 2003	Tallaringa (TAL)	96	240	32	8	0	10
April 2003	Emu Junction (EMU)	108	270	32	8	8	15
April 2004	Lake Wyola (WYO)	144	360	48	12	0	20
September 2004	Lake Maurice (MAU)	108	270	36	8	2	16
September 2004	Maralinga (MAR1)	108	270	36	9	1	16
April 2005	Tjuntjuntjara Track (TJU1)	108	270	36	7	10	20
April 2005	Tjuntjuntjara Track (TJU2)	108	270	36	6	0	20
November 2005	Dingo Flat Gate (DIN)	108	270	36	6	0	15
November 2005	Igy Corner (IGY)	108	240	36	6	0	15
April 2006	Lake Meramangye (MER)	96		32	6	0	9
April 2006	Observatory Hill (OBH)	96	240	32	7	0	9
September 2006	Serpentine Lakes (SER)	108	270	36	7	0	18
September 2006	Vokes Hill (VOK2)	108	270	36	8	3	20
September 2007	Maralinga (MAR2)	96	240	28	6	0	20
September 2007	Lake Dey Dey (DEY)	108	270	36	5	0	16
TOTAL		**1860**	**4650**	**620**	**133**	**29**	**123**

Table 3: Total number of individual observations of plants and animals from quadrats and opportune locations during the survey.

TAXON	Quadrats	Opportune	TOTAL
Plants	5,662	736	6,398
Mammals	3,612	780	4,392
Birds	11,844	3,123	14,967
Reptiles	3,863	3,534	4217
TOTAL	24, 981	5,173	30,154

Trapping effort for the MT Biological Survey is presented in Table 23 which details the trapping effort for each type of trap used in the standard methods in terms of trap nights (the number of traps multiplied by the number of nights for which they were open). Full details of trap effort at each site are provided along with site location information in Appendix 1. Figures 19 – 30 illustrate the range of activities undertaken and equipment used during the survey.

Study Area Definition:
The study area for this mapping project was defined by the South Australian extent of the Great Victoria Desert Interim Biogeographical Regionalisation of Australia (IBRA) Bioregion, south of the Anangu Pitjantjatjara Yankunytjatjara (APY) Lands but excluding contemporary mapping regions to the east (within the Mt Willoughby IPA) and south-east (Gawler Ranges). The mapping also included parts of the Nullarbor and Gawler Bioregions (Figure 20) that occur in the MT Lands. The mapping region also excluded cleared agricultural land in the south east of the Bioregion and five kilometres into the adjacent Eyre Peninsula IBRA Bioregion, where continuous native vegetation could be detected from enhanced satellite imagery. The vegetation mapping for the southern Great Victoria Desert revises the floristic vegetation mapping done for the Unnamed (Mamungari) Conservation Park, Tallaringa Conservation Park, the Yellabinna Region and Yumbarra Conservation Park.

Satellite Image Selection and Preparation:
For the southern mapping region, 10 suitable Landsat 7 ETM+ 'scenes' were obtained from DEH's Image and Product Services archive. The imagery used over the MT Lands is described in Table 5. These images were captured during the summer of 1999-2000, following a period of below average rainfall in the previous six to twelve months. Using imagery taken after a recognised dry period captured the landscape at a time with minimal annual and ephemeral plant growth. Imagery captured after wet periods may capture the landscape with an increase in annual and ephemeral plant growth, which would result in an increase in the spectral variability on the imagery. Any increases in spectral variability would also increase the difficulty in assigning meaningful mapping groups to image classes. Due to the patchy nature of rainfall events in the South Australian arid region, edge-matching between scenes that may or may not have experienced the same rainfall events preceding the image capture would also increase the difficulty mapping over large areas after periods with higher than average rainfall. The vegetation survey data used for analysis was therefore sub-set, to reflect the dry conditions captured in the imagery, by restricting the records to only the species likely to be persistent after a prolonged dry period. As a result, only dominant perennial vegetation species within communities have been mapped as part of this project.

Table 4: Summary of satellite imagery used for southern Maralinga Tjarutja Lands vegetation mapping.

Sensor:	Scene (Path/Row):	Date Acquired:	Rectification Accuracy:
Landsat 7 ETM+	99/81	01/01/2000	11.2m
Landsat 7 ETM+	99/82	01/01/2000	16.7m
Landsat 7 ETM+	99/83	21/03/2000	16.6m
Landsat 7 ETM+	100/81	9/02/2000	8.8m
Landsat 7 ETM+	100/82	9/02/2000	14.3m
Landsat 7 ETM+	101/80	31/01/2000	26.3m
Landsat 7 ETM+	101/81	27/10/1999	29.2m
Landsat 7 ETM+	101/82	28/11/1999	24.2m
Landsat 7 ETM+	102/80	14/07/1999	22.3m
Landsat 7 ETM+	102/81	14/07/1999	23.2m
Landsat 7 ETM+	102/82	5/12/1999	17.3m
Landsat 7 ETM+	103/80	29/01/1999	18.5m
Landsat 7 ETM+	103/81	29/01/1999	12.5m
Landsat 7 ETM+	103/82	26/11/1999	12.5m
Landsat 7 ETM+	104/80	3/12/1999	19.1m
Landsat 7 ETM+	104/81	3/12/1999	28.7m
		Average Accuracy:	*18.8 m*

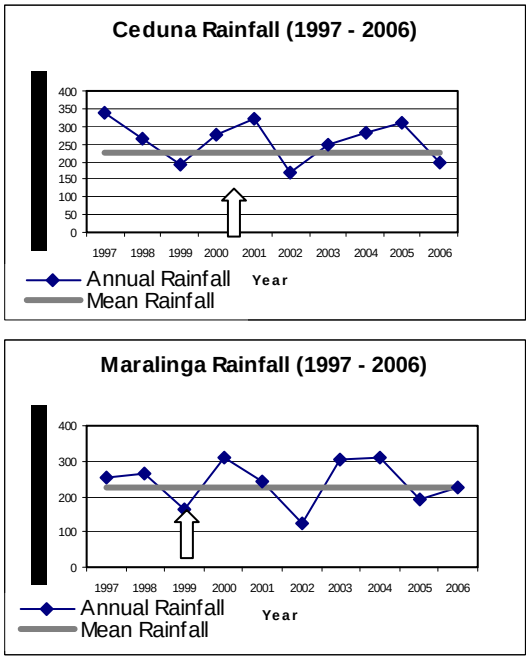

Figure 19: Summary of annual rainfall at Ceduna and Maralinga (1997-2006) Source: Bureau of Meteorology (December 2006).

The scenes used for mapping were already rectified to an average accuracy of 21 metres (between 12.5 and 29.2 metres) resulting in a spatial accuracy within that of 1:50,000 mapping accuracy standards (i.e. +/- 25m). The Ground Sampling Interval of the Landsat ETM+ sensor (or the pixel size) is equivalent to an area of 25 m x 25 m. Due to the mapping region extending across two Universal Transverse Mercator (UTM) zones – zones 52 and 53, the source scenes were reprojected using ER Mapper 7.0 to Lamberts Conformal Conic coordinate reference system, enabling a single projection across the entire mapping region. For the purposes of vegetation mapping, Bands 1 to 5 and band 7 were used.

The scenes were clipped to the vegetation mapping region, with a 5km buffer of the Great Victoria Desert, and excluding: the already mapped Anangu Pitjantjatjara Yankunytjatjara Lands, Gawler Ranges and Mt Willoughby IPA vegetation mapping regions (although a 5km buffer into these mapping regions was maintained for edge matching purposes) and cleared agricultural land in the south east of the Bioregion. The mapping boundary also included a 15km buffer into Western Australia and utilised a revision of the Great Victoria Desert / Nullarbor Plains IBRA Bioregion boundary. The GVD/NUL boundary revision was based on floristic vegetation mapping of the Nullarbor Plains, completed using the same vegetation mapping methods followed for this mapping project in November 2006, see Kenny and Thompson (2008).

Satellite Image Classification:

The resulting clipped images were then processed using ER Mapper 7.0 and an ISO Unsupervised Classification tool to simplify the multi-spectral data (6 bands per scene) to a single band with a user-defined number of separate image classes, based on spectral differences within the scene. The number of classes for each scene was determined by ascertaining the size of the clipped scene and the homogeneity of both the vegetation and geomorphology on the scene. The unsupervised classification outputs were converted to ESRI GRID raster format using the 'Raster to other Format' tool in ArcGIS ArcToolbox.

The classified raster datasets were then split into five separate raster subsets, based on a re-interpretation of the three southern Great Victoria Desert IBRA Subregions; GVD 3 – Maralinga, GVD 5 Tallaringa and GVD 6 – Yellabinna, and including a GVD – Nullarbor Plain Bioregion transition region and a GVD – Gawler Bioregion transition region. Splitting the clipped images to these subregion and transition region subsets helped increase the accuracy of class attribution between areas with often quite different biogeography, reflected in the different structural floristic vegetation communities. Although some southern GVD4 – Kintore Subregion fell into the north-west of the mapping region, this subregion was processed as a part of the GVD3 Subregion due to the lack of vegetation survey quadrats within that Subregion within the mapping study area boundary. The GVD – Nullarbor Plain Bioregion transition region was defined as part of the Nullarbor Plains vegetation mapping project. The GVD – Gawler Bioregion transition region was defined from Department for Water, Land and Biodiversity Conservation (DWLBC) Pastoral Program's land system mapping.

Vegetation Survey Data Collection:

There have been previous biological surveys conducted, or currently in progress, within the southern extent of the Great Victoria Desert Bioregion. Vegetation survey data collected as part of these biological surveys contributed most of the data used for the vegetation mapping analysis. These surveys include:

Biological Survey of the Sandy Deserts (Phase Two: Great Victoria Desert) (BS 94)
Biological Survey of Eyre Peninsula (BS 128)
Vegetation Survey of Pureba CP (BS 113)
Biological Survey of Yumbarra Conservation Park South Australia (BS 73)
Biological Survey of Tallaringa (BS 11)
Biological Survey of the Yellabinna Region South Australia (BS 2)
Biological Survey of the Nullarbor Plains (BS 14)

Additional standard vegetation survey sites were collected as part of a vegetation survey of the Gawler

Craton (Biological Survey 430) within the Yellabinna Regional Reserve, Yumbarra Conservation Park and in the eastern Maralinga Tjarutja Aboriginal Lands in October 2005. Some sites during this survey period were accessed by helicopter in otherwise inaccessible areas. Vegetation sites surveyed during this survey period followed the methods established for pastoral areas in the Guide to a Native Vegetation Survey using The Biological Survey of South Australia (Heard and Channon 1997). Each survey site consisted of a 100m x 100m quadrat, or equivalent area, from which the details of the vegetation and physical attributes were recorded onto standard data sheets. Sites were generally marked with a pair of star droppers, one with a numbered survey disk attached, however sites accessed by helicopter were not permanently marked. Voucher specimens were taken for each new species encountered, or where taxonomy was uncertain and submitted for identification by botanists at the State Herbarium of South Australia. Vegetation mapping sites were then entered and validated on the Biological Databases of South Australia (BDBSA) database system.

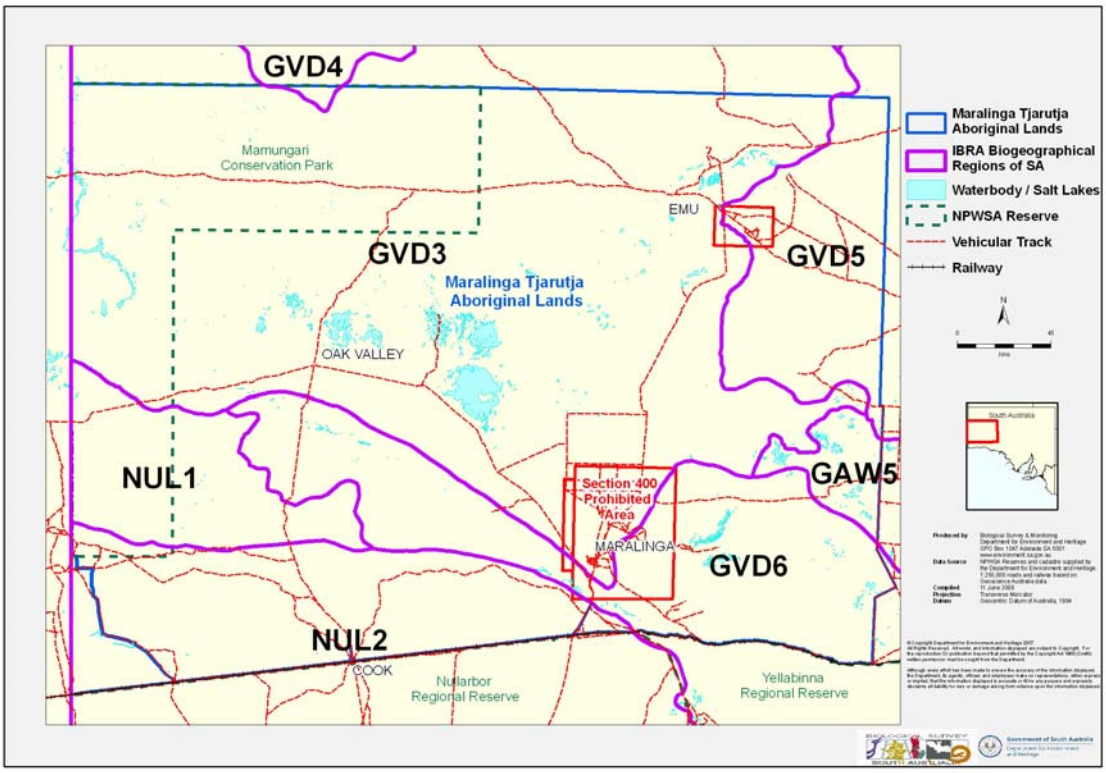

Figure 20: Map of the Maralinga Tjarutja Lands showing IBRA sub-region names and boundaries.

The combined site data comprised species information from 584 full vegetation survey sites comprises a total of 17,615 records representing 1,005 unique taxa and formed the core dataset to be prepared for vegetation analysis. The survey sites used for analysis include sites that were extracted from within a five kilometre buffer of the vegetation mapping region, to incorporate sites that may provide more information to assist in describing transitional communities between the mapping region and adjacent Bioregions.

To supplement the standard survey site data, some additional vegetation mapping sites were surveyed during the October 2005 survey period. These sites were done to increase the number of sites available for analysis and increase the spatial extent of vegetation survey sites across the mapping region. To reduce the time taken to complete a site, only perennial plant species with estimated cover abundance greater than or equal to 5% (CA codes 1 to 5) within the 100m x 100m standard quadrat and only a subset of the complete physical description attributes were recorded. The attributes collected at a standard vegetation site, as well as those collected at vegetation mapping sites (forming the minimum data requirements), are summarised in Tables 6 and 7 below.

Vegetation mapping sites were captured onto the standard plant and physical description datasheets and have been given a site identifier prefix of “VMS” plus the two initials of one observer. Vegetation mapping sites have an ascending number sequence from

"00101' though to "99901" for each observer, for each survey number. A site photograph was taken, but the sites were not permanently marked. Voucher specimens were taken for each new species encountered, or where taxonomy was uncertain, and also submitted for identification by botanists at the State Herbarium of South Australia. Vegetation mapping sites were then entered and validated on the BDBSA Survey database system. A further 64 vegetation mapping sites were surveyed using this method for the Great Victoria Desert mapping region. This data included 606 additional records, from 209 unique species.

As a result of incorporating the vegetation mapping sites, a total of 648 survey sites, 18,221 plant species records (from 1,016 unique species) were available for the vegetation data analysis for mapping purposes.

Table 5: Standard survey and vegetation mapping site physical description variables recorded.

Site Description:
*Site ID
*Latitude (decimal degrees)
*Longitude (decimal degrees)
Physical Description:
*Landform Pattern
*Landform Element
*Site Slope
*Site Aspect
*Outcrop Cover
*Outcrop Lithology
*Surface Strew Size
*Surface Strew Cover
*Surface Strew Lithology
Visit Description:
*Survey Number
*Observers x2
*Date
*Image file name
*Bare Earth Estimate
*Litter Estimate
*Visit comments
*Quadrat size

Table 6: Standard survey and vegetation mapping site plant description variables recorded.

Vegetation Patch Description:
*Species (including Lichen spp.)
*Voucher Number
*Voucher Comment
*AD (Association Dominance)
*LF (Life Form)
*CA (Cover Abundance)
*LS (Life Stage)
*Species Comments
*Assemblage Information
*SA Structural Formation

Vegetation Survey Data Analysis:
The quadrat-based vegetation data from standard vegetation biological survey sites and supplementary vegetation mapping sites were extracted from the BDBSA Survey database system. Taxonomy was updated in a stand-alone Access 97 database, and included grouping of some plant species, sub-species and synonyms. This established a list of species entities or complexes recognised for analysis purposes (refer to Appendix 1 for a listing of plant species entities/complexes used for this project). The vegetation quadrat data from these sites was then filtered for the vegetation mapping analysis. Any species with an estimated cover abundance code of less than 5% (CA codes of N and T) were excluded for this analysis. The data was further filtered to contain only perennial plant species and only ephemeral/annual species considered relevant for analysis. Species only occurring at one site were also excluded and only data from the most recent site visit, were more than one visit was recorded, was included in the analysis.

The vegetation field data was then analysed using the cluster analysis program PC-ORD, using a Sorensen (Bray-Curtis) distance measure with a Flexible Beta group linkage method (cluster flexible beta value: -0.25). The final analysis was performed on data from 646 sites, made up of 4387 records and 295 unique species/entities (from 351 unique species), with species weighted on cover abundance (CA) by a factor of 5. The vegetation analysis group number output from this analysis was attributed to a spatial layer of the survey site following a review of the sites dominant overstorey and understorey and an assessment of the sites likelihood of membership in the allocated analysis group.

Data Integration (Satellite Image and Survey Site Data Analysis):
A GIS Analyst from the Environmental Information and Analysis Branch, Environmental Information Directorate of DEH developed the tool, for determination of image classes at survey sites using Visual Basic for Desktop ArcGIS (ArcMap) 9.1. The tool extracts the frequency of classified image class values within a specified neighbourhood matrix around the point-based survey site locations of a known vegetation community type (the vegetation analysis group).

Executing the tool required two source datasets for each clipped scene: Firstly, a point-feature class (an ESRI shape-file was used) containing the vegetation survey sites, attributed with a unique site identifier, UTM zone & Map Grid of Australia 1994 (MGA94) Easting and Northing. Secondly, an ESRI GRID raster dataset exported from the ER Mapper ISO un-supervised classification output. These inputs were in

the same spatial coordinate reference system (Lamberts Conformal Conic, based on the Geocentric Datum of Australia 1994 [GDA94] was used here). The tool extracted the raster frequency values within a user-specified matrix neighbourhood around each of the survey site locations on the scene.

The neighbourhood matrix size option is specified by the user (options are 3 x 3, 5 x 5, 7 x 7 and 9 x 9). The heterogeneity (or homogeneity) of the landscape for the vegetation mapping region determine the size of the matrix selected for the spatial analysis. That is, the more complex or heterogeneous the landscape, the smaller the matrix, and conversely, the more simple or homogeneous the landscape, the larger the matrix. Due to the heterogeneity of the vegetation communities and landscape in the southern Great Victoria Desert vegetation mapping region, a matrix of 3 x 3 pixels was used (up to 50 m on the diagonal from the coordinates where the field data was collected). The tool created a comma-delimited text file containing the unique site identifier and the frequency for each image class occurring within the specified neighbourhood around the site.

Additional sites were captured using heads up digitising in ArcMap to allocate sites within mainly dry and intermittent water bodies (salt lakes and pans) within the vegetation mapping region. These sites were attributed with a default vegetation analysis group value of 999 (indicating areas of no vegetation cover) and greatly assisted in defining water-bodies as 'no vegetation' mapping class. These sites were not included within the PC-ORD cluster analysis, and used only for the analysis of site data with the classified images.

The results of the frequencies of class occurrence at survey sites were imported into Microsoft Access 97 and converted to a table. This table was then attributed with the vegetation analysis group number for each site and other site-based attributes to assist in identifying the site further (e.g., "PATCHID", "VISITNR" and "SURVEYNR") and exported to Microsoft Excel for sorting and interpretation.

Development of Vegetation Mapping Groups from Classified Satellite Imagery

The interpretation of the survey site and satellite imagery class frequency Excel table resulted in designating certain classes that correspond with the vegetation analysis groups on each scene. The satellite image classes were then attributed with the vegetation analysis group numbers, consolidating the unsupervised classification into a reduced number of vegetation mapping classes. These vegetation mapping classes were displayed on screen in ArcMap with vegetation mapping classes on adjacent scenes, and adjusted where necessary to ensure the distribution of the vegetation communities were bio-geographically accurate and also maintain a seamless transition between the scenes. The process to define the vegetation mapping classes was somewhat of an iterative process, where some fine tuning was required to allocate the final selection of classes that represented each of the vegetation community on each scene. An ArcGIS Personal Geodatabase was created with a series of tables created to reclassify each of the scene subsets. These tables were used to document the interpretation for each of the raster dataset (GRID) classes and the vegetation analysis groups that each of the raster classes was determined to represent. The reclassification of the raster datasets was then done using the ArcGIS 'Reclass by Table' tool within ArcToolbox.

For the Great Victoria Desert mapping, the classified images were split into three separate image subsets, based on a re-interpretation of three of the southern Great Victoria Desert IBRA Subregions (GVD 3 – Maralinga, GVD 5 Tallaringa and GVD 6 – Yellabinna). These Subregion datasets were attributed with the vegetation mapping groups as separate datasets.

Raster Filtering of Vegetation Mapping Classes:

Filtering tools within the ArcGIS Spatial Analyst extension were used to remove continuous cells, referred to as 'regions', of the same vegetation mapping group number that were below a combined area of 2.5 hectares (for the source Landsat imagery, this equates to 40 continuous pixels/cells). Each scene was then merged back together to compile Great Victoria Desert vegetation mapping raster dataset, using the raster mosaic tool within ArcGIS ArcToolbox. Additional filtering was undertaken by Image and Product Services Branch, Environmental Information, to produces a raster dataset with a minimum mapping unit of 10 hectares. This filtering process incorporated a routine to remove narrow, linear features less than 75m in width.

Raster to Vector Conversion:

The raster dataset was converted to vector (polygon), maintaining a 10ha minimum mapping unit, by the Image and Product Services Branch, Environmental Information. The resulting vector dataset was generalised, smoothed and attributed with standard vegetation mapping items before being produced as a final vector vegetation mapping dataset.

Spatial Analyst zonal statistics could also be used to generate polygon attributes from the corresponding raster dataset where mosaics of several vegetation mapping groups exist in the 2.5 hectare filtered raster dataset (that is, more than one >2.5 ha 'regions' representing different mapping groups, contained within one >10ha polygon).

National Vegetation Information System (NVIS):
The vegetation mapping process would also require the inclusion of the data into the National Vegetation Information System (NVIS). There are currently about 1,000 vegetation group descriptions stored within the South Australian component of this Australia wide program. It will be necessary to compare the 21 floristic group descriptions determined from the southern GVD mapping with the floristic descriptions in the NVIS database, to reduce the introduction of new codes into the NVIS System. It was found that there were *x* suitable groups existing, and these were subsequently used. Most of these existing NVIS groups came from the previous vegetation mapping within and adjacent to the southern GVD mapping region.

On completion of the mapping component of the project, databases are consolidated and documented to ensure information is easily accessible to all those who wish to access it. This involves completing all metadata records for the Oracle database and incorporating all the digital data into correct locations. The floristic mapping is kept as a regional mapping product with a layer-file generated and also incorporated into the Statewide NVIS coverage, all with relevant documentation and metadata.

Figure 21: Installing pitfall trapping line with members of Oak Valley community. (Photo: D. Hopton).

Figure 22: Survey participant from Oak Valley installing a pitfall trap near Waldana Well. (Photo: J. Foulkes).

Figure 23: Site selection trip with Anangu from Oak Valley at Waldana Well. (Photo: B. Sparrow).

Figure 24: Show and tell of lizards caught on the survey with children form Oak Valley. (Photo: D. Hopton).

Figure 25: Elliott trap on edge of spinifex hummock. Note small mammal tracks around entrance. (Photo: A. Robinson).

Figure 26: Pitfall trap line showing one of six pits and fence that joins pits. (Photo: A. Robinson).

Figure 27: Jeff Foulkes processing a reptile specimen during the survey. (Photo: A. Robinson).

Figure 28: A harp trap for catching bats set up in a gap in the canopy of a Black Oak survey site. (Photo: K. Graham).

Figure 29: Anabat recorder (yellow box) and microphone (taped to tree) set up at a survey quadrat. (Photo: J. Foulkes).

Figure 30: Plant press, plant specimen and voucher labels on work area on the side of a vehicle. (Photo: K. Graham).

RESULTS

Vegetation Mapping

By D. S. Thompson and J. N. Foulkes[1]

Introduction

Vegetation Communities

The analysis of data from 646 site survey quadrats was used to define floristic vegetation groups. The vegetation analysis groups were used as a guide to describing the vegetation mapping groups. The group numbers from the cluster analysis were assigned back to quadrats and the membership of each group was inspected by reviewing the overstorey and understorey dominants for each site, along with indicator species for the floristic analysis groups. Some site memberships were altered to better reflect the dominant overstorey and understorey species present at the quadrat, to ensure sites were matched to the appropriate group (structurally and floristically) for mapping purposes. Some groups were also split to better define communities lumped in the analysis. As a result, 29 vegetation communities were defined, and described using a combination high frequency and unique indicator plant species from the quadrats assigned with the same analysis group number.

Vegetation Mapping

The relationship between the vegetation communities and the classified Landsat ETM+ images was used to define vegetation mapping groups, based on the floristic analysis groups. From this, 24 vegetation mapping groups were defined for the region. Some vegetation mapping groups depict more than one floristic analysis group, where insufficient information was available to define separate mapping groups, for each analysis group, from the imagery classes. The relationships between floristic analysis groups and vegetation mapping groups are summarised in Table 7 and are described later. Most vegetation mapping group descriptions follow the vegetation community names refined as an output of the floristic analysis. However, the floristic groups are described under the corresponding vegetation mapping group where more than one floristic analysis group is represented by a single mapping group. Two analysis groups were not mapped in the final filtered raster dataset. These groups are described later).

Table 7: The relationship between floristic analysis and vegetation mapping groups.

Analysis Group	Mapping Group
1	12
2	13
22	16
23	5
24	11
25	21
28	12
34	5
35	*Not Mapped*
38	15
39	3
45	4
47	10
48	1
50	14
51	20
53	17
54	8
55	10
100	1
112	2
113	9
115	6
117	20
122	12
267	7
332	3
400	*Not Mapped*
450	18

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Previous Vegetation Mapping:
There have been previous vegetation mapping work undertaken within, and adjacent to, the mapping region defined for this project. The southern Great Victoria Desert mapping supercedes the floristic vegetation mapping done for the Unnamed (Mamungari) Conservation Park by the Ecological Survey Unit (1979) [cited in Greenslade *et al.* (1986)], Tallaringa Conservation Park mapping refer to Robinson *et al.* (1988), the Yellabinna Region mapping in Copley and Kemper (1992) and Yumbarra Conservation Park mapping see Owens *et al.* (1995). Mapping groups from these regions that are relevant for this mapping project are discussed below.

Unnamed (Mamungari) Conservation Park Mapping (Ecological Survey Unit 1979)
Mapping undertaken by the Ecological Survey Unit for the Mamungari (then the Unnamed) Conservation Park was restricted within the park boundary and was captured at a scale of 1:250,000. The mapping was derived from colour Landsat images composites onto clear mylar before being digitised to a GIS coverage. This mapping identified 11 vegetation communities, all of which were relevant to this mapping project, and are listed below.

1 *Eucalyptus gongylocarpa* open woodland/*Acacia aneura* woodland.
2 *Eucalyptus gongylocarpa* open woodland
3 *Brachychiton gregorii/Codonocarpus cotinofolius* open woodland
4 *Duboisia hopwoodii* tall shrubland
5 *Eucalyptus gonglyocarpa* open woodland dune communities without typical swale associations)
6 *Eucalyptus* spp. Tall shrubland/*Acacia aneura* woodland.
7 *Casuarina cristata* [*pauper*] woodland
8 *Casuarina cristata* [*pauper*]/ *Acacia aneura* woodland with *Maireana sedifolia* understorey.
9 *Acacia ligulata* tall shrubland
10 *Maireana sedifolia* low shrubland

Tallaringa Vegetation Mapping (Robinson *et al*. 1988)
The Robinson *et al.* (1988) mapping was completed for 1:100,000 topographic mapsheets corresponding with the Tallaringa Conservation Park. Mapping in this study was captured onto clear mylar at scale of 1:100,000, using black and white aerial photograph mosaics to delineate vegetation groupings, then digitised to a GIS coverage. The vegetation community descriptions were derived from survey site data and PATN analysis to identify groups with a combination high frequency and unique plant species. This mapping identified 10 vegetation communities, all of which were relevant to this mapping project, and are listed below.

1. *Acacia aneura/Maireana villosa* Tall Open Shrubland
2. *Acacia aneura/Monocather paradoxa* Tall Open Shrubland
3. *Senna artemisioides/Dodonaea microzyga* Low Open Shrubland
4. *Acacia ramulosa* Tall Open Shrubland
5. *Senna artemisioides* ssp. *petiolaris* Tall Open Shrubland
6. *Scleroleana diacantha/Maireana erioclada* Low Open Shrubland
7. *Eragrostis falcata/Zygophyllum eremaeum* Open Herbland
8. *Tecticornia indica* ssp. *leiostachya* Low Shrubland
9. *Myoporum platycarpum* Low Open Woodland
10. *Acacia papyrocarpa* Low Open Woodland

Yellabinna Region Vegetation Mapping (Copley and Kemper 1992)
Mapping undertaken for the Yellabinna Region was undertaken for 22 disconnected 1:50,000 map-sheets, corresponding with survey site groupings. The mapping was derived from colour aerial photography (1:40,000 and 1:87,000 scale) and re-interpreted onto 1:100,000 ortho-photo maps before being digitised to a GIS coverage. The vegetation community descriptions were derived from an analysis of structural description and character plant species from survey site data. This mapping identified 21 vegetation communities, 20 of which were relevant to this mapping project, and are listed below.

17 *Casuarina pauper, Myoporum platycarpum* Low open woodland
19 *Acacia papyrocarpa, Maireana sedifolia* Low open woodland
21 *Acacia tetragonophylla* Very low open woodland
8 *Eucalyptus trivalvis, Acacia aneura* Mallee
9 *Eucalyptus socialis, Triodia scariosa* Mallee
11 *Eucalyptus leptophylla, Triodia lanata* Mallee
15 *Eucalyptus socialis, Acacia gilesiana* Mallee
23 *Eucalyptus incrassata, Eucalyptus yumbarrana* Mallee
16 *Eucalyptus eremicola, Triodia scariosa* Open mallee
22 *Eucalyptus brachycalyx, Geijera linearifolia* Open mallee
7 *Eucalyptus youngiana, Triodia irritans* Low mallee

10 *Eucalyptus pimpiniana* Open low mallee
14 *Cassia nemophila* var. *platypoda* Tall open shrubland
13 *Acacia ramulosa, Dicrastylis beveridgei* var. *lanata* Tall open shrubland
6 *Geijera linearifolia, Dodonaea viscosa* ssp. *angustissima* Tall open shrubland
12 *Leptospermum coriaceum, Bossiaea walkeri* Open shrubland
1 *Tecticornia halocnemoides, Disphyma crassifolium* Low shrubland
3 *Atriplex vesicaria* Low shrubland
5 *Stipa drummondii, Danthonia caespitosa* Open tussock grassland
4 *Sclerolaena obliquicuspis, Tetragonia eremaea* Open herbland

Yumbarra Conservation Park Vegetation Mapping (Owens *et al.* 1995)
Mapping was undertaken for eight 1:100,000 map-sheets corresponding with the Yumbarra Conservation Park. The mapping was captured at a scale of 1:100,000, derived from a combination of 1:50,000 and 1:100,000 black and white aerial photograph mosaics supplemented by 1:40,000 and 1:80,000 (approx.) colour aerial photographs. Mapping was delineated onto clear mylars before being digitised to a GIS coverage. The vegetation community descriptions for the Yellabinna region provided the basis for this mapping project but were derived from field checking and a PATN analysis of survey site data. This mapping identified 11 vegetation communities, 10 of which were relevant to this mapping project, and are listed below.

11 *Eucalyptus brachycalyx* Open mallee
8 *Eucalyptus oleosa* Open mallee
12 *Eucalyptus yumbarrana* Open low mallee
6 *Eucalyptus leptophylla* over *Triodia lanata* Open low mallee
7 *Dodonaea viscosa* ssp. *angustissima, Acacia ramulosa* Tall open shrubland
9 *Geijera linearifolia, Dodonaea viscosa* ssp. *angustissima* Tall open shrubland
4 *Eucalyptus youngiana, Triodia irritans* Open shrubland
1 *Tecticornia lylei, Darwinia salina* Low open shrubland
2 *Sclerolaena obliquicuspis* Low open shrubland
3 *Stipa drummondii, Danthonia caespitosa* Open (tussock) grassland

The bioregion-based area mapped used for this project has also been clipped to accommodate contemporary vegetation mapping. This includes vegetation mapping to the north-east, refer to the Mt Willoughby IPA mapping (Brandle *et al.* 2005), to the north, see the Anangu Pitjantjatjara Yankunytjatjara Lands mapping (Robinson *et al*. 2003), and to the south-east, see the Gawler Ranges mapping, (Hudspith *et al.* 2001). A five-kilometre buffer has been established into these contemporary mapping regions, for future edge-matching purposes. Mapping groups from these regions that are relevant for this project are discussed below.

Mt Willoughby IPA Vegetation Communities (**Brandle *et al.* 2005)**
Mapping was undertaken for a 10km buffer of the Mt Willoughby IPA and was captured at a nominal scale of 1:100,000, however spatial accuracy is considered closer to 1:50,000 (+/-25m). The mapping was derived from Landsat ETM+ imagery and survey site data using the methods followed for the southern Great Victoria Desert mapping. This mapping identified 9 vegetation communities occurring across the Stony Plains and Great Victoria Desert Bioregions encompassed by the IPA, 4 of which were relevant to this mapping project, and are listed below.

4 *Acacia ramulosa*, +/- *Acacia aneura* Tall shrubland
5 *Acacia aneura* complex Shrubland.
6 *Eremophila freelingii*, +/- Emergent *Acacia aneura* complex Shrubland
3 *Atriplex vesicaria*, +/- *Eremophila rotundifolia* and *Senna artemisioides* Low shrubland

Anangu Pitjantjatjara Yankunytjatjara Lands Mapping (Robinson *et al.* 2003)
Mapping was undertaken within the Anangu Pitjantjatjara Yankunytjatjara Lands at a scale of 1:250,000. The mapping was derived from a classification of Landsat TM imagery and analysis of survey site data. Some additional riparian communities were mapped by buffering GeoScience Australia 1:250,000 drainage features before being with the derived vegetation mapping using GIS. This mapping identified 16 vegetation communities, 4 of which were relevant to this mapping project, and are listed below.

5 *Acacia ramulosa, Acacia ligulata, Grevillea stenobotrya, Grevillea juncifolia* Tall open shrubland
6 *Triodia basedowii* Open hummock grassland +/- emergent *Eucalyptus* spp.
7 *Acacia aneura* var. *aneura, Acacia minyura* Low open woodland over tussock grasses
1 *Atriplex vesicaria* +/- *Maireana* spp. +/- Samphire spp. Low open shrubland

Gawler Ranges Vegetation Communities (Hudspith *et al.* 2001)
Mapping was undertaken for two full and two partial 1:100,000 map-sheets corresponding with the Gawler Ranges National Park. The mapping was captured at a scale of 1:100,000, derived from 1:40,000 colour aerial photographs and transferred to 1:100,000 hard copy colour Landsat geo-rectified maps. The mapping was transferred onto clear mylar 1:100,000 maps before being digitised to a GIS coverage. This mapping identified 20 vegetation communities, 12 of which were relevant to this mapping project, and are listed below.

10 *Acacia papyrocarpa* over +/- *Atriplex vesicaria* and/or *Maireana sedifolia* Low woodland
15 *Casuarina pauper* Low woodland
14 *Callitris preissii* +/- *Callitris glaucophylla* +/- *Callitris verrucosa* Low open woodland
16 *Acacia aneura* over *Ptilotus obovatus* Very low open woodland
12 *Eucalyptus oleosa* +/- *Eucalyptus gracilis* +/-*Eucalyptus brachycalyx* over *Eremophila scoparia* +/- *Cratystylis conocephala* Mallee
13 *Eucalyptus incrassata* +/- *Eucalyptus socialis* over *Melaleuca uncinata, Leptospermum coriaceum, Calytrix involucrata* and/or *Triodia lanata* Open mallee
5 *Acacia ligulata* +/- *Dodonaea viscosa* ssp. *angustissima* +/- *Alectryon oleifolius* Tall closed shrubland
2 *Tecticornia indica* ssp. *leiostachya* Low shrubland
7 *Atriplex vesicaria* +/- *Maireana sedifolia* +/- emergent *Alectryon oleifolius* Low shrubland
8 *Maireana sedifolia* +/- *Atriplex vesicaria* +/- emergent *Alectryon oleifolius* Low shrubland
6 *Stipa* spp. +/- emergent *Alectryon oleifolius* Open tussock grassland
9 *Carrichtera annua* +/- *Stipa* spp. +/- *Sclerolaena* spp. +/- emergent *Alectryon oleifolius* Herbland

The mapping region for the southern Great Victoria Desert was also mapped in conjunction with two other adjacent vegetation mapping regions; the Nullarbor Plains refer to Kenny and Thompson (2008) and the western Gawler Bioregion see Kenny (2008.). Mapping groups from these regions that are relevant for this mapping project are discussed below.

Nullarbor Plains Bioregion Vegetation Communities (Kenny and Thompson (2008))
Mapping was undertaken for the Nullarbor Plains Bioregion, captured at a scale close to 1:50,000 mapping standards, but nominally at 1:100,000. The mapping was derived from Landsat ETM+ imagery and survey site data using the same methods outlined under the methods chapter in this report. This mapping identified 22 vegetation communities, 8 of which were relevant to this mapping project, and are listed below.
NB: A Great Victoria Desert – Nullarbor Plains transition region mapped as part of the Nullarbor Plains project has been remapped for the Maralinga Tjarutja Lands project.

1 *Acacia papyrocarpa* over *Cratystylis conocephala, Atriplex vesicaria Tecticornia* spp. /*Tecticornia* spp. Very Low Woodland
2 *Acacia tetragonophylla / Pittosporum angustifolium* over *Cullen cinereum* Very Low Woodland
3 *Casuarina pauper / Acacia aneura* complex over Senna artemisioides ssp. Low Woodland
4 *Eucalyptus brachycalyx / E. oleosa* +/- *Acacia papyrocarpa* over *Eremophila scoparia* Open Mallee
5 *Eucalyptus concinna* and/or *E. socialis or Eucalyptus yumburrana* ssp. *yumburrana* over *Triodia scariosa* or *Triodia lanata* and/or *Triodia irritans* Open Mallee over Open Low Mallee
6 *Eucalyptus oleosa* ssp. *ampliata* over *Cratystylis conocephala* and *Maireana erioclada* Open Mallee
9 *Acacia ligulata* or *Acacia ramulosa* or *Acacia aneura* complex over *Dodonaea viscosa* ssp. *angustissima* Tall Open Shrubland
14 *Eriochiton sclerolaenoides* +/- *Sclerolaena obliquicuspis* over +/- *Eriochiton sclerolaenoides* +/- *Enneapogon cylindricus* +/- emergent *Atriplex vesicaria* Low Shrubland

Western Gawler Bioregion Vegetation Communities (Kenny (2008))
Mapping was undertaken for the western Gawler Bioregion, derived from Landsat ETM+ imagery and survey site data and pastoral assessment site data using the same methods outlined under the Methods chapter in this report. The final raster mapping product is at a scale better than 1:100,000 mapping accuracy standards. This mapping identified 25 vegetation communities, n of which were relevant to this mapping project, and are listed below.

6 *Casuarina pauper* +/- *Acacia papyrocarpa* +/- *A. aneura* complex +/- *Alectryon oleifolius* ssp. *canescens* +/- *Santalum acuminatum* over *Maireana sedifolia, Atriplex vesicaria* ssp. +/- *Enchylaena tomentosa* var. *tomentosa* Low Open Woodland
10 *Acacia aneura* complex over *Aristida contorta* +/- *Eragrostis eriopoda* +/- *Maireana georgei* +/- *Ptilotus obovatus* var. *obovatus* +/- *Monachather paradoxa* Very Low Open Woodland
11 *Acacia aneura* complex over *Maireana sedifolia* +/- *Ptilotus obovatus* var. *obovatus* +/- *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. +/- *Aristida contorta* Very Low Open Woodland

15 *Acacia ligulata, A. ramulosa* var., *Senna artemisioides* ssp. *petiolaris*, *Dodonaea viscosa* ssp. *angustissima* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Eucalyptus socialis* over *Enchylaena tomentosa* var. *tomentosa, Austrostipa* spp. +/- *Aristida contorta* +/- *Aristida holathera* var. *holathera* +/- *Enneapogon* spp. Tall Open Shrubland

This current vegetation mapping of the southern Great Victoria Desert provides the most comprehensive vegetation mapping of this area available. The mapping is nominally at the scale of 1:250 000, and it is envisaged that the derived vector dataset will be within the mapping accuracy standards for this scale. However, the Landsat ETM+ imagery used to obtain this classification has a pixel size of 25m and an average spatial accuracy of 21m. As a result, the raster filtering and vector generalisation processes introduce greater error to the spatial accuracy. For any detailed work using this vegetation mapping data it is recommended the raster dataset is used. Mapping accuracy for this layer exceeds the parameters of 1:100,000 mapping accuracy standards (+/-50m) and incorporates additional areas delineated as different mapping groups that will be filtered in the vector dataset.

Detailed Description of the Vegetation Mapping and Floristic Analysis Groups

The following section details each vegetation mapping group and the floristic analysis groups, where the mapping group represents more than one vegetation community. Mapping groups have been renumbered to reflect the order they are presented here while floristic analysis group numbers follow the numbers assigned by PC-ORD. The groups are described by order of structural formation and then alphabetically by the dominant overstorey species.

Mapping Group

- Group number and dominant vegetation description
- General description including landform and distribution
- % of area mapped
- Relationship to floristic groups and IBRA sub-regions
- Floristic group number (including a description where the mapping group represents more than one vegetation community)
- Number of quadrats in Group
- Landform
- Vegetation Structure
- Indicator plant species: define the group because of their abundance and/or their uniqueness
- A photograph depicting a typical quadrat for each group.

NB: Quadrat names (Survey Number, Site ID, Patch ID, Visit Number and Visit Date) for each group are listed in Appendix 2.

Table 8: Cover abundance categories and descriptions (after Braun-Blanquet (1956)).

CA	Cover Abundance Description
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

WOODLANDS

GVD Mapping Group 1

Acacia aneura complex over *Eremophila latrobei* ssp. *glabra* +/- *Acacia tetragonophylla* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus* spp., *Eragrostis eriopoda, Aristida contorta, Monachather paradoxa* Low Open Woodland

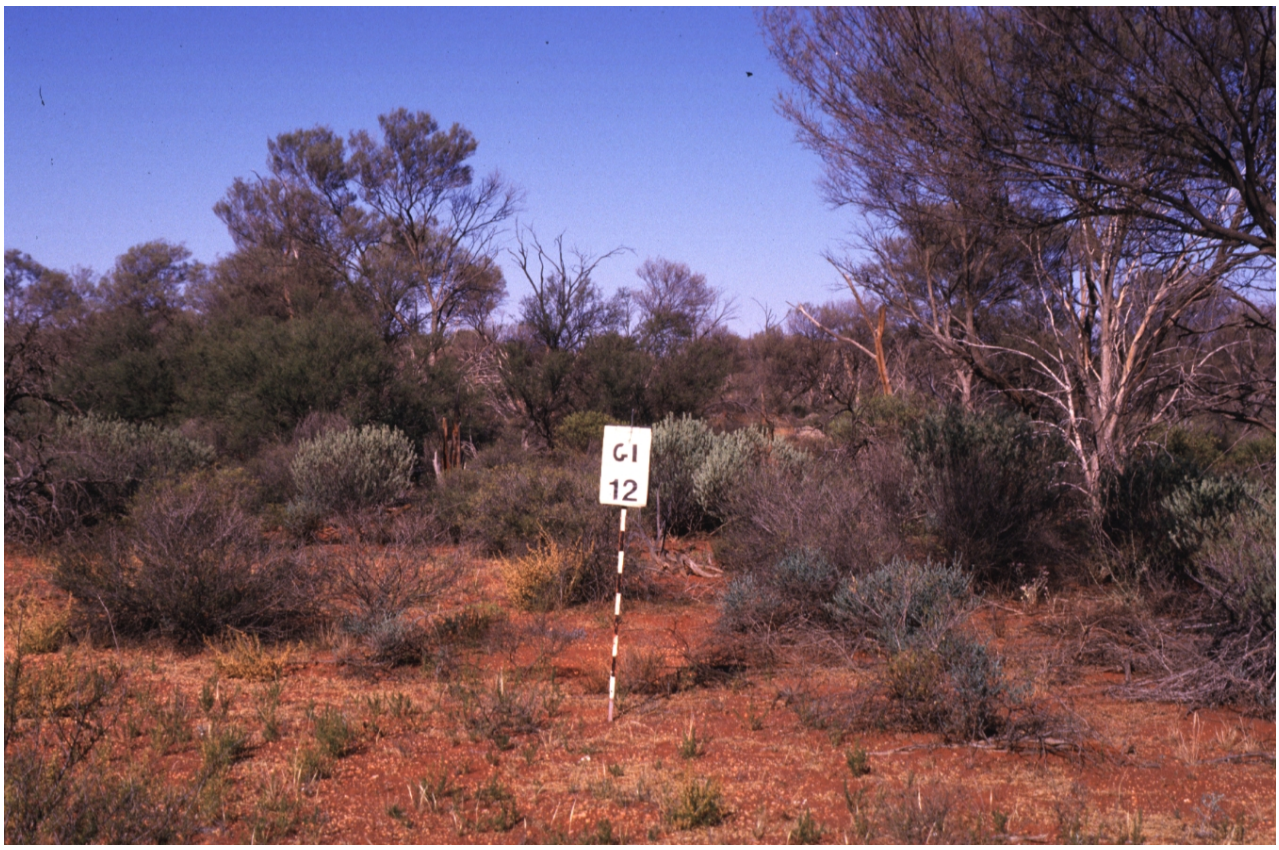
A dominant vegetation community of the sand plains of the Great Victoria Desert, particularly in the Tallaringa sub-region (GVD 5) and to a lesser extent the Maralinga sub-region (GVD 3). Restricted to some inter-dune areas in the north and east of Yellabinna sub-region (GVD 6) and the transition into the Gawler Bioregion.

Area mapped as Group 1 = 35,988 km^2 (34.1%)
This mapping class relates to the GVD floristic groups 48 and 100.

Floristic Group 48 (n=69)
Acacia aneura complex over *Eremophila latrobei* ssp. *glabra*, *Ptilotus polystachyus* var. *polystachyus*, *Ptilotus obovatus* var. *obovatus*, *Eragrostis eriopoda*, *Aristida contorta*, *Monachather paradoxa* Low Open Woodland
Landform: Plain (inc undulating plain) (26), sandy plain (12), swale (9), closed depression (7), inter-dune corridor (4), dune crest (2), dune/consolidated dune (2) stony plain (2), dune slope, ridge, not recorded (3)
Vegetation Structure: Low Open Woodland (13), Very Low Open Woodland (8), Low Woodland (4), Tall Open Shrubland (3), Very Low Open Forest (2), Very Low Woodland (2), Open (Tussock) Grassland, Tall Shrubland, not recorded (35)
Indicator species: *Eragrostis eriopoda*, *Eremophila latrobei* ssp. *glabra*, *Acacia aneura* complex, *Ptilotus polystachyus* var. *polystachyus* and *Ptilotus obovatus* var. *obovatus*

Quadrat EMU00901

Floristic Group 100 (n=11)
Acacia tetragonophylla over *Senna artemisioides* ssp. *petiolaris*, *Aristida contorta* +/- *Eragrostis* spp., emergent *Acacia aneura* complex Tall Open Shrubland
Landform: Plain (including undulating plain) (4), closed depression (4), dune/consolidated dune, ridge, stony plain
Vegetation Structure: not recorded (11)
Indicator species: *Acacia tetragonophylla*, *Eragrostis falcata* and *Boerhavia diffusa (NC)*



Quadrat GI01202

GAW Mapping Group 11

Acacia aneura complex over *Maireana sedifolia* +/- *Ptilotus obovatus* var. *obovatus* +/- *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. +/- *Aristida contorta* Very Low Open Woodland

Jessup (1951) noted that the presence of *Maireana sedifolia* appears only to grow where less than 60cm of sand overlies the substrata. *Atriplex vesicaria* appears where the overlying sand is deeper (up to 1 metre) and where the sand becomes deeper, then both bushes are absent and the community becomes the *Acacia aneura* complex over tussock grasses described in Floristic Group 1.

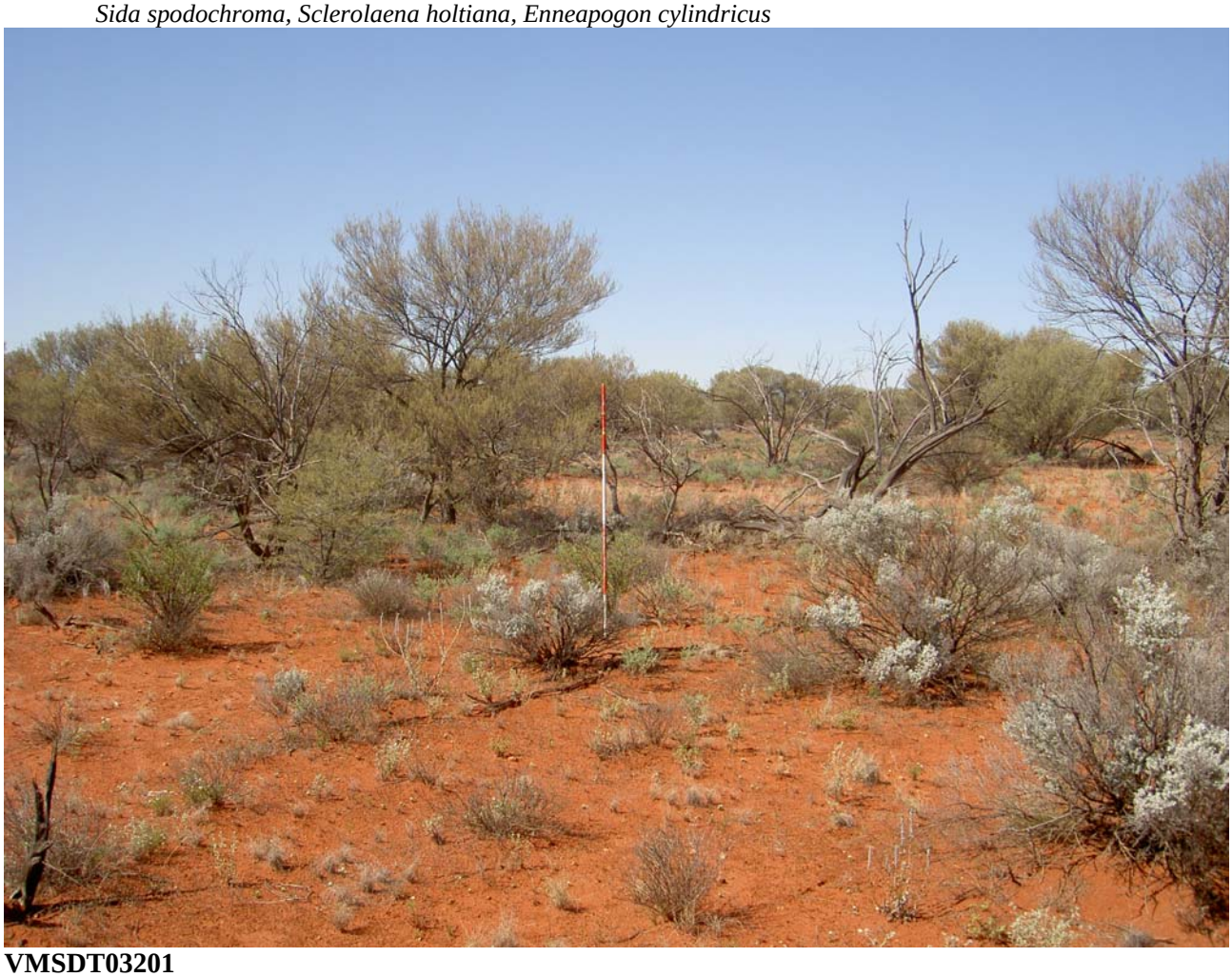
Widespread across the central to western part of Kingoonya (GAW5) and Gawler Lakes (GAW2) and the northern extent of Gawler Volcanics (GAW2).

Area mapped as Group 2 1087.0 km^2 (1.03%)
No. of Survey sites (n=54)

Landform: Sandy plain (21), Plain (including undulating plain) (16), Stony plain (3), Not recorded (2). Dune / consolidated dune (2), Hill crest (2), Hill slope (2), Dune crest (2), Dune slope (1), Clay plain (1), Drainage depression (1), Inter-dune corridor (1)

Vegetation Structure: Very Low Open Woodland (17), Not Recorded (11), Very Low Woodland (7), Tall Very Open Shrubland (5), Open Shrubland (4), Low Shrubland (3), Low Open Woodland (2), Shrubland (1), Tall Open Shrubland (1), Very Open Shrubland (1), Low Open Shrubland (1), Low Very Open Shrubland (1)

Indicator species: *Maireana sedifolia, Ptilotus obovatus* var. *obovatus, Aristida contorta, Atriplex vesicaria* ssp., *Eremophila latrobei* ssp. *glabra, Acacia aneura complex, Sida fibulifera, Dodonaea microzyga* var. *microzyga, Sida spodochroma, Sclerolaena holtiana, Enneapogon cylindricus*



VMSDT03201

GAW Mapping Group 10

Acacia aneura complex over *Aristida contorta* +/- *Eragrostis eriopoda* +/- *Maireana georgei* +/- *Ptilotus obovatus* var. *obovatus* +/- *Monachather paradoxa* Very Low Open Woodland

This community is found on the widespread sandy plains. There were expansive areas where the *Acacia aneura* complex was in decline, often dead or dying, probably due to the combined factors of drought, fire and grazing history (including rabbits, sheep, kangaroos and goats).

Western extent of Kingoonya (GAW5) and smaller areas of central Gawler Lakes (GAW3) and eastern Gawler Volcanics (GAW2) sub-regions.

Area mapped as Group 10 = 1707.7 km^2 (1.62%)
This mapping class relates to GAW floristic group 1 (n=60)
Landform: Sandy plain (22), Plain (including undulating plain) (18), Stony plain (4), Dune/consolidated dune (3), Inter-dune corridor (3), Swale (2), Ridge (2), Closed depression (1), Open depression 1), Dune crest (1), Dune slope (1), Other (1), Not recorded (1)
Vegetation Structure: Very Low Open Woodland (16), Not recorded (13), Very Low Woodland (7), Tall Open Shrubland (6), Tall Very Open Shrubland (5), Low Open Woodland (3), Very Open Shrubland (3), Tall Shrubland (1), Open Shrubland (1), Shrubland (1),Low Shrubland (1), Low Very Open Shrubland (1), Low Woodland (1), (Tussock) Grassland (1)
Indicator species: *Maireana georgei, Eragrostis eriopoda, Aristida contorta, Acacia aneura* complex, *Ptilotus obovatus* var. *obovatus, Sclerolaena diacantha, Monachather paradoxus, Maireana integra, Triraphis mollis*

VMSDT03001

GVD Mapping Group 2

Acacia aneura complex over *Maireana sedifolia, Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus obovatus* var. *obovatus, Aristida contorta* Low Open Woodland

This community occurs mainly in the south-eastern corner of the Maralinga Lands, predominantly to the east of Oak Valley and around Maralinga mainly on sand-plain or the very broad inter-dune corridors in this part of the MT Lands.

Area mapped as Group 2 = 3,041 km^2 (2.9%)
This mapping class relates to the floristic group 112 (n=12)

Landform: Sandy plain (7), dune/consolidated dune, inter-dune corridor, plain (including undulating plain), hill slope, stony plain
Vegetation Structure: Very Low Open Woodland (3), Very Low Woodland (3), Low Woodland (2), Low Open Shrubland, Low Open Woodland, Open Mallee, Tall Open Shrubland
Indicator species: *Maireana sedifolia, Aristida contorta, Ptilotus obovatus* var. *obovatus*, *Acacia aneura* complex.

Quadrat MAU00801

GVD Mapping Group 3

Acacia ramulosa var., *Acacia aneura* complex over, *Senna artemisioides* ssp. *petiolaris* +/- *Dodonaea viscosa* ssp. *angustissima* +/- *Ptilotus* spp, *Aristida holathera* var. *holathera*, *Eragrostis eriopoda* Low Open Woodland

This community is widespread across the MT Lands occurring predominantly on the dunes but also in the swales; however it does not occur in extensive areas.

Area mapped as Group 3 = 6,044 km^2 (5.7%)
This mapping class relates to the GVD floristic groups 39 and 332.

Floristic Group 39 (n=40)
Acacia ramulosa var., *Acacia aneura* complex over S*enna artemisioides* ssp. *petiolaris*, *Ptilotus polystachyus* var. *polystachyus*, *Aristida holathera* var. *holathera*, *Eragrostis eriopoda* Low Open Woodland
Landform: Dune/consolidated dune (24), plain (including undulating plain) (5), swale (3), dune crest (2), sandy plain (2), inter-dune corridor (2), dune slope, inter-dune low
Vegetation Structure: Low Open Woodland (5), Very Low Open Forest (2), Very Low Woodland (2), Very Open Mallee (2), Low Woodland, Tall Open Shrubland, Tall Open Woodland, Open Shrubland, not recorded (25)
Indicator species: *Acacia ramulosa* var., *Aristida holathera* var. *holathera*

Quadrat EMU00401

Floristic Group 332 (n=30)
Acacia ramulosa var. over *Dodonaea viscosa* ssp. *angustissima* +/- *Ptilotus polystachyus* var. *polystachyus* +/- *Ptilotus obovatus* var. *obovatus, Aristida holathera* var. *holathera, Eragrostis eriopoda* Tall Open Shrubland
Landform: Dune crest (10), dune/consolidated dune (10), dune slope (3), swale (3), rock outcrop (2), dune foot-slope, not recorded (1)
Vegetation Structure: Tall Open Shrubland (7), Tall Shrubland (6), Low Open Woodland (2), Very Low Woodland (2), Very Open Mallee (2), Low Woodland, Open Mallee, Tall Very Open Shrubland, Very Low Open Woodland, not recorded (7)
Indicator species: *Dodonaea viscosa* ssp. *angustissima, Acacia ramulosa* var., *Gyrostemon ramulosus.*

Quadrat WIL00801

GVD Mapping Group 4

+/- Alectryon oleifolius ssp. *canescens +/- Myoporum platycarpum* ssp. *platycarpum +/- Casuarina pauper +/- Eucalyptus concinna +/- Eucalyptus oleosa* ssp. *+/- Eucalyptus socialis* over *+/- Acacia ramulosa, Senna artemisioides* ssp., *Maireana sedifolia, Austrostipa nitida* Low Open Woodland

A woodland – mallee complex occurring around the northern extremes of the Yellabinna sub-region (GVD6).

Area mapped as Group 4 = 1,649km^2 (1.2%)
This mapping class relates to the GVD floristic group 45. (n=34)

Landform: Inter-dune corridor (14), dune/consolidated dune (9), inter-dune low (5), plain (5), closed depression
Vegetation Structure: Low Open Woodland (6), Open Mallee (2), Very Low Open Woodland (2), Very Low Woodland (2), Very Open Mallee, not recorded (21)
Indicator species: *Senna artemisioides* ssp. *petiolaris*, *Austrostipa nitida*, *Senna artemisioides* ssp. X *coriacea.*

Quadrat EMU00801

GVD Mapping Group 5

Casuarina pauper and/or *Acacia papyrocarpa* over *Maireana sedifolia* or Cratystylis *conocephala, Senna cardiosperma* ssp. *gawlerensis* +/- *Senna artemisioides* ssp. *petiolaris, Atriplex vesicaria* ssp. Low Open Woodland

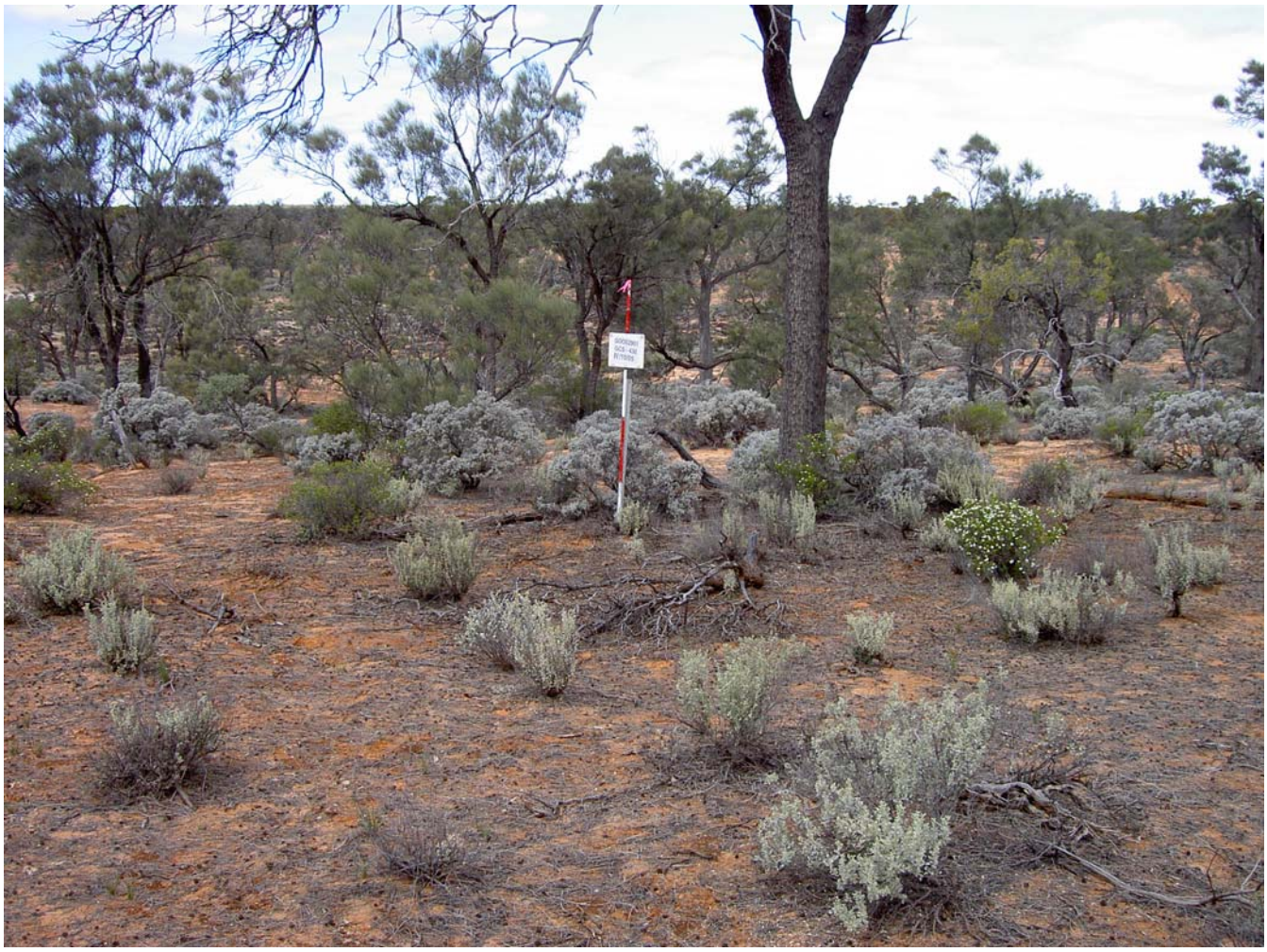
This mapping group is an amalgamation of two vegetation analysis groups with dominant overstorey of Black Oak and Western Myall. These groups have been depicted as one mapping groups to better represent the transition from Great Victoria Desert Bioregion to the Nullarbor Plain and Gawler Bioregions. This mapping group also represents an extensive area of western myall east of Emu where it occurs on an area with gypsious surface geology associated with mainly dry salt lakes / playa pans surrounded by sandy plains and low dunes.

Area mapped as Group 5 = 857 km^2 (0.8%)
This mapping class relates to the GVD floristic groups 23 and 34.

Floristic Group 34 (n=32)
Casuarina pauper +/- *Acacia papyrocarpa* (often as emergents) over *Senna cardiosperma* ssp. *gawlerensis, Maireana sedifolia, Atriplex vesicaria* ssp. Low Woodland
Landform: Plain (including undulating plain) (9), sandy plain (7), closed depression (4), hill slope (3), drainage depression (2), low rise, lunette, pediment, not recorded (2)
Vegetation Structure: Low Woodland (8), Very Low Woodland (6), Low Open Woodland (3), Low Shrubland (2), Woodland (2), Open Mallee, Shrubland, Tall Very Open Shrubland, Very Low Open Woodland, Very Open Shrubland, not recorded (3)
Indicator species: *Atriplex vesicaria* ssp, *Acacia papyrocarpa, Maireana sedifolia*

VMSDT01901 (no site board)

Floristic Group 23 (n=13)
Casuarina pauper over *Cratystylis conocephala* +/- *Senna artemisioides* ssp. *petiolaris*, *Atriplex vesicaria* ssp. Low Open Woodland
Landform: Plain (3), dune slope (2), inter-dune corridor (2), sandy plain (2), closed depression, hill slope, limestone plain, and swale
Vegetation Structure: Low Open Woodland (6), Low Woodland (4), Very Low Open Woodland, Very Low Woodland, Woodland
Indicator species: *Cratystylis conocephala*, *Maireana radiata*



Quadrat GOO02901

GVD Mapping Group 6

Casuarina pauper +/- *Alectryon oleifolius* ssp. canescens +/- *Acacia aneura* complex over *Senna cardiosperma* ssp. *gawlerensis*, *Ptilotus obovatus* var. *obovatus* Low Open Woodland

This mapping groups represents the Black Oak communities present in the Maralinga sub-region GVD3 occurring on heavier soils, often with coarse stone strew, than surrounding sand plains and sand dunes.

Area mapped as Group 6 = 1,897 km^2 (1.8%)
This mapping class relates to the GVD floristic group 115 (n=31)

Landform: sandy plain (10), plain (including undulating plain) (4), swale (4) hill slope (3), inter-dune corridor (3), dune slope (2), clay plain, dune crest, dune/consolidated dune, inter-dune low, stony plain
Vegetation Structure: Low Open Woodland (11), Low Woodland (10), Low Open Forest (2), Open Woodland (2) Low Very Open Shrubland, Very Low Open Woodland, Very Low Woodland, not recorded (3)
Indicator species: *Casuarina pauper, Ptilotus obovatus* var. *obovatus, Alectryon oleifolius* ssp. *canescens, Senna cardiosperma* ssp. *gawlerensis*

Quadrat VOK00801

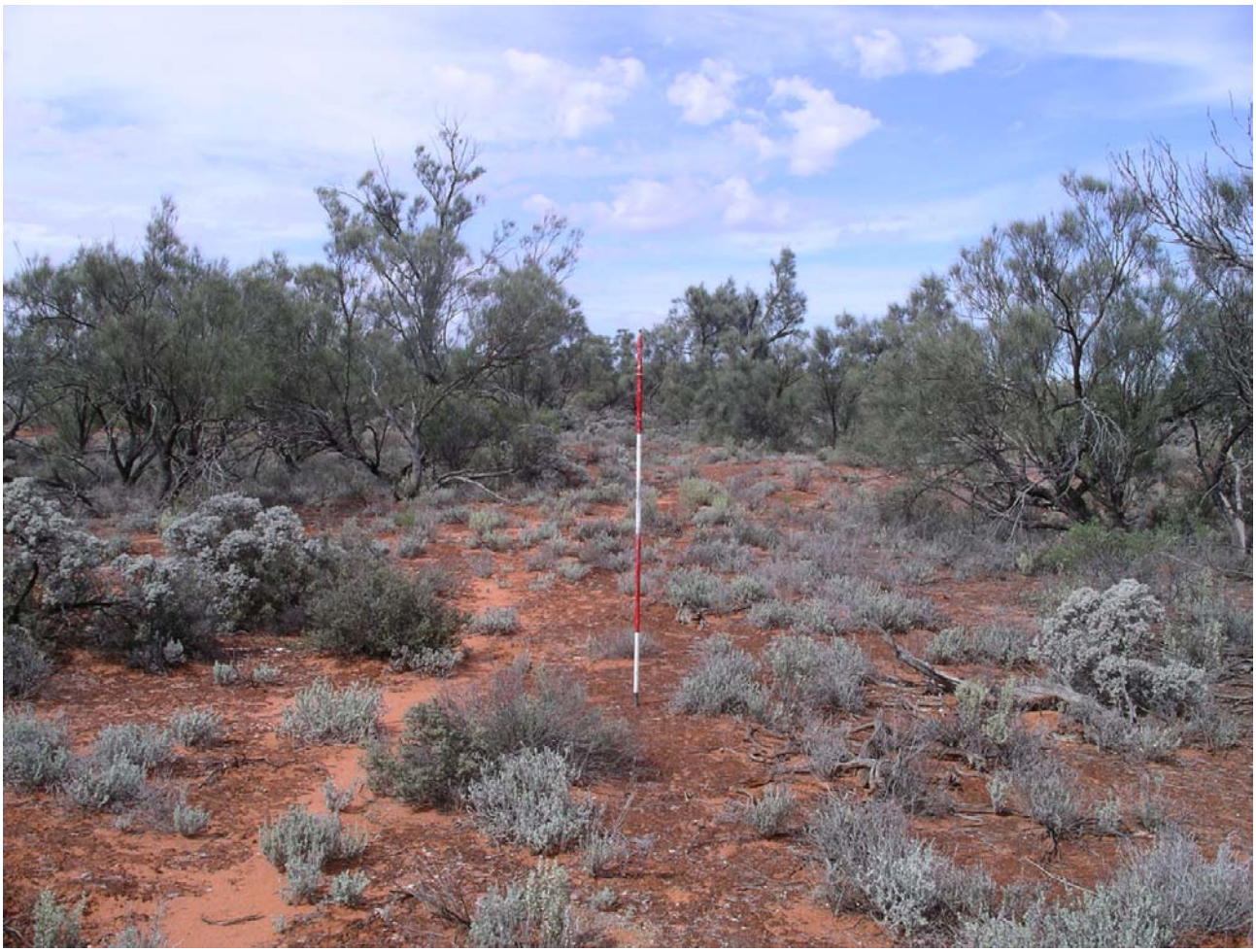
GAW Mapping Group 6

Casuarina pauper +/- *Acacia papyrocarpa* +/- *A. aneura* complex +/- *Alectryon oleifolius* ssp. *canescens* +/- *Santalum acuminatum* over *Maireana sedifolia, Atriplex vesicaria* ssp. +/- *Enchylaena tomentosa* var. *tomentosa* Low Open Woodland

This group was described in the Gawler Ranges mapping (2001) and modified for this mapping process. Most sites had a strew cover present of calcareous material and were on soils with a high clay content. This community was surveyed along the south western flank of the Kingoonya subregion (GAW5), the southern extent of the Gawler Volcanics sub-region (GAW2) and the north-west extent of the Myall Plains (GAW1).

Area mapped as Group 6 = 20. 9 km^2 (0.02%)
This mapping class relates to the GAW floristic group 16

Landform: Sandy plain (6), Closed depression (1), Plain (inc. undulating plain) (6), Dune slope (1), Hill foot-slope (4), Lunette (2), Inter-dune low (1), Limestone plain (1), Low rise (mound) (1), Swale (1)
Vegetation Structure: Low Open Woodland (9), Very Low Woodland (4), not recorded (6), Low Woodland (2), Open Mallee (1) Very Low Open Forest (1), Very Low Open Woodland (1)
Indicator species: *Casuarina pauper*, *Atriplex vesicaria* ssp., *Enchylaena tomentosa* var. *tomentosa*, *Maireana sedifolia*, *Alectryon oleifolius* ssp. *canescens*, *Santalum acuminatum*, *Chenopodium curvispicatum*, *Myoporum platycarpum* ssp. *platycarpum*, *Dodonaea microzyga* var. *microzyga*, *Enneapogon cylindricus*



VMSDT01401

GVD Mapping Group 7

Eucalyptus gongylocarpa, Eucalyptus youngiana +/- *Eucalyptus concinna* +/- *Eucalyptus glomerosa* over *Acacia ligulata* +/- *Acacia ramulosa, Ptilotus polystachyus* var. *polystachyus, Triodia basedowii, Aristida holathera* var. *holathera* Low Open Woodland

This group is under-represented in the mapping and occurs predominantly as an emergent of the vegetation community represented by mapping group 10 and to a lesser extent, as a transition community on dune slopes with mapping group 15 in the Maralinga sub-region (GVD3). It may be better represented as a sub-dominant mosaic community within other dominant communities.

Area mapped as Group 8 = 56 km^2 (0.1%)
This mapping class relates to the GVD floristic group 267 (n=15).

Landform: Dune slope (4), dune crest (3), sandy plain (3) dune/consolidated dune (2), dune foot-slope, hill slope, inter-dune corridor
Vegetation Structure: Open Mallee (5), Low Woodland (2), Very Open Low Mallee (2), Open Shrubland, Tall Open Shrubland, Very Low Open Woodland, Very Open Mallee, not recorded (2)
Indicator species: *Triodia basedowii*, *Eucalyptus gongylocarpa*, *Osceola basedowii*, *Eucalyptus youngiana*, *Eucalyptus glomerosa*

Quadrat VOK00501

MALLEE

GVD Mapping Group 9

Eucalyptus concinna +/- *Eucalyptus canescens* ssp. *canescens* +/- *Eucalyptus socialis* ssp. +/- *Eucalyptus eremicola* +/- *Acacia aneura* complex over *Senna artemisioides* ssp. *petiolaris* +/- *Eremophila paisleyi* ssp. *paisleyi, Ptilotus obovatus* var. *obovatus, Triodia scariosa* Open Mallee

The transition from mapping group 9 to mapping group 10 would be rarely as distinct as boundary lines suggest in this mapping. The differences will be more ecotonal, with a gradual transition from mapping group 10 in the south east (Yellabinna sub-region) to mapping group 9 in the north-west (Maralinga sub-region).

Area mapped as Group 10 = 18,560 km^2 (17.6%)
This mapping class relates to the floristic group 113 (n=24)

Landform: Sandy plain (13), dune/consolidated dune (3), hill slope (2), inter-dune corridor (2), swale (2), dune crest, plain
Vegetation Structure: Open Mallee (13), Low Open Woodland (2), Open Low Mallee (2), Low Woodland, Mallee, Very Open Low Mallee, not recorded (4)
Indicator species*:* *Triodia scariosa*, *Eremophila paisleyi* ssp. *paisleyi*

Quadrat TJU00901

GVD Mapping Group 10

***Eucalyptus concinna* +/- *Eucalyptus socialis* ssp. over *Dodonaea viscosa* ssp. *angustissima*, *Senna artemisioides* ssp. *petiolaris*, *Acacia colletioides* +/- *Acacia ligulata* +/- *Bossiaea walkeri*, *Aristida contorta* +/- *Triodia spp.* +/- *Lomandra leucocephala ssp. robusta* +/- emergent *Myoporum platycarpum ssp. platycarpum* Open Mallee**

This community commonly occurred on dunes and swales within the Yellabinna sub-region GVD6. The communities represented by this mapping group had a dominant to sub-dominate Eucalyptus spp. Overstorey. However, in sand dune complexes a more shrubby community was present with low mallee Eucalyptus species present. The mapping extent of this group may also be better depicted in combination with mapping group 15 in the Yellabinna sub-region GVD6.

Area mapped as Group 11 = 19,595 km^2 (14.2%)
This mapping class relates to the floristic groups 47 and 55.

Floristic Group 47
Eucalyptus concinna +/- *Eucalyptus oleosa* ssp. over *Acacia ligulata* + *Bossiaea walkeri* +/ *Triodia lanata* and/or *Triodia scariosa*, *Lomandra leucocephala* ssp. *robusta* Open Mallee
No. quadrats in Group 13
Total no. species in group
No. introduced spp. in group
Landform: Dune/consolidate dune (4), dune crest (3), playa/pan (2), swale (2), inter-dune corridor, not recorded (1)
Vegetation Structure: Open Mallee (5), Very Open Mallee, Very Low Open Woodland, Very Open Mallee, not recorded (5)
Indicator species*: Bossiaea walkeri, Eucalyptus concinna, Lomandra leucocephala* ssp. *robusta, Triodia lanata, Acacia rigens*

Quadrat GOO00203

Floristic Group 55 (n=13)
Eucalyptus concinna +/- *Eucalyptus socialis* ssp. over *Dodonaea viscosa* ssp. *angustissima*, *Senna artemisioides* ssp. *petiolaris*, *Acacia colletioides*, *Podolepis capillaries*, *Aristida contorta* +/- T*riodia lanata* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* Open Mallee
No. quadrats in Group 13
Landform: Swale (4), dune/consolidated dune (3), inter-dune corridor (2), inter-dune low (2), dune slope, plain
Vegetation Structure: Open Mallee (3), Mallee, Tall Shrubland, Very Low Open Woodland, Very Open Low Mallee, not recorded (6)
Indicator species: *Dodonaea viscosa* ssp. *angustissima*, *Acacia colletioides*, *Aristida contorta*

Quadrat GOO00502

GAW Mapping Group 12

Eucalyptus concinna +/- *E. leptophylla* +/- *E. yumbarrana* ssp. +/- *E. youngiana* over *Dodonaea viscosa* ssp. *angustissima* +/- *Bossiaea walkeri* +/- *Duboisia hopwoodii* +/- *Triodia irritans* +/- *T. lanata* +/- *T. scariosa* Mallee

This sandy dune community mainly occurred on the southern boundaries of the study area and appears to be more extensive to the west of this study area, in the Great Victoria Desert IBRA Region. The community had a diverse understorey composition and was also described in Hudspith *et al.* (2001). This community was represented by sites in the south west extent of Kingoonya IBRA subregion (GAW5) and a sandy incursion into the Gawler Volcanics (GAW2).

Area mapped as Group 12 = 1087.0km^2 (1.03%)

This mapping class relates to the GAW floristic group 24 (n=8)
Landform: Dune foot-slope (2), Dune/consolidated dune (2), Inter-dune low (2), sandy plain (1), not recorded (1)
Vegetation Structure: Mallee (1), Very Low Open Woodland (1), Very Low Woodland (1), Very Open Mallee (1), not recorded (4)
Indicator species *Eucalyptus concinna, Dodonaea viscosa* ssp. *angustissima, Ptilotus polystachyus* var. *polystachyus, Amphipogon caricinus* var. *caricinus, Bossiaea walkeri, Eucalyptus leptophylla, Goodenia cycloptera, Triodia irritans, Acacia colletioides, Duboisia hopwoodii, Eucalyptus yumbarrana* ssp., *Triodia scariosa, Eucalyptus youngiana.*

Quadrat VMSDT26101

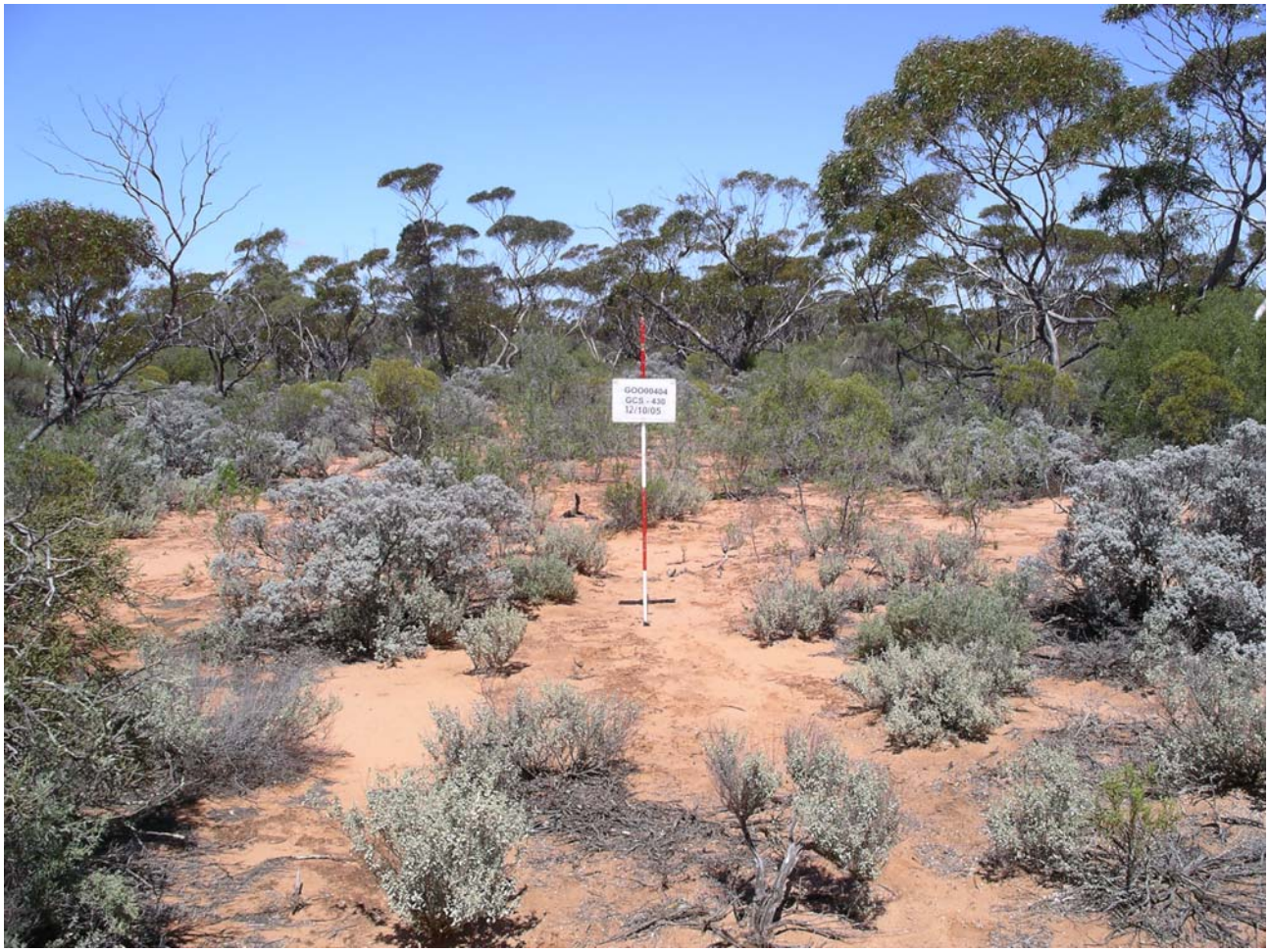
GVD Mapping Group 11

*Eucalyptus oleos*a ssp. +/- *Eucalyptus brachycalyx* or *Eucalyptus concinna* over *Acacia nyssophylla, Atriplex vesicaria* ssp., *Maireana radiata, Maireana pentatropis* +/- *Cratystylis conocephala* Open Mallee

This mapping group occurs on calcareous sands with or without a calcrete sub-surface layer. *E. brachycalyx* occurs on the more shallow loamy sands towards the margins of the Yellabinna dune-field, and is replaced by *E. concinna* on deeper sands within the dune-field proper.

Area mapped as Group 12 = 310 km^2 (0.03%)
This mapping class relates to the GVD floristic group 24 (n=15).

Landform: Sandy plain (4), swale (3), dune slope (2), dune/consolidated dune, inter-dune corridor, lunette, open depression, plain, playa/pan
Vegetation Structure: Open Mallee (8), Very Open Mallee (3), Open Shrubland (2), Mallee
Indicator species: *Maireana radiata, Cratystylis conocephala*



Quadrat GOO02901

GAW Mapping Group 13

Eucalyptus oleosa ssp. +/- *E. brachycalyx* +/- *E. gracilis* +/- *Casuarina pauper* over *Eremophila scoparia, Cratystylis conocephala, Senna artemisioides* ssp. +/- *Geijera linearifolia* +/- *Enchylaena tomentosa* var. *tomentosa* +/- *Rhagodia ulicina* +/- *Atriplex stipitata* +/- *A. vesicaria* ssp. +/- *Maireana erioclada* Mallee

This community was also described in White and Gould (2002) as Mallee with mixed shrub understorey. Mainly occurring on calcareous plains, the understorey component of the group had a diverse mix across the sites but in low frequencies. This community was restricted to the most southern extent of the study area. Mainly in the northern extent of the Myall Plains (GAW1) and the southern extent of the Gawler Volcanics (GAW2).

Area mapped as Group 13 = 3.9 km^2 (<0.01%)
This mapping class relates to the GAW floristic group 12 (n=11)

Landform: plain (including undulating plain) (3), Hill foot-slope (3), Sandy plain (2), Dune/consolidated dune (2), Other (1)
Vegetation Structure: Open Mallee (2), Very Open Mallee (1), Mallee (1), Tall Open Shrubland (1), not recorded (6)
Indicator species: *Enchylaena tomentosa* var. *tomentosa, Atriplex stipitata, Eucalyptus oleosa* ssp., *Acacia papyrocarpa, Atriplex vesicaria* ssp., *Geijera linearifolia, Maireana trichoptera, Rhagodia ulicina, Zygophyllum apiculatum, Cratystylis conocephala, Eremophila scoparia, Eucalyptus gracilis, Maireana radiata, Olearia calcarea, Atriplex nummularia* ssp. *nummularia, Solanum coactiliferum, Acacia rigens, Hakea leucoptera* ssp. *leucoptera, Scaevola spinescens, Brachyscome trachycarpa.*

VMSDT01301

GVD Mapping Group 12

+/- Eucalyptus yumbarrana ssp. *yumbarrana +/- Eucalyptus brachycalyx* or *Eucalyptus concinna +/- Eucalyptus gracilis* over *Melaleuca eleuterostachya +/- Hakea francisiana +/- Westringia rigida +/- Eremophila scoparia, Triodia* spp. Open Mallee

Occurring on longitudinal dunes and into inter-dune corridors in the south of Yellabinna sub-region GVD6. *E. brachycalyx* occurs on more loamy sands towards the margins of the Yellabinna dune-field, replaced by *E. concinna* on deeper sands within the dune-field proper.

Area mapped as Group 13 = 20 km^2 (0.02%)
This mapping class relates to the floristic groups 1, 28 and 122.

Floristic Group 1 (n=43)
Eucalyptus yumbarrana ssp. *yumbarrana +/- Eucalyptus oleosa* ssp. over *Melaleuca eleuterostachya +/- Hakea francisiana +/- Westringia rigida*, *Triodia scariosa* Open Mallee

Occurring on longitudinal dunes and into inter-dune corridors in the south of Yellabinna sub-region GVD6. *E. brachycalyx* occurs on more loamy sands towards the margins of the Yellabinna dune-field, replaced by *E. concinna* on deeper sands within the dune-field proper.
Landform: Inter-dune corridor (18), dune crest (12), dune/consolidated dune (6), dune slope (4), hill slope, inter-dune low, plain
Vegetation Structure: Open Mallee (21), Open Low Mallee (7), Mallee (5), Very Open Mallee (2), Low Woodland, not recorded (7)
Indicator species: *Triodia scariosa, Melaleuca eleuterostachya, Eucalyptus yumbarrana* ssp. *yumbarrana, Hakea francisiana*

Quadrat PUR02001

Floristic Group 28 (n=39)
Eucalyptus yumbarrana ssp. *yumbarrana* +/- *Eucalyptus concinna* or *Eucalyptus brachycalyx* over *Melaleuca eleuterostachya, Triodia lanata* Open Mallee

Occurring on longitudinal dunes and into inter-dune corridors in the south of Yellabinna SubregionGVD6. *E. brachycalyx* occurs on more loamy sands towards the margins of the Yellabinna dune-field, replaced by *E. concinna* on deeper sands within the dune-field proper.

Landform: Dune crest (11), dune slope (11), swale (5), inter-dune corridor (4), dune/consolidated dune (3), sandy plain (2), dune foot-slope, hill crest, hill slope
Vegetation Structure: Open Low Mallee (13), Open Mallee (10), Mallee (5), Very Open Mallee (4), Very Open Low Mallee (3), Very Low Woodland (2), Tall Very Open Shrubland, not recorded (1)
Indicator species: *Melaleuca eleuterostachya, Triodia lanata, Eucalyptus yumbarrana* ssp. *yumbarrana, Beyeria opaca*

Quadrat GOO02301

Floristic Group 122

Eucalyptus oleosa ssp. *oleosa +/- Eucalyptus gracilis +/- Eucalyptus brachycalyx or Eucalyptus concinna over Melaleuca eleuterostachya +/- Eremophila scoparia, Triodia irritans Open Mallee*

Occurring on longitudinal dunes and into inter-dune corridors in the south of the Yellabinna sub-region GVD6. *E. brachycalyx* occurs on more loamy sands towards the margins of the Yellabinna dune-field, replaced by *E. concinna* on deeper sands within the dune-field proper.

No. quadrats in Group (n=11)

Landform: Sandy plain (2), swale (2), dune crest, dune foot-slope, dune/consolidated dune, hill slope, inter-dune corridor, open depression, plain
Vegetation Structure: Open Mallee (4) Open Low Mallee (2), Low Mallee, Mallee, Shrubland, Tall Open Shrubland, not recorded (1)
Indicator species: *Triodia irritans, Eucalyptus oleosa* ssp. *oleosa*

Quadrat GOO03301

SHRUBLAND

GVD Mapping Group 14

Acacia aneura complex over *Eremophila latrobei* ssp. *glabra, Earache mucronata, Eragrostis eriopoda* +/- *Monachather paradoxa* Tall Open Shrubland

A community with a limited distribution predominantly east of Emu and on the eastern edge of the MT Lands boundary adjacent Tallaringa CP and IGY Corner.

Area mapped as Group 15 = 911 km^2 (0.9%)
This mapping class relates to the GVD floristic group 50 (n= 21).

Landform: Plain (including undulating plain) (6), stony plains (4), hill slope (3), ridge (3), hill crest (2), closed depression, sandy plain, swale, other
Vegetation Structure: Tall Open Shrubland (3), Tall Very Open Shrubland (3), Tall Shrubland (2), Very Low Woodland (2), Very Low Open Woodland, not recorded (11)
Indicator species: *Acacia aneura* complex

Quadrat WIL00403

GVD Mapping Group 15

Acacia ligulata, Acacia ramulosa var.*, Dodonaea viscosa* ssp. *angustissima* over *Aristida holathera* var. *holathera* +/- *Aristida contorta* Tall Open Shrubland

This group tended to be over represented in areas recently burnt (1999-2000 images) and is probably significantly over represented in the Yellabinna (GVD6) sub-region as a dune community. In the Yellabinna sub-region, the areas depicted with mapping group 15 would have more Eucalyptus spp. as the dominant overstory species (as low open mallee) with a significant shrub and/or Triodia spp. understorey. A transition to a separate distinguishable community in the Yellabinna sub-region was difficult to delineate in the dune complex south-east of Ooldea. May be better represented by mapping group 10 (floristic analysis groups 47 and 55).

Area mapped as Group 16 = 13,759 km^2 (10.0%)
This mapping class relates to the GVD floristic group 38.

Landform: Dune/consolidated dune (14), dune crest (11), dune slope (7), swale (6), inter-dune corridor, lake, plain, not recorded (2)
Vegetation Structure: Tall Open Shrubland (13), Tall Shrubland (7), Open Mallee (4), Very Low Open Woodland (4), Shrubland (3), Low Open Woodland, Open Shrubland, Very Open Mallee, Very Open Shrubland, not recorded (9)
Indicator species: *Acacia ligulata*, *Aristida holathera* var. *holathera*

Quadrat WIL00203

GAW Mapping Group 15

Acacia ligulata, A. ramulosa var.*, Senna artemisioides* ssp. *petiolaris, Dodonaea viscosa* ssp. *angustissima* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Eucalyptus socialis* over *Enchylaena tomentosa* var. *tomentosa, Austrostipa* spp. +/- *Aristida contorta* +/- *Aristida holathera* var. *holathera* +/- *Enneapogon* spp. Tall Open Shrubland

On deep red dunes, Jessup (1951) describes this community as *Acacia linophylla – A. ramulosa* association. It is generally a climax community, but where the dunes are unstable the primary colonizers are the *Acacia ligulata* and *Dodonaea viscosa*. The amount of rainfall determines the abundance of grasses present. Data from White (2001) was also included in this group and the description modified. Sites were mainly on the study boundary extent of the survey area.

IBRA distribution: This community was found in the Kingoonya (GAW5), Gawler Lakes (GAW3), Gawler Volcanics (GAW2) and Myall Plains (GAW1) IBRA sub regions.

Area mapped as Group 15 = 119.3 km^2 (0.11%)
This mapping class relates to the GAW floristic group 7 (n=33)

Landform: Dune/consolidated dune (11), Sandy plain (9), Dune slope (5), dune crest (4), Plain (including undulating plain) (3), Swale (1)

Vegetation Structure: Open Shrubland (7), Tall Open Shrubland (5), Not recorded (5), Tall Shrubland (4), Shrubland (4), Low Woodland (2), Tall Very Open Shrubland (2), Tall Open Woodland (1) Very Low Open Woodland (1), Very Low Woodland (1), Very Open Shrubland (1)

Indicator species: *Senna artemisioides* ssp. *petiolaris, Acacia ligulata, Dodonaea viscosa* ssp. *angustissima, Acacia ramulosa (NC), Acacia ramulosa* var. *linophylla, Eremophila sturtii, Hibiscus krichauffianus, Sida ammophila, Eremophila scoparia, Acacia sibirica, Dissocarpus paradoxus, Austrostipa scabra* ssp. *falcata, Eremophila gilesii.*

VMSDT02801

GVD Mapping Group 16

Atriplex vesicaria ssp. over *Hemichroa diandra* +/- *Tecticornia* spp. +/- emergent *Melaleuca nanophylla* Low Open Shrubland

This community is found in association with gypsiferous (kopi) landforms and depressions. *Melaleuca nanophylla* is often present as an emergent or forming dense thickets on the gypsiferous rises surrounding the lower-lying depression.

Area mapped as Group 17 = 383 km^2 (0.3%)
This mapping class relates to the floristic group 22 (n=10).

Landform: Closed depression (2), salt-lake (2), dune slope, hill foot-slope, playa/pan, rock outcrop (2)
Vegetation Structure: Low Open Shrubland (4), Low Shrubland (2), Tall Open Shrubland (2), Low Very Open Shrubland, not recorded (1)
Indicator species: *Hemichroa diandra, Melaleuca nanophylla, Maireana oppositifolia, Kippistia suaedifolia.*

Quadrat EMU00201
(NB: *M nanophylla* fringe on lunette in back ground)

GVD Mapping Group 17

+/- Dodonaea viscosa ssp. *angustissima +/- Acacia oswaldii* over *Atriplex vesicaria, Austrostipa nitida +/- Aristida contorta +/-* emergent *Myoporum platycarpum* ssp. *platycarpum* and/or *Alectryon oleifolius* ssp. *canescens* Shrubland

A very minor vegetation group distributed mainly across the southern half of the MT Lands.

Area mapped as Group 18 = 391 km^2 (0.3%)
This mapping class relates to the floristic group 53 (n=23).

Landform: Plain (including undulating plain) (5), sandy plain (4), dune slope (2), salt crust (2), swale (2), dune crest, dune foot-slope, dune/consolidated dune, inter-dune low, lunette, open depression, ridge, not recorded (1)
Vegetation Structure: Shrubland (4), Tall Open Shrubland (3), Very Open Shrubland (2), (Tussock) Grassland, tall Shrubland, Tall Very Open Shrubland, Very Low Open Woodland, not recorded (10)
Indicator species: *Austrostipa nitida*, *Acacia oswaldii*

Quadrat WIL01001

GVD Mapping Group 18

Tecticornia spp., *Atriplex vesicaria* over +/- *Hemichroa diandra* +/- *Maireana oppositifolia* Low Open Shrubland

This group may be underrepresented in the mapping, due to the lack of survey sites adjacent to salt lakes within this vegetation community. The extent of this mapping group has been largely delineated based on proximity to intermittent and mainly dry water features.

Area mapped as Group 19 = 83 km^2 (0.1%)
This mapping class relates to the GVD floristic group 450 (n=5).

Landform: Playa/pan (3), closed depression, salt-lake
Vegetation Structure: Low Open Shrubland
Indicator species:

Quadrat SER00201

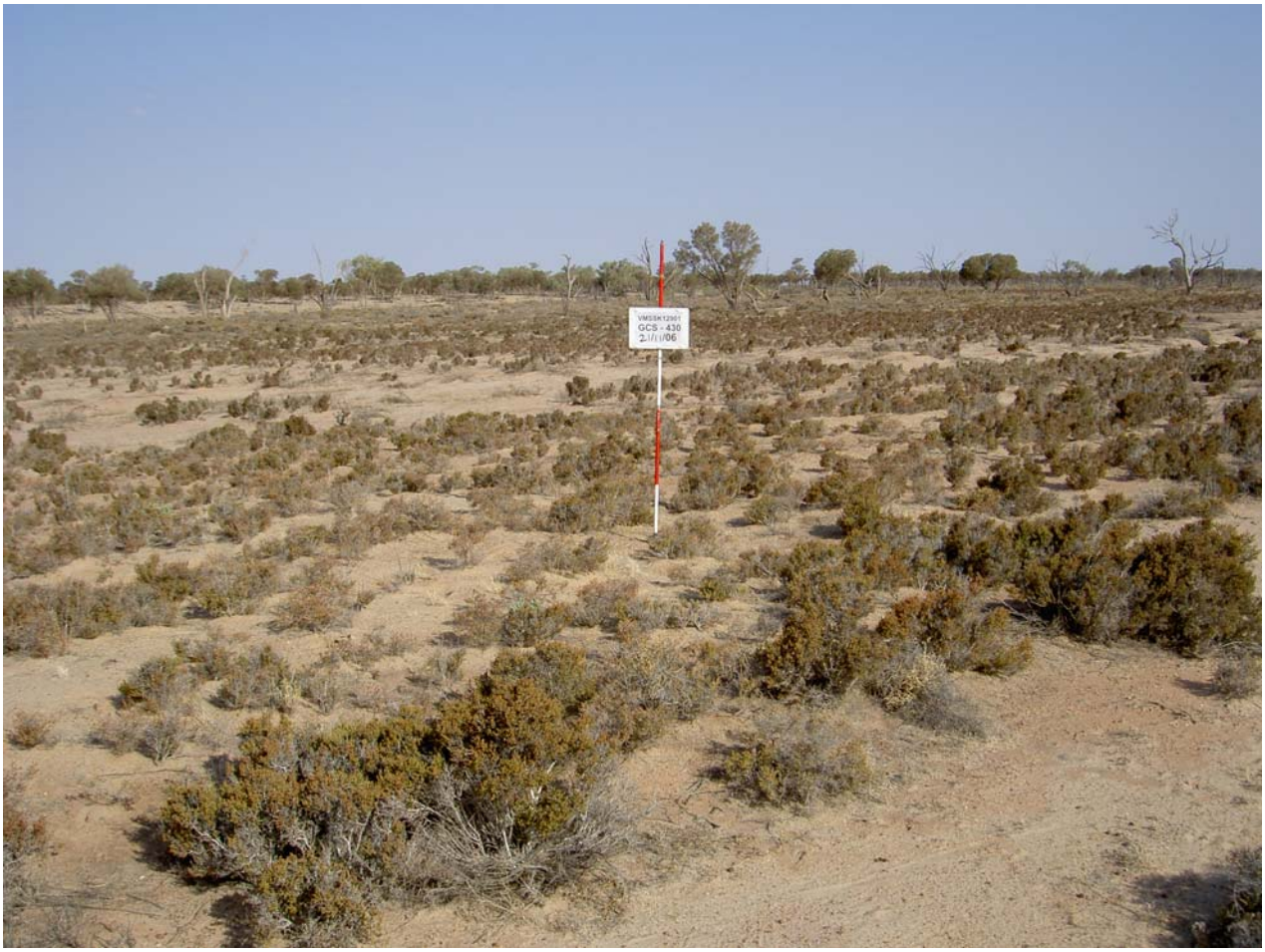
GAW Mapping Group 17

Atriplex vesicaria ssp., *Tecticornia indica* ssp. *leiostachya* +/- *Tecticornia medullosa* over *Sclerolaena divaricata, Eragrostis setifolia,* +/- *Sclerolaena ventricosa* +/- *Frankenia* sp. +/- *Sclerolaena brachyptera* +/- *Dissocarpus paradoxus* Low Open Shrubland

This community was found in the saline low lying depression areasi the northern part of the Gawler Volcanics (GAW2) and Kingoonya (GAW5) sub-regions.

Area mapped as Group 17 = 14.2 km^2 (0.01%)

Landform: Other (2), Swamp (1), playa/pan (1), Flood out (1)
Vegetation Structure: Low Shrubland (2), Low Open Shrubland (1), Not recorded (2)
Indicator species*:* *Tecticornia indica* ssp. *leiostachya*, *Atriplex* ssp., *Tecticornia* ssp., *Chenopodium desertorum* ssp. *desertorum, Maireana cannonii, Myoporum brevipes, Sclerolaena brachyptera*



Quadrat VMSSK12901

GVD Mapping Group 19

Salsola tragus, Eriochiton sclerolaenoides, Sclerolaena obliquicuspis, Sclerolaena diacantha, Austrostipa nitida, Enneapogon avenaceus +/- emergents *Acacia tetragonophylla* or *Alectryon oleifolius* ssp. *canescens* or *Pittosporum angustifolium* Low Open Shrubland / (Tussock) Grassland

This minor group is closely related to a Nullarbor Plains community, including inliers of lacustrine limestone karst around Maralinga, within the Great Victoria Desert Bioregion.

Area mapped as Group 20 = 471 km^2 (0.3%)
This mapping class relates to the floristic group 51 (n=19).

Landform: Plain (including undulating plain) (5), limestone plain (4), closed depression (3), dune foot-slope, dune slope, hill slope, inselberg/tor, lunette, sandy plain, other
Vegetation Structure: Very Low Open Woodland (4), (Tussock) Grassland (3), Low Open Shrubland (2), Open (Tussock) Grassland (2), Very Low Open Forest (2), Low Open Woodland, Low Shrubland, Tall Open Shrubland, Very Low Woodland, not recorded (2)
Indicator species: *Austrostipa nitida, Sclerolaena obliquicuspis, Acacia calcicola*.

Quadrat VMSSK06301

GAW Mapping Group 20

Maireana astrotricha, Atriplex vesicaria ssp. +/- *Maireana pyramidata* over *Austrostipa* spp. +/- *Dissocarpus paradoxus* +/- *Sclerolaena divaricata* +/- *Ptilotus obovatus* var. *obovatus* +/- *Maireana triptera* Low Open Shrubland

This community was chiefly derived from the Pastoral monitoring data (White, 2002) and was also described by Jessup (1951) as a *Kochia planifolia* association. It can be difficult to differentiate from *Maireana sedifolia* when doing "drive by" notation, particularly when the *M. sedifolia* has been heavily grazed. It is also mainly found on stony plains with 30-70% surface strew present. Mostly in the northern extent of the Gawler Volcanics (GAW2) and the northern Kingoonya (GAW5) sub regions and also within western extent of the Gawler Lakes (GAW3).

Area mapped as Group 20 = 4.3 km^2 (<0.01%)
No. survey quadrats in Group (n=5)
No. of sites in area as PMB Group 8 (n=85)
No. of sites in PMB Group 8 analysis (n=179)

Landform: Stony plain (3), Plain (including undulating plain) (1), Dune slope (1)
Vegetation Structure: Low Open Shrubland (2), Open (Tussock) Grassland (1) Low Very Open Shrubland (1) Low Shrubland (1)
Indicator species: *Ptilotus obovatus* var. *obovatus, Sclerolaena divaricata, Enneapogon avenaceus, Maireana triptera, Rhagodia ulicina*

Quadrat VMSSK16901

GAW Mapping Group 22

Maireana sedifolia over *Eriochiton sclerolaenoides* +/- *Atriplex vesicaria* ssp. +/- *Austrostipa scabra* ssp. *scabra* Low Open Shrubland

On plains with calcareous surface strew present, this community was largely mapped from field noted locations of its occurrence. It sometimes had *Acacia aneura* complex present as an emergent, which may indicate a transition from Floristic group 2, where the *A. aneura* complex has declined. The survey site quadrats where in the central northern part of the Gawler Volcanics (GAW2) and the western part of Kingoonya (GAW5).

Area mapped as Group 21 = 9.0 km^2 (0.01%)
No. survey quadrats in Group (n=6)

Landform: Plain (including undulating plain) (5), Stony plain (1)
Vegetation Structure: Low Shrubland (1), Low Open Shrubland (1), Not recorded (4)
Indicator species: *Maireana sedifolia, Eriochiton sclerolaenoides, Brachyscome ciliaris* var. *ciliaris, Enchylaena tomentosa* var. *tomentosa, Enneapogon sp., Pittosporum angustifolium*

Quadrat WIL02501

GVD Mapping Group 20

Sclerolaena diacantha, Enneapogon avenaceus, Salsola tragus with emergent senescent *Acacia aneura* complex Low Shrubland

This group is under-represented in the mapping. This mapping group may represent senescent Mulga woodlands that have been burnt.

Area mapped as Group 21 = 0.32 km^2 (<0.1%)
This mapping class relates to the floristic group 117 (n=9).

Landform: Plain (including undulating plain) (4), sandy plain (3), ridge, not recorded (1)
Vegetation Structure: Low Shrubland, Very Low Open Woodland, Low Very Open Shrubland, not recorded (6)
Indicator species: *Sclerolaena diacantha*

Quadrat IGY00801

GVD Mapping Group 21

Senna artemisioides ssp. *petiolaris* +/- *Senna artemisioides* ssp. *coriacea* over *Atriplex vesicaria* ssp., emergent *Acacia oswaldii* +/- emergent *Pittosporum angustifolium* Tall Open Shrubland

This group is under-represented in the mapping due to its extreme patchiness and limited distribution where it does occur.

Area mapped as Group 22 = 3.9 km^2 (<0.1%)
This mapping class relates to the floristic group 25 (n=9).

Landform: Plain (including undulating plain) (5), lunette, playa/pan, ridge, sandy plain
Vegetation Structure: Tall Open Shrubland. Tall Shrubland, Low Open Woodland, not recorded (6)
Indicator species:

Quadrat no site photo available

Floristic Groups Not Mapped

WOODLAND

GVD Floristic Group 400 (n=9)
Callitris gracilis or *Callitris glaucophylla* or *Callitris verrucosa* over *Dodonaea viscosa* ssp. *angustissima, Rhagodia preissii* ssp. *preissii* Low Woodland

This group is not represented in the MT Lands mapping. It is a community which occurs on dune crests west of Vokes Hill Corner. Much of this has been burn during hot fires in early 2003. .

Landform: Dune/consolidated dune (3), dune crest. Dune foot-slope, dune slope, swale, sandy plain, hill slope
Vegetation Structure: Low Open Woodland (2), Low Woodland (2), Open Mallee, Very Low Woodland, Very Low Open Mallee, Woodland

Quadrat VOK01401

GAW Mapping Group 24

Chenopodium nitrariacum or *Muehlenbeckia florulenta* Low Shrubland or *Eragrostis setifolia* or *E. australasica* Tussock Grassland

This community was not captured within the site survey process but was observed in field notes as occurring in closed depression areas. Due to the lack of representation of site data, the group was amalgamated to include the main dominant species that were found to occur in these depression areas that had not been covered in the previous Floristic groups. Jessup (1951) also remarks on the existence of these communities as Canegrass Swamp complex and Mulga Swamps complex.

This community was mapped within the Kingoonya (GAW5) sub region.

Area mapped as Group 24 = 0.01 km^2 (<0.01%)
No. survey quadrats in Group (n=0)

No site photo available.

FLORA

By J. N. Foulkes[1] and M. G. Stead[2]

Introduction

This chapter gives an introductory overview of flora in the Maralinga Tjarutja Lands (MT Lands) and a brief review of previous botanical collecting. This is followed by sections detailing various aspects of the flora, including new records and accounts of species of particular significance i.e. those with a Federal or State conservation status rating and environmental weeds.

Vegetation overview

The biogeography of the MT Lands is complex. The range of landforms, soils, outcropping, microclimates and range of climatic influences combine to provide a diverse expression of arid landscapes in South Australia. The MT Lands have also remained largely intact, further enhancing the biological importance of this region.

Vegetation communities are dominated by typical arid-adapted species with understorey vegetation largely of spinifex hummock grasses (*Triodia* species) and short-lived tussock grasses and herbs. A range of soil types and rainfall gradients are reflected in a particularly diverse range of woodland species. The MT Lands support a wide variety of characteristic central Australian tree species, Black Oak (*Casuarina pauper*), *Callitris verrucosa*, Desert Kurrajong (*Brachychiton gregorii*) and Marble Gum (*Eucalyptus gongylocarpa*).

The sand plains and dune fields of the Great Victoria Desert, form the biologically richest and least disturbed sandy desert in the State. Unlike other major South Australian deserts such as the Simpson Desert (Foulkes 2008), the Great Victoria Desert supports a surprisingly dense and diverse cover of vegetation with mallee eucalypts particularly well represented in both species richness and abundance. Parts of the Nullarbor bioregion present in the MT Lands are characterised by chenopod shrublands (*Atriplex*, *Maireana* and *Sclerolaena* species) and mulga (*Acacia aneura* complex) woodlands (Kenny and Thompson 2008).

The region generally appears to be in a relatively natural condition, with many areas sampled having no or only a few introduced weed species. The sand-plain and dune communities are particularly undisturbed. Since European settlement, changes to Aboriginal burning practices, grazing by rabbits and camels, have all influenced the status, structure and distribution of individual plant species and communities. The evidence from explorer accounts, the extinction of many medium-sized native mammals from this and similar regions in central Australia, and anecdotal evidence, suggests that significant changes to vegetation have occurred, particularly from the impact of rabbits.

Changes in Aboriginal burning practices has resulted in a more homogeneous vegetation pattern with a tendency towards lower diversity of many plant species, low variation in age structure and, with higher and more even litter loads, a greater susceptibility to hot and widespread wildfires. Where wildfires have burnt areas such as mulga woodlands, regeneration of the community has been prevented or greatly reduced by the impact of rabbit grazing and browsing and by subsequent repeated hot fires or drought, resulting in expanses of grasslands with sparse emergent mulga, such as that found to the south-east of Oak Valley.

Because of the MT Lands remoteness and the lack of reliable water, the region escaped the severe impacts associated with European settlement and livestock grazing. The presence of Anangu prolonged traditional land management practices as compared to other areas of the State, probably until severe droughts early in the 19th century forced most Anangu to move from the Lands. The development of the Woomera Prohibited Area and the Maralinga Prohibited Area in the 1950's, saw the displacement of the remainder of nomadic people in the MT Lands and wider desert regions (see Beadell 1967, 1971, 1983).

Traditional practices as patch burning had a significant influence on vegetation composition and structure in all but the most remote water free regions (Morelli 1992, Latz 1996, 2007). Burning was carried out to promote growth and availability of palatable species for kangaroos and other game and for an increase in edible plants particularly those that produce large amounts of fruit and seeds and to protect fire sensitive and culturally valuable species such as mulga from wildfire by seasonal burning-off in surrounding vegetation (see Kimber 1983).

The nature of this type of burning resulted in the landscape having a mosaic of vegetation in different stages of post-fire regeneration. The effect of this type of fire regime, carried out over many generations, encouraged a high diversity of plant and animal species adapted to fire, but possibly had a negative impact on species less tolerant of fire.

The controlled use of fire by Anangu provided a landscape-scale land management process that allowed them to inhabit (albeit in small numbers) in areas considered useless for European land-use practices. With the shift to communities, Anangu people became increasingly dependent on the missions for food and general welfare. Many traditional cultural pursuits were either discouraged or not feasible – Aboriginal custodians often no longer had the ability or need to visit their land and maintain fire regimes.

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Fire has had the greatest influence on the composition, structure and distribution of plant communities. Plant and animal species and communities now respond to a fire regime probably not experienced since the beginning of human occupation, and are undergoing further change as the impacts of climate change are becoming more apparent.

HISTORY OF BOTANICAL STUDY PRIOR TO THE SURVEY

Early expeditions and surveys.

The comprehensive review by Willis (1981) on the history of botanical investigation in central Australia includes much information of relevance to the MT Lands. Only a brief account will be provided here, and Willis can be consulted for more detail.

The early development of European botanical knowledge in the area was an adjunct to other activities, such as initial general exploration and prospecting, anthropological studies, and general scientific research.

The first plant collections from the MT Lands by Europeans were made by Giles and dated 1875. However, Robert Helms appears to have made the first substantial contribution, collecting several hundred plants on the Elder Exploring Expedition in 1891.

The next major contributor was Herbert Basedow who made important collections from the MT Lands in 1903, while working there as a government prospector. Many of the early collections from north-western South Australia were also studied by J. M. Black.

E.H Ising also made many collections in the 1920's on a trip along the Transcontinental Railway between Kingoonya and Hughes.

Many hundreds of plant collections from the MT Lands were made by J. B. Cleland on trips for anthropological research are stored in the State Herbarium. Tindale (1941) also published some similar information for plants he collected on a 1934 anthropological expedition. A comprehensive plant list with identifications by J. M. Black was appended to Tindales' paper. The distribution of herbarium records prior to this survey are shown in Figure 31.

The early MT Lands plant collections at the State Herbarium of SA were substantially expanded in more recent times following the Nullarbor Biological Survey (McKenzie and Robinson (1987) and Yellabinna (Copley and Kemper 1992).

PLANT SPECIES DIVERSITY AND ABUNDANCE

Sampling

A total of 6 401 plant records were made over this survey, 5 662 being from 170 vegetation quadrats and 736 as opportunistic sightings. A total of 2 240 or 35% of these records are represented by voucher specimens lodged at the State Herbarium. The distribution of flora survey sites are shown in Figure 32 and Biological Survey of SA plant records are shown in Figure 33.

A complete list of vascular plants occurring within the MT Lands is provided in Appendix 1. The list of species in Appendix I incorporates many of the more recent taxonomic and nomenclatural changes.

Limitations in sampling the MT Land's plant biodiversity are suggested by the relatively high proportion of plant species that were recorded very infrequently. A total of 129 species (18% of those recorded) were recorded only once (based on survey site and opportune location combined). The limitations inherent in the more intensive site-based vegetation sampling were offset by opportunistic records only to a limited degree. After completing the vegetation sites, there was often little time for collecting general plant records. There were also cultural constraints that limited access to locations where different species could be found.

Species richness

The MT Lands supports approximately 916 separate vascular plant species, and 685 of these (72%) were recorded within the MT Lands on the biological survey.

It is not possible to determine the precise total number of plant species within the MT Lands due to ongoing taxonomic work and the presence of species complexes but they are not distinguishable (or at least are not readily or reliably distinguishable on a morphological basis).

Figure 34 illustrates the species richness of plants recorded within each cluster of sites during the survey. Species richness varied considerably, ranging from 62 species (TAL) to 143 species (MAR1 cluster). Mean species richness over all clusters was 116 species. To a large degree this reflects seasonal differences as sites sampled in spring (e.g. MAU, MAR1, SER, VOK,) following good winter rain, whereas OAK and TAL sites were sampled in autumn with little or no summer rainfall. As indicated earlier, the impacts of fire (or lack thereof) can also influence species richness. Sites within GVD3 sub-region are more influenced by fire than GVD5, GVD6 sub-regions and Nullarbor and Gawler bioregions (see Figure 1).

Representation of plant families and genera

Fifty-nine plant families were present in the MT Lands. The most species-rich families in the MT surveys are: Chenopodiaceae (e.g. saltbushes) (116 species), Compositae (daisies)(114 species), Leguminosae (e.g. acacia, pea flowers) (109 species), Gramineae (grasses) (95 species), Myrtaceae (eucalypts, tea-trees) (60 species) and Myporaceae (e.g. eremophila (51 species), which comprise almost 60% of the recorded flora.
The first four families also dominate the in the APY Lands (Robinson *et al.* 2003), Stony Deserts (Brandle

1998) and Flinders Ranges (Brandle 2001). Based on the total number of individual records, Chenopodiaceae species are the most prevalent in MT Lands survey quadrats, reflecting the range of land types across the three bioregions present on the MT Lands.

The fifty most frequent perennial species are ranked in Table 9. The most frequently recorded perennial species in MT Lands quadrats was *Acacia aneura* complex (Mulgas) being present at 141 (81.5%) of the 173 quadrats sampled. The third most frequent species, *Enchylaena tomentosa* (Ruby Saltbush), occur

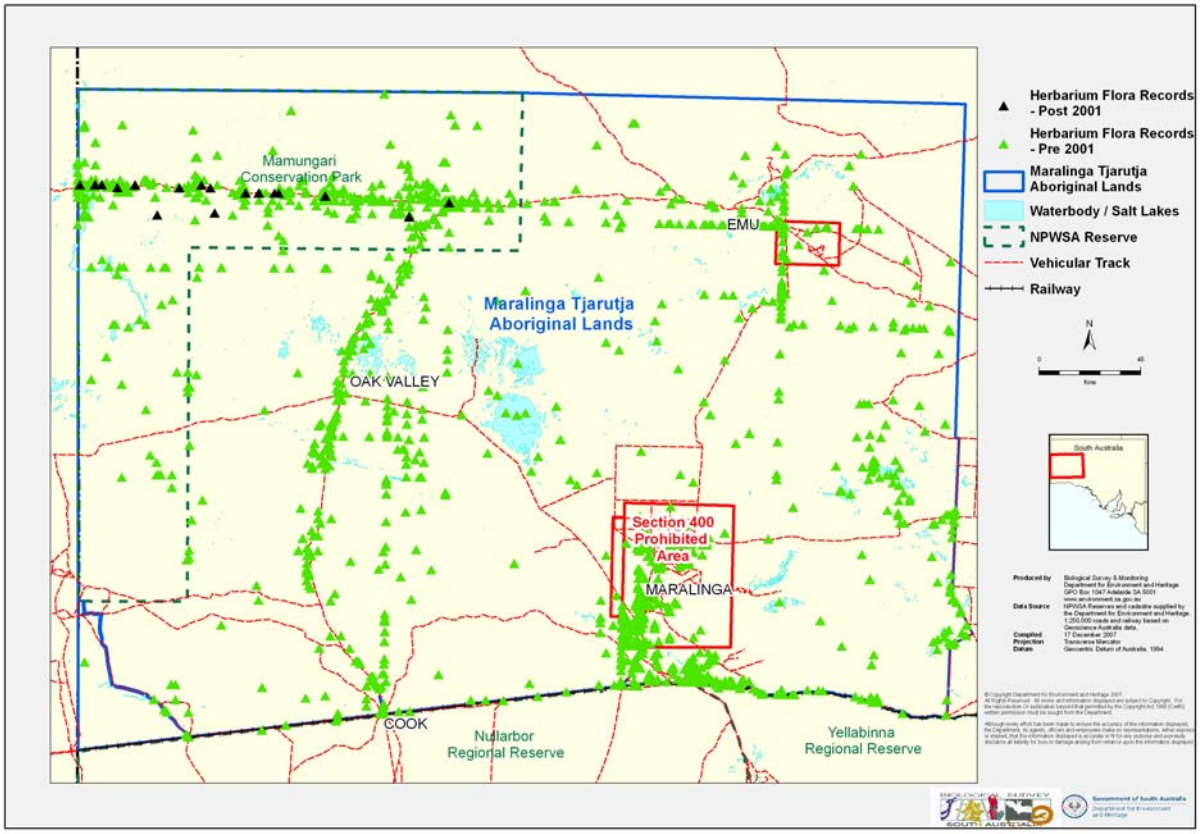

Figure 31: Distribution of herbarium vascular plant specimen records (pre-2001) and (post-2001) across the Maralinga Tjarutja Lands.

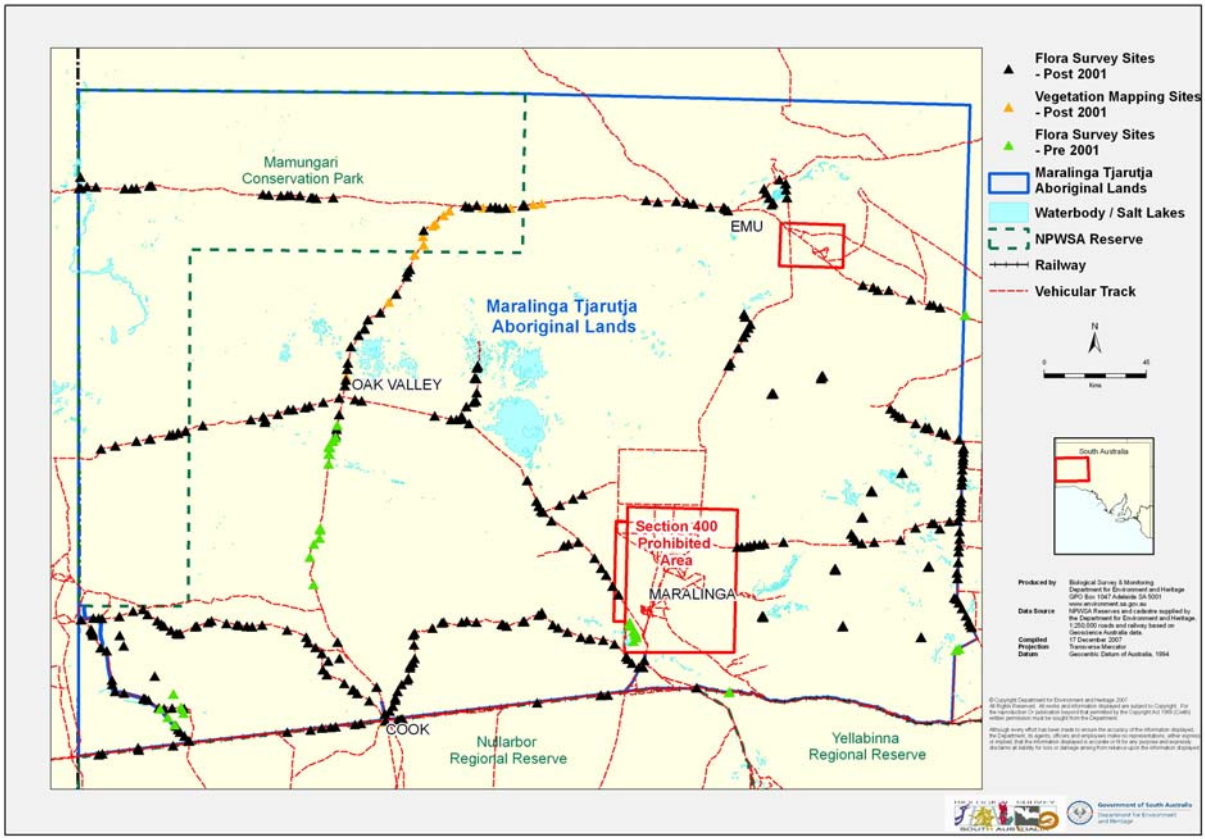

Figure 32: Distribution of flora survey sites (pre-2001) and from this survey (2001-2007) and vegetation mapping sites across the Maralinga Tjarutja Lands.

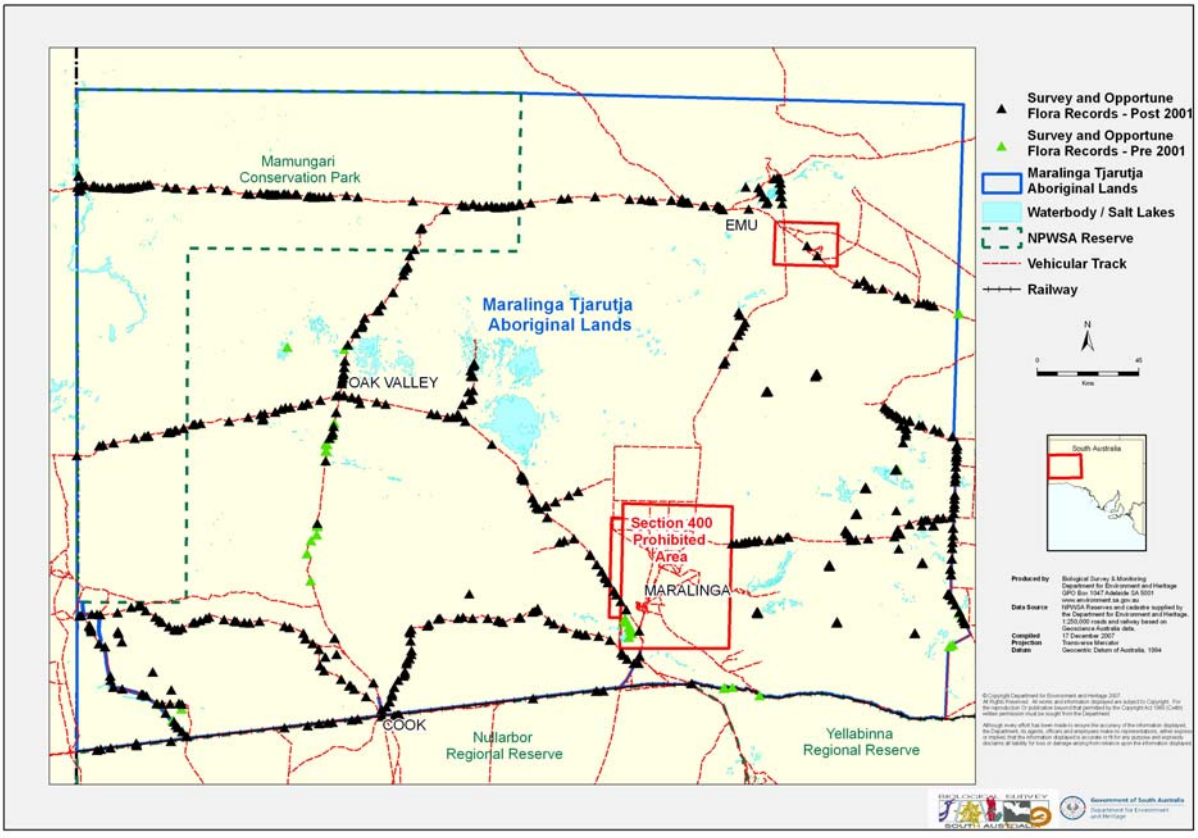

Figure 33: Distribution of Biological Survey of SA flora records (pre-2001 ▲) and (post-2001▲) across the Maralinga Tjarutja Lands.

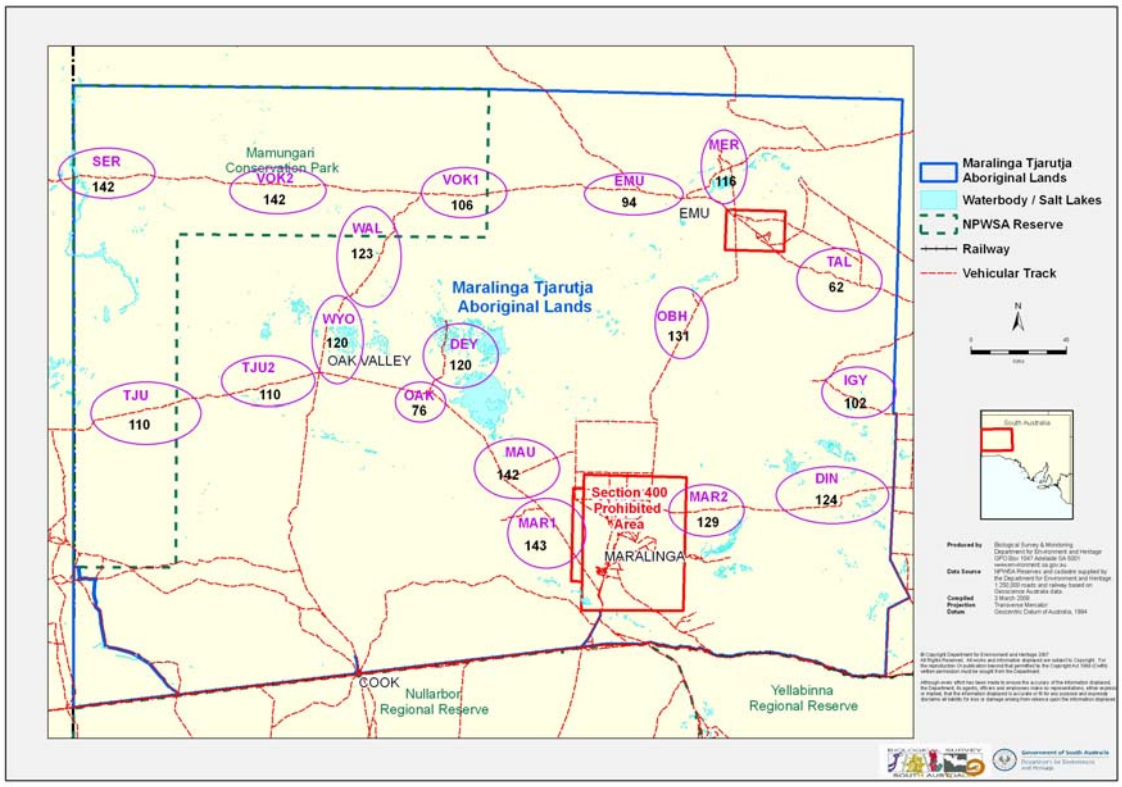

Figure 34: Location of areas sampled (clusters of quadrats) and vascular plant species richness within each of the Maralinga Tjarutja Lands site clusters during this survey (2001-2007).

widely but at low densities in most vegetation types across the MT Lands.

Tussock grasses are well represented among the most common perennial species with *Aristida contorta* (Curly Wire-grass) occurring at 73 quadrats (42.2%) and *Aristida holathera* var *holathera* at 63 quadrats, *Enneapogon polyphyllus* (Leafy Bottle-washers) at 59 quadrats, *Enneapogon avenaceus* (57 quadrats) and *Monochather paradoxa* (55 quadrats) Some of these grasses are short-lived perennial and may either die back completely in very dry years, or persist in a dormant state until significant rain falls.

Hummock grasses occur much less widely, with the most common species being *Triodia basedowii* (Hard Spinifex) at 29 quadrats, *Triodia scariosa* (17 quadrats), *T. irritans* (Grey Spinifex) with 9 quadrats and *T. lanata* (5 quadrats). However, where they do occur, hummock grasses usually dominate their communities, forming relatively dense and uniform layers (in contrast to the tussock grasses which are more widespread, but less abundant overall). Hence, two *Triodia* species (*T. basedowii* and *T. scariosa*) fall among the top five species in terms of overall abundance based on canopy cover (Table 10).

The values used in Table 10 are the midpoints of the canopy cover classes which when summed provide an estimate of relative cover for each species. In terms of cover the most common species overall is *Acacia aneura* complex (mulga), *Triodia scariosa* followed by *T. basedowii*. A similar pattern was evident in the APY Lands where *Triodia* spp. and *Aristida contorta and Acacia aneura* complex were the species with the highest cover.

Significantly there are no weed species ranked among the common species for any of the three tables of perennial species referred to above (see discussion of weed species).

New Records for the Maralinga Tjarutja Lands

Table 13 shows the new plant species (listed by family) recorded for the Maralinga Tjarutja Lands. A total of 174 new species (and sub-species) from 34 families for the MT Lands were recorded on the survey. There are at least eight species which are new to South Australia collected on the survey;

Eremophila hygrophana
Sida sp. B
Sida sp. Rabbit Flat
Sida sp. Watarrka
Sida sp. golden calyces
Pityrodia loricata
Goodenia larapinta
Nicotiana ingulba

There are still other specimens awaiting comparison with other specimens to confirm their identity.

Table 9: The 50 most common perennial plants based on their frequency of occurrence in the 173 survey quadrats sampled on the MT Lands Biological Survey. The top 15 species are highlighted for comparison with Table 10 below.

Species	Total	% Quadrats
***Acacia aneura* complex**	**141**	**81.5**
Salsola tragus	**108**	**62.4**
Enchylaena tomentosa* var. *tomentosa	**105**	**60.7**
Ptilotus obovatus* var. *obovatus	**100**	**57.8**
Ptilotus polystachyus* var. *polystachyus	**79**	**45.7**
Acacia ligulata	**75**	**43.4**
Acacia tetragonophylla	**74**	**42.8**
Aristida contorta	**73**	**42.2**
Dodonaea viscosa* ssp. *angustissima	**68**	**39.3**
***Senna artemisioides* ssp. *petiolaris* (NC)**	**68**	**39.3**
Alectryon oleifolius* ssp. *canescens	**63**	**36.4**
Aristida holathera* var. *holathera	**63**	**36.4**
Enneapogon polyphyllus	**59**	**34.1**
Enneapogon avenaceus	**57**	**32.9**
Monachather paradoxus	**55**	**31.8**
Rhyncharrhena linearis	55	31.8
Eragrostis eriopoda	54	31.2
Acacia oswaldii	52	30.1
Atriplex vesicaria ssp.	51	29.5
Maireana sedifolia	50	28.9
Casuarina pauper	49	28.3
Sclerolaena diacantha	49	28.3
Eremophila latrobei ssp. *glabra*	47	27.2
Euphorbia tannensis ssp. *eremophila*	47	27.2
Rhodanthe floribunda	47	27.2
Acacia gilesiana	46	26.6
Senna artemisioides ssp. *petiolaris*	44	25.4
Acacia ramulosa var.	43	24.9
Chamaesyce drummondii	41	23.7
Sclerolaena parviflora	41	23.7
Zygophyllum eremaeum (NC)	41	23.7
Solanum orbiculatum ssp. *orbiculatum*	39	22.5
Solanum ellipticum	38	22.0
Zygophyllum ovatum	38	22.0
Amyema preissii	37	21.4
Eucalyptus concinna	37	21.4
Austrostipa nitida	36	20.8
Scaevola spinescens	36	20.8
Senna cardiosperma ssp. *gawlerensis*	36	20.8
Vittadinia eremaea	36	20.8
Acacia nyssophylla	35	20.2
Eremophila latrobei ssp.	35	20.2
Rhagodia spinescens	35	20.2
Eriochiton sclerolaenoides	34	19.7
Maireana erioclada	34	19.7
Maireana pentatropis	34	19.7
Eragrostis xerophila	33	19.1
Maireana georgei	33	19.1

Maireana trichoptera	33	19.1
Rhagodia eremaea	33	19.1
Santalum acuminatum	33	19.1
Sida fibulifera	33	19.1
Chenopodium curvispicatum	32	18.5
Chrysocephalum eremaeum	32	18.5
Lepidium phlebopetalum	32	18.5
Sclerolaena obliquicuspis	30	17.3
Lysiana exocarpi ssp. *exocarpi*	29	16.8
Triodia basedowii	29	16.8
Acacia kempeana	28	16.2

Figure 35: Desert Poplar (*Codonocarpus cotonifolius*) is commonly found as coloniser of recently burnt areas. (Photo: D. Kraehenbuehl).

Figure 36: Pink Mulla Mulla (*Ptilotus exaltatus* var *exaltatus*) is one of eight species of *Ptilotus* recorded from the MT Lands. (Photo: J. Foulkes).

Figure 37: Velvet Potato-bush (*Solanum ellipticum*) was recorded at 22% of survey sites across the MT Lands. (Photo: A. C. Robinson).

Table 10: The 15 most common perennial plants based on aggregate of estimated foliage cover in the 173 vegetation survey quadrats sampled on the MT Lands Biological Survey. The cover classes were coded using the mid-point of the estimated cover percentage: < *5% N* = **1**, *T* = **2**, *1* = **3**; *5-25%* = **15**; *25-50%* = **37**; *50-75%* = **62**.

Species	Total	No. Quadrats	% Quadrats
Acacia aneura complex	772	141	81.5
Triodia scariosa	455	17	9.8
Triodia basedowii	370	29	16.8
Ptilotus obovatus var. *obovatus*	361	100	57.8
Atriplex vesicaria ssp.	337	51	29.5
Casuarina pauper	336	49	28.3
Senna artemisioides ssp. *petiolaris (NC)*	286	68	39.3
Eragrostis eriopoda	285	54	31.2
Aristida contorta	275	73	42.2
Aristida holathera var. *holathera*	265	63	36.4
Eucalyptus concinna	262	37	21.4
Maireana sedifolia	252	50	28.9
Acacia ligulata	240	75	43.4
Enneapogon avenaceus	226	57	32.9
Dodonaea viscosa ssp. *angustissima*	202	68	39.3

Table 11: Frequency of weed species recorded on the Maralinga Tjarutja Lands during the survey.

Species	Common Name	No. records
Brassica tournefortii	Wild Turnip	9
Carrichtera annua	Ward's Weed	7
Setaria parviflora	Slender Pigeon-grass	18
Sonchus oleraceus	Common Sow-thistle	8
Tribulus terrestris	Caltrop	4
Cenchrus ciliaris	Buffel Grass	1
Eragrostis pergracilis	Small Love-grass	6
Erodium aureum		5

Table 12: Plant species recorded on the Maralinga Tjarutja Lands which have a Federal (EPBC Act) or State (SA NPW Act) conservation status ratings. # denotes recorded on this survey.

Family	Species	Common Name	ESACTSTATC	NPWACTSTAT
AIZOACEAE	*Sarcozona bicarinata*	Ridged Noon-flower		V
CAMPANULACEAE	*# Lobelia heterophylla*			R
CHENOPODIACEAE	*#Maireana melanocarpa*	Black-fruit Bluebush		R
	#Sclerolaena blackiana	Black's Bindyi		R
	Sclerolaena symoniana	Symon's Bindyi		V
	Atriplex morrisii			V
	Sclerolaena fusiformis			V
COMPOSITAE	*Gratwickia monochaeta*			R
	Podolepis jaceoides	Showy Copper-wire Daisy		R
	#Brachyscome ciliaris var. *subintegrifolia*			R
	Olearia arida	Desert Daisy-bush		V
CRUCIFERAE	*Phlegmatospermum eremaeum*	Spreading Cress		R
DILLENIACEAE	*Hibbertia crispula*	Ooldea Guinea-flower	VU	V
FRANKENIACEAE	*Frankenia cinerea*			R
GOODENIACEAE	*Dampiera lanceolata* var. *intermedia*	Aldinga Dampiera		E
	Goodenia glandulosa			R
GRAMINEAE	*#Austrostipa nullanulla*	Club Spear-grass	VU	V
	#Austrostipa tenuifolia			R
LABIATAE	*Teucrium grandiusculum* ssp. *pilosum*			E
LEGUMINOSAE	*#Acacia rhodophloia*	Minni Ritchi		R
	Acacia helmsiana	Helm's Wattle		R
	Acacia jennerae	Coonavittra Wattle		R
	Swainsona kingii			V
	Swainsona dictyocarpa			V
LILIACEAE	*Corynotheca licrota*	Sand Lily		R
MALVACEAE	*Alyogyne pinoniana* var. *microandra*			V
MYOPORACEAE	*#Eremophila hillii*	Hill's Emubush		R
	Eremophila parvifolia	Small-leaf Emubush		R
MYRTACEAE	*#Eucalyptus canescens* ssp. *beadellii*	Beadell's Mallee		R
	#Eucalyptus wyolensis	Wyola Mallee		R
	#Eucalyptus kingsmillii ssp. *alatissima*	Kingsmill's Mallee		R
	#Melaleuca nanophylla	Dwarf-leaf Honey-myrtle		R
SANTALACEAE	*#Choretrum glomeratum* var. *chrysanthum*	Yellow-flower Sour-bush		R
SANTALACEAE	*Santalum spicatum*	Sandalwood		V
STERCULIACEAE	*#Gilesia biniflora*	Western Tar-vine		R

Table 13: Frequency of new plant taxa within family recorded for the Maralinga Tjuratja Lands between 2001 and 2007.

Family	Species (Common Name)	Post 2001
AIZOACEAE	*Sarcozona bicarinata* (Ridged Noon-flower)	1
AMARANTHACEAE	*Ptilotus helipteroides* var. (Hairy Mulla Mulla)	2
ASCLEPIADACEAE	*Cynanchum floribundum* (Desert Cynanchum)	2
	Sarcostemma viminale ssp. *australe* (Caustic Bush)	1
BORAGINACEAE	**Heliotropium europaeum* (Common Heliotrope)	4
CAMPANULACEAE	*Wahlenbergia tumidifructa* (Swollen-fruit Bluebell)	1
CHENOPODIACEAE	*Atriplex cinerea* (Coast Saltbush)	1
	Atriplex leptocarpa (Slender-fruit Saltbush)	3
	Atriplex paludosa ssp. *cordata* (Marsh Saltbush)	1
	Chenopodium desertorum ssp. *microphyllum* (Small-leaf Goosefoot)	4
	Chenopodium melanocarpum f. *melanocarpum* (Black-fruit Goosefoot)	7
	Einadia nutans ssp. *eremaea* (Dryland Climbing Saltbus)	1
	Maireana astrotricha (Low Bluebush)	2
	Maireana campanulata (Bell-fruit Bluebush)	1
	Maireana georgei/turbinata (Satiny Bluebush)	1
	Maireana melanocarpa (Black-fruit Bluebush)	1
	Maireana ovata	6
	Maireana pyramidata (Black Bluebush)	1
	Rhagodia ulicina (Intricate Saltbush)	1
	Sclerolaena blackiana (Black's Bindyi)	1
	Sclerolaena decurrens (Green Bindyi)	1
	Sclerolaena holtiana (Holt's Bindyi)	15
	Sclerolaena parallelicuspis (Western Bindyi)	2
	Tecticornia indica ssp. *bidens* (Brown-head Samphire)	4
CAMPANULACEAE	*Newcastelia spodiotricha*	2
COMPOSITAE	*Anemocarpa podolepidium* (Rock Everlasting)	1
	Brachyscome ciliaris var. *lanuginosa* (Woolly Variable Daisy)	2
	Brachyscome ciliaris var. *subintegrifolia*	1
	Brachyscome iberidifolia (Swan River Daisy)	19
	Brachyscome trachycarpa (Smooth Daisy)	39
	Chrysocephalum semipapposum (Clustered Everlasting)	5
	Eriochlamys behrii (Woolly Mantle)	1
	Gnephosis arachnoidea (Spidery Button-flower)	5
	Gnephosis eriocarpa (Native Camomile)	1
	Lemooria burkittii (Wires-and-wool)	1
	Minuria annua (Annual Minuria)	1
	Minuria denticulata (Woolly Minuria)	1
	Minuria integerrima (Smooth Minuria)	1
	Olearia ramulosa (Twiggy Daisy-bush)	1
	Podolepis jaceoides (Showy Copper-wire Daisy)	3
	Podolepis longipedata (Tall Copper-wire Daisy)	1
	Vittadinia arida	6
	Vittadinia australasica var. *australasica* (Sticky New Holland Daisy)	1
	Vittadinia gracilis (Woolly New Holland Daisy)	2
	Vittadinia pustulata (Ridged New Holland Daisy)	1
	Vittadinia sp. (New Holland Daisy)	16
CONVOLVULACEAE	*Convolvulus clementii*	6
CUCURBITACEAE	*Citrullus colocynthis* (Colocynth)	1
	Cucumis myriocarpus (Paddy Melon)	1

CYPERACEAE	*Fimbristylis dichotoma* (Common Fringe-rush)	1
EUPHORBIACEAE	*Phyllanthus lacunarius* (NC) (Lagoon Spurge)	1
	Chamaesyce inappendiculata	2
GERANIACEAE	*Erodium angustilobum* (NC)	1
	Erodium carolinianum (Clammy Heron's-bill)	18
GOODENIACEAE	*Goodenia cycloptera* (Serrated Goodenia)	8
	Goodenia fascicularis (Silky Goodenia)	1
	Goodenia glandulosa	1
	Goodenia gypsicola	1
	Goodenia larapinta	1
	Scaevola collina (Hill Fanflower)	1
	Scaevola parvibarbata (Small-beard Fanflower)	1
GRAMINEAE	*Astrebla pectinata* (Barley Mitchell-grass)	1
	Austrodanthonia setacea (Small-flower Wallaby-grass)	2
	Austrostipa dongicola	1
	Austrostipa elegantissima (Feather Spear-grass)	1
	Austrostipa nullanulla (Club Spear-grass)	10
	Austrostipa puberula (Fine-hairy Spear-grass)	1
	Austrostipa scabra ssp. (Rough Spear-grass)	2
	Austrostipa scabra ssp. *falcata* (Slender Spear-grass)	2
	Austrostipa scabra ssp. *scabra* (Rough Spear-grass)	28
	Austrostipa tenuifolia	3
	Brachyachne ciliaris (Hairy Native Couch)	2
	Cenchrus ciliaris (Buffel Grass)	1
	Dactyloctenium radulans (Button-grass)	1
	Digitaria brownii (Cotton Panic-grass)	12
	Enneapogon intermedius (Tall Bottle-washers)	7
	Enteropogon ramosus (Umbrella Grass)	3
	Eragrostis leptocarpa (Drooping Love-grass)	1
	Setaria basiclada	4
	Setaria parviflora (Slender Pigeon-grass)	2
	Setaria reflexa	5
	Triodia lanigera (Spinifex)	5
	Triodia melvillei (Melville's Spinifex)	1
	Tripogon loliiformis (Five-minute Grass)	1
HALORAGACEAE	*Haloragis odontocarpa f. rugosa* (Mulga Nettle)	1
LABIATAE	*Lycopus australis* (Australian Gipsywort)	1
	Teucrium racemosum (Grey Germander)	2
LEGUMINOSAE	*Acacia aneura* var. *aneura* (Mulga)	36
	Acacia aneura var. *intermedia* (Broad-leaf Mulga)	29
	Acacia aneura var. *macrocarpa* (Weeping Mulga)	1
	Acacia aneura var. *major*	12
	Acacia aneura var. *microcarpa*	13
	Acacia aneura var. 'silver falcate' (NC)	1
	Acacia aneura var. *tenuis* (Mulga)	9
	Acacia brachybotrya (Grey Mulga-bush)	2
	Acacia brachystachya (Turpentine Mulga)	4
	Acacia continua (Thorn Wattle)	1
	Acacia melleodora (Net-veined Wattle)	2
	Acacia paraneura (NC) (Weeping Mulga)	1
	Acacia ramulosa var. *linophylla* (Horse Mulga)	38
	Acacia ramulosa var. *ramulosa* (Horse Mulga)	5

	Acacia rhodophloia (Minni Ritchi)	1
	Daviesia benthamii ssp. (Spiny Bitter-pea)	1
	Indigofera psammophila (Sand Indigo)	3
	Senna artemisioides ssp. (Desert Senna)	1
	Senna artemisioides ssp. *artemisioides* (Desert Senna)	1
	Senna phyllodinea	1
	Swainsona campylantha	1
	Swainsona villosa (Villous Swainson-pea)	2
LILIACEAE	*Corynotheca micrantha* var. *divaricata* (Small-flower Sand Lily)	1
	Thysanotus baueri (Mallee Fringe-lily)	1
	Thysanotus exiliflorus (Inland Fringe-lily)	9
LORANTHACEAE	*Amyema linophylla* ssp. *orientale* (Casuarina Mistletoe)	1
MALVACEAE	*Abutilon halophilum* (Plains Lantern-bush)	4
	Hibiscus solanifolius (Solanum-leaf Hibiscus)	8
	Hibiscus sturtii var. (Sturt's Hibiscus)	1
	Malvastrum americanum var. *americanum* (Malvastrum)	2
	Melaleuca interioris (Broombush)	5
	Sida corrugata var. (Corrugated Sida)	1
	Sida corrugata var. corrugata (Corrugated Sida)	8
	Sida filiformis (Fine Sida)	1
	Sida petrophila (Rock Sida)	7
	Sida sp. B (C.Dunlop 1739)	2
	Sida sp. golden calyces (H.N.Foote 32)	3
	Sida sp. L (A.M.Ashby 4202)	1
	Sida sp. R (P.Copley 1390)	9
	Sida sp. Rabbit Flat (R.B.Major 158)	4
	Sida sp. Watarrka (D.E.Albrecht 8672)	1
MYOPORACEAE	*Eremophila arenaria*	3
	Eremophila behriana (Rough Emubush)	1
	Eremophila decipiens var. *decipiens* (Long-stalk Tar-bush)	12
	Eremophila freelingii (Rock Emubush)	1
	Eremophila maculata ssp. (Spotted Emubush)	3
	Eremophila oppositifolia ssp. (Opposite-leaved Emubush)	1
	Eremophila parvifolia (Small-leaf Emubush)	1
	Eremophila platythamnos ssp.	1
	Eremophila sp. Decussate (R.J.Chinnock	1
	Eremophila sp. Dendritica (W.S.Reid AD	5
	Eremophila sp. Fallax (D.E.Symon 12311	2
	Eremophila sp. Hygrophana (P.J.Lang B8	2
	Eremophila willsii var.	1
	Eremophila willsii var. integrifolia (Will's Emubush)	19
	Myoporum platycarpum ssp. (False Sandalwood)	10
MYRTACEAE	*Aluta maisonneuvei* ssp. *auriculata* (Desert Thryptomene)	8
	Eucalyptus brachycalyx (Gilja)	2
	Eucalyptus canescens ssp.	4
	Eucalyptus oleosa ssp. *ampliata* (Red Mallee)	3
	Eucalyptus oleosa ssp. *oleosa* (Red Mallee)	3
	Eucalyptus socialis ssp. "South Great Victoria Desert"	16
	Eucalyptus yumbarrana ssp. (Yumbarra Mallee)	7
	Melaleuca xerophila (Boree)	1
NYCTAGINACEAE	*Boerhavia dominii* (Tar-vine)	2
OLEACEAE	*Jasminum didymum* ssp. *lineare* (Native Jasmine)	1

ORCHIDACEAE	*Caladenia* sp. (Spider-orchid)	1
PORTULACACEAE	*Calandrinia reticulata*	10
	Portulaca oleracea (Common Purslane)	6
SANTALACEAE	*Choretrum glomeratum var. chrysanthum* (Yellow-flower Sour-bush)	1
SAPINDACEAE	*Dodonaea viscosa ssp.* (Sticky Hop-bush)	1
SOLANACAE	*Nicotiana rosulata* ssp.	6
	Nicotiana rosulata ssp. *rosulata*	2
	Solanum ferocissimum (Spiny Potato-bush)	3
	Solanum orbiculatum ssp.	8
STERCULIACEAE	*Gilesia biniflora* (Western Tar-vine)	2
	Keraudrenia nephrosperma	5
	Rulingia loxophylla	1
	Rulingia magniflora	1
UMBELLIFERAE	*Trachymene cyanopetala* (Purple Trachymene)	3
VERBENACEAE	*Pityrodia loricata*	1
ZYGOPHYLLACEAE	*Tribulus eichlerianus* (Eichler's Caltrop)	8
	Zygophyllum ammophilum (Sand Twinleaf)	6
	Zygophyllum aurantiacum ssp. *simplicifolium*	4
	Zygophyllum glaucum (Pale Twinleaf)	2
	Zygophyllum prismatothecum (NC) (Square-fruit Twinleaf)	1
		773

Relative abundance of annual/ephemeral species

The presence and abundance of annual or ephemeral plants is influenced by seasonal conditions that varied greatly between survey trips. This means that the resultant sampling by the full set of quadrats will be less representative in regard to areas, habitats and species than for the perennial flora. The 15 most frequently recorded species in MT Lands quadrats are ranked in Table 10.

The most frequently recorded 'annual', and by far the most frequently recorded of any plant species, was *Salsola tragus* (Buckbush), being present at 108 (62.4%) of the 173 quadrats sampled. Although short-lived, its dried foliage persists, enabling it to be detected in less favourable conditions. *Salsola tragus* disperses readily by wind and on animal fur and is widely distributed, occurring in most habitat types, including sandplain, dunes and limestone plains.

Annual species had a variable influence on understorey structure, displaying a typical desert 'boom or bust' response to suitable levels of rainfall. The MT Lands can receive either winter or summer rainfall, although summer rainfall is more likely. Survey times were not targeted to compare seasonal influences. After good winter rains, that the annual vegetation included much recent growth of *Erodium*, Compositae (e.g. Common Everlasting) and Cruciferae (e.g. Wild Turnip) species not previously observed in such abundance.

Significant Species

Weeds

Eight species of grass were recorded on the MT Lands Biological Survey (Table 11), representing 0.8% of the total plant species present on the lands. A total of 52 introduced species have been recorded as occurring in the MT Lands, but the majority were recorded at only 1 or 2 locations, occur in association with the Transcontinental Railway line and have not been recorded for at least 20 years. Of the weeds still present, none are particularly widespread, occurring mainly on roadsides and other disturbed areas, such as rabbit warrens.

One species, however, is of particular concern because of its highly invasive nature (Figure 38, 39). Buffel Grass (*Cenchrus ciliaris*) has been widely introduced to the Australian rangelands for its production values (Hall 2000) and has spread into many non-target areas. While it has brought major benefits to many pastoral landholders, it is contentious because it also threatens biodiversity values in diverse inland regions (Friedel *et al*. 2006). Species particularly at risk from increasing Buffel Grass include ground layer flora and fire sensitive trees and shrubs, granivores, ground dwelling fauna, and fauna most at risk from structural change, especially any that are susceptible to fire (Friedel *et al.* 2007). Buffel Grass is almost certainly present in all rangeland bioregions (see Interim Biogeographic Regionalisation for Australia (IBRA) 2007 for definition) and is continuing to establish in new areas and to increase where it already exists.

In its 2008 report, the Biodiversity Working Group of the Australian Collaborative Rangelands Information System (ACRIS) recognised the importance of tracking changes in transformer weeds such as Buffel Grass, where transformer weeds are invasive plants that can transform the basic attributes of habitats (Bastin *et al.* 2008). The Working Group noted that detailed information on the distribution and density of Buffel grass was very poor. Detailing the specific impacts of Buffel Grass on biodiversity, especially for those assets at greatest risk, was also important, as was documenting the potential for control.

Figure 38. Buffel Grass (*Cenchrus ciliaris*) is the biggest potential environmental weed threat to plant communities in the MT Lands. (Photo: P. Lang).

Figure 39: Typical habit of Buffel Grass (*Cenchrus ciliaris*). (Photo: A.C. Robinson).

Nationally Rated
Two nationally rated plant species are currently recognized as occurring in the MT Lands (Table 12); however, only one of these, *Austrostipa nullanulla* was collected during the survey.

***Austrostipa nullanulla* (Club Spear-grass) VU, V**
Club Spear-grass is a small, tufted perennial grass to 0.5 m high (Vickery *et al.* 1986). Its leaf blades are linear to 30 cm in length and are usually tightly rolled. This species extends from far south-west NSW and north-west Victoria into SA and appears to be restricted to gypseous rises (Vickery *et al.* 1986; Jessop *et al.* 2006). During the survey it was collected on ten occasions from sites in the Great Victoria Desert Bioregion in the south and east of the MT Lands.

***Hibbertia crispula* (Ooldea Guinea-flower) VU, V**
The Ooldea Guinea-flower is only known from two disjunct locations in Australia, both in South Australia. The first from near Ooldea and the other near Lake Everard. It is a small, low shrub to 50 cm, which produces yellow flowers in the axils of the leaves during August-September. The potential threats to it include competition from weeds and grazing by feral animals, however the impacts of these threats are poorly known. Its distribution is not known to overlap with any EPBC Act-listed ecological communities and there is no management plan prepared for it.

State Rated Species
Thirty-fiver state rated species are currently identified as occurring in the MT Lands including seven which were recorded for the first time in the MT Lands on this survey. Of the state rated species, two are considered Endangered, 11 Vulnerable and 22 Rare.

The two endangered species, Aldinga Dampiera (*Dampiera lanceolata* var *intermedia*) and *Teucrium grandiusculum* ssp. *pilosum* have not been recorded in the MT Lands since 1923 and 1960 respectively and were not recorded on this survey.

During the survey, fourteen of the rated plant species were recorded or collected (Table 12). Very little is known of the ecology of many of the rated species. The following section summarises information known about a selection of these species.

***Acacia jennerae* (Coonavittra wattle) R**
This species closely resembles the habit of a small mallee eucalypt with its bushy, often multi-stemmed growth form, similar bark and phyllode characters (Maslin 2001). It is typically a shrub or tree, 2-6 metres in height, with reddish brown glabrous bark (Whibley & Symon 1992, Maslin 2001). It's thin, pointed phyllodes are grey-green and narrowly elliptic to narrowly oblanceolate in shape. This species is sporadic and sparsely distributed in northern SA with single collections from the Serpentine Lakes, Simpson Desert, and west of Mt. Finke. It occurs on red sandy flats. It exhibits a similar distribution in the arid and semi-arid areas of WA and the NT (Whibley & Symon 1992).

***Acacia rhodophloia* (Minni Ritchi) R**
Acacia rhodophloia is a multi-stemmed rounded shrub or small tree up to 5m in height (Figure 40). The common name given to this species (Minni Ritchi) refers to its distinctive bright red or maroon bark which sheds in short, narrow curly strips (Whibley & Symon 1992; Flora of Australia). Its flat, rigid phyllodes are variable in shape, adopting a linear to narrow-elliptic through narrow-oblanceolate form (Jessop & Toelken 1986). One or two simple inflorescences occur per axil with the stalk of the axillary inflorescences sometimes being longer than the flower heads themselves. The flower heads are dense, either circular or cylindrical in shape (Whibley & Symon 1992). Flowering is sporadic but predominately occurs between March and October (Maslin 2001).

The few specimens of this species collected within SA were sourced from the Mulgathing and Bulgunnia stations which are located approximately 100km north of Tarcoola (Whibley & Symon 1992). The single collection from east of Emu from this survey represents the first record for the MT Lands. It occurs on drier sites on plains and sand hills with red sandy soils or on rocky ground often on laterite, quartzite or granite in gullies along creeks. It is often found growing on mesas or scree slopes and is frequently associated with *Triodia* spp. and, to a lesser extent, scrub heath and *Casuarina* shrub (Maslin 2001).

Figure 40: Minni Ritchi *Acacia rhodophloia* was collected on one occasion during the survey. (Photo: J. McDonald).

***Austrostipa tenuifolia* R**
The prominent features of this perennial species include its sparse basal tuft and the presence of extravaginal shoots to 40cm in height (Vickery *et al.* 1986). The tussock itself grows to between 0.6- 1m in height and the leaf blades grow to 30cm long, typically in-rolled and scabrous to touch. The panicle is sparse spreading to 5 cm across. *A. tenufolia* can be

distinguished from *A. variabilis* by its longer floret, awns and glumes. This species is distributed from the southern regions of Western Australia, east to the Yorke Peninsula in South Australia (Vickery *et al.* 1986); however this is the first records from the MT Lands. It has been recorded mainly in sandy soils and usually in grassland or associated with *Callitris* or *Allocasuarina* species (Jessop *et al.* 2006). Two collections of this species were made during the survey from two locations.

***Brachyscome ciliaris* var. *subintegrifolia* R**
Brachyscome ciliaris var. *subintegrifolia* is a bushy, much-branched, perennial herb to 45cm high with erect stems. A solitary mauve or white flower sits atop each short thread-like peduncle (Jessop & Toelken 1986). *Brachyscome ciliaris* var. *subintegrifolia* is one of a number of varieties of *B. ciliaris* with an indistinct geographical or ecological range. Two or more varieties often occur within a population and, as a result, it might be more appropriate to view them as forms (Jessop & Toelken 1986). This variety also occurs in the NT, Qld, NSW and Victoria. It will grow in relatively dry situations on most soil types and has been observed in a diverse range of habitats from woodland, shrub and mallee communities through to sandhills, gibber plains and clay pans (Salkin *et al.* 1995; The Australian Botany Society 1981). Flowering occurs for most of the year. The single record from this survey was collected from the bed of Serpentine Lake in September 1996.

***Bulbostylis turbinata* R**
Bulbostylis turbinata is an erect annual to 15cm with thread-like scabrous stems and often hairy leaves (Jessop & Toelken 1986). The leaves of *B. turbinata* never exceed half the length of its stems (Jessop & Toelken 1986). The specimens collected during the Great Victoria Desert survey are likely to be the first confirmed specimens of this species collected in South Australia. Although, *B. turbinata* is known to occur in Qld, NT and WA, only two specimens had been collected in SA prior to this survey both of which were cautiously identified as *B. tubinata* (Jessop & Toelken 1986).

***Choretrum glomeratum* var. *chrysanthum* (Yellow-flower sour-bush) R**
The Yellow-flower sour-bush is a shrub to 1- 2 m high with slightly striate, glabrous branches that often appear leafless (Jessop & Toelken 1986; George & Hewson 1984). The branches are terete in cross-section and the leaves alternate. This variation produces very small, axillary, yellow flowers throughout the year (Flora of Australia). It is found sporadically throughout the *Choretrum* spp. range, but is considered less common (George & Hewson 1984). A single specimen was collected from an area burnt in 2003 within the VOK2 cluster of sites.

***Corynotheca licrota* (Sand Lily) R**
The Sand Lily is a stem-less, rhizomatous, perennial herb with tuberous roots and white to pale yellow flowers clustered in groups of 2-6 along a panicle inflorescence, which can reach up to 70cm (Jessop & Toelken 1986; Henderson 1987). Its leaves are grass-like to 60cm in length and generally persist throughout the flowering period. It occurs inland on sand dunes or in sandy soiled plains in areas of low-rainfall (Henderson 1987). It was not collected during the current survey, however there are nine specimens of this species from the MT Lands.

***Eremophila hillii* (Hill's Emubush) R**
Hill's Emubush is a low, spreading, finely leaved shrub to 80cm tall with terete branches and red or orange-red flowers (Figure 36) (Chinnock 2007). *Eremophila hillii* closely resembles *E. glabra*. Prior to this survey, this species was known only in isolated pockets from a few locations in the Nullarbor Plain region of SA. A single record exists for WA. This species appears confined to shallow calcareous loams over limestone (Chinnock 2007) on the southern margins of the MT Lands (Figure 41).

Figure 41: Typical habit of Hill's Emubush *Eremophila hillii* on shallow calcareous loams. (Photo: P. Lang).

***Eucalyptus canescens* spp. *beadellii* (Beadell's Mallee) R**
Beadell's Mallee grows between 2-4 metres tall with dull to slightly glossy green foliage (Figure 42). The lower halves of the stems are covered with a rough, flaky grey-brown bark (Nicolle 1997b). This species possesses large club-shaped buds when mature, which are held in umbels of seven. The flowers are cream (Figure 43) (Nicolle 1997a; 1997b). Prior to this survey, this eucalypt was considered to have a very limited distribution and was known only from a single population measuring no more than a few square kilometres in extent occurring near the junction of the Vokes Hill and Oak Valley tracks to the north of Cook (Nicolle 1997a). This population is situated within a mallee community, on sand plain in the southern Great Victoria Desert. Eight additional locations were

recorded from within the SER, VOK2, TJU2 and MAR1 clusters of sites.

Figure 42: *Eucalyptus canescens* ssp. *beadellii* occurs on sandplain west of Oak Valley, and west of Vokes Hill corner. (Photo: P. Lang).

Figure 43: Distinctive cream flowers of *Eucalyptus. canescens* ssp. *beadellii.* (Photo: A. C. Robinson).

***Eucalyptus kingsmilli* spp. *allatissima* (Kingmill's Mallee) R**

Kingmill's Mallee is a distinctive mallee attaining a height of between 3 and 8 metres. The bark on the lower half of the trunk and stems is rough, grey and fibrous. This bark forms ribbons towards the top before being replaced by a smooth grey or pinkish brown bark on the upper trunk and branches (Figure 45). Its thick leaves are alternate, with a broad-lanceolate shape and dull green to blue-green colouration (Nicolle 1997b; Brooker & Kleinig 2001). The buds, which are either yellow or red, occur in umbels of three and hang in a pendulous fashion (Brooker & Kleinig 2001) (Figure 44). This species produces creamy white to yellow flowers during the months of April-September.

This species is scattered throughout its range, extending eastwards from north of Meekatharra in WA (Brooker & Kleinig 2001) over the border into the southern Great Victoria Desert in the MT Lands, which form the eastern extent of its distribution. There are now 15 locations for this species within the MT Lands, including three new records from this survey from west of Vokes Hill corner. It is typically observed growing on plains in red and brown sands (Chippendale 1988).

Figure 44: The distinctive fruits of Kingmill's Mallee *Eucalyptus kingsmillii*. (Photo: P. Lang).

Figure 45: Typical habit of Kingmill's Mallee *E. kingsmillii*. (Photo: P. Lang).

***Eucalyptus wyolenis* (Wyola Mallee) R**

A prominent feature of this multi-stemmed mallee, which can reach up to 6 metres in height, is the persistent rough grey-brown bark found towards the base of its trunk. This is replaced by tan to cream bark above (Nicolle 1997b; Boomsma 1998). *E. wyolensis* is distinguished by its subdued yellow flowers and its crown of large sessile, opposite to sub-opposite, grey leaves (Nicolle 2005). Branches and stems less than two years of age are glaucous and distinctly square in section, however, both of these attributes dissolve with age (Boomsma 1998). The inflorescences are arranged in axillary pairs, with the buds in each inflorescence clustered into groups of 9 to 11 (Nicolle 1995; 1997b).

Endemic to SA, the only known population of this species occurs in a stand of open mallee vegetation measuring approximately 2 × 0.8km in size located within the southern portion of the Great Victoria Desert. This stand is dissected along its (two kilometre) length by the Oak Valley road which runs to the south of Lake Wyola in the Ooldea Ranges (Figure 46) (Nicolle 1995).

This single population occurs on deep red sand plain in open mallee vegetation, above an understorey dominated by *Triodia* spp. It is associated with *E. concinna*, *E. canescens* spp. *beadellii* and *E. eucentrica* (Nicolle 1995).

Figure 46: *Eucalyptus wyolensis* (R) and *E. canescens* ssp. *beadellii* (L) on sandplain west of Oak Valley. (Photo: A. C. Robinson).

***Lobelia heterophylla* R**
Lobelia heterophylla is an erect, glabrous, annual herb growing to a height of approximately 30 cm often with a solitary stem emerging from a distinct tap-root (Jessop & Toelken 1986). The alternately arranged leaves are variable in shape being linear to elliptic. During October *L. heterophylla* produces pale blue flowers with yellow throats along a spike-like inflorescence. It is found on dunes often in association with *Triodia* spp. (Jessop & Toelken 1986). It was recorded on three dune sites during this survey. All sites were on the Anne Beadell Highway, with one record from the SER cluster of sites and two from the VOK1 cluster of sites.

***Maireana melanocarpa* (Black-fruit Bluebush) R**
Black-fruit Bluebush is much-branched shrub to half a metre high with woolly, terete branchlets and spreading, alternate, rounded leaves (Wilson 1975). Its flowers are solitary and glabrous except from its woolly ciliate margin to the lobes. When dry the fruiting perianth is brown to black (Jessop & Toelken 1986).

This species has been infrequently collected but appears to be very constant in its features (Wilson 1975). It grows on sandy rises on the edge of salt lakes and flowers/fruits from May through September. Prior to its collection in the Great Victoria Desert its known distribution within SA was restricted to the western side of the Flinders Ranges between Beltana and Lake Watherstone near Leigh Creek (Wilson 1984; Wilson 1975). A single specimen was collected west of Oak Valley on the Tjuntjuntjara Track, making it the most westerly record for the species.

***Melaleuca nanophylla* (Dwarf-leaf Honey-myrtle) R**
The Dwarf-leaf Honey-myrtle is a shrub or tree to five metres tall with dark grey fissured bark (The Australian Botany Society 1981). The crowded sessile leaves, which can be broad or acute, are alternately arranged in series of several spirals. *M. nanophylla* is completely glabrous except for its tawny coloured, immature pubescent foliage (Jessop & Toelken 1986). The pale yellow flowers are arranged in small spikes. The flower is comprised of five petals which are often deciduous. It appears to flower very irregularly (Jessop & Toelken 1986) probably in response to major rainfall events.

They are typically found on kopi (gypsum) rises near salt flats (The Australian Botany Society 1981) and all specimens collected on this survey were on the margins of claypans or on gypseous rises within claypans.

***Santalum spicatum* (Sandalwood) V**
Sandalwood is a root parasitic shrub or small tree growing to 4 metres in height with rough, grey bark, rigid, spreading branches and waxy, grey-green lanceolate to narrowly elliptic shaped leaves (Jessop & Toelken 1986). When in flower its numerous fragrant flowers are held in small panicles (George & Hewson 1984). The yellowish to red-brown fruit, which is covered with minute, flaky, resin fragments, contains a single seed (Jessop & Toelken 1986). This species is scattered throughout Western Australia and the northern half of South Australia (George & Hewson 1984), however it was collected only once on this survey, from the Tjuntjuntjara Track close to the WA border. *S. spicatum* was historically felled for its timber and, consequently, is much less abundant than it once was (Jessop & Toelken 1986). It is found growing in loamy soils and amongst rocks in woodland and tall shrubland (George & Hewson 1984).

***Sclerolaena symoniana* (Symon's Bindyi) V**
Symon's Bindyi is a rounded shrub to 30cm high with velvety branches and succulent, silky leaves. In cross-section the long narrow leaves, which can grow to 3 cm in length, are triangular. Its cylindrical flowers are produced in pairs (Jessop & Toelken 1986; Flora of Australia 1984). *S. symoniana* flowers/ fruits throughout the year (Jessop & Toelken 1986). *S. symoniana* occurs in WA, NT and the north-western and Nullarbor regions of South Australia where it is found growing on the sandy margins of salt lakes (Jessop & Toelken 1986; George & Hewson 1984). On this survey it was recorded from ten locations along the Anne Beadell Highway within the SER, VOK and EMU clusters of survey sites.

***Sida* spp. (numerous species)**
Sida is a genus of herbs or small shrubs in the Mallow family (Malvaceae), widely distributed through Australia. Ten additional species of *Sida* were recorded on this survey, six of which are yet to be

formally described (e.g. Figure 47). It is unlikely that any are of any conservation significance.

Figure 47: *Sida* sp. B was collected for the first time in SA on this survey. (Photo: A.C. Robinson).

Figure 48: Black's Bindyi *Sclerolaena blackiana* was collected on a single occasion during the survey. (Photo: P. Lang).

***Eremophila hygrophana* (Figure 49)**

Eremophila hygrophana is a much-branched shrub between 0.3-1.2m tall with densely clustered, thick, alternate to sub-opposite leaves. The leaves are typically linear to linear-oblanceolate in shape, although, obovate shaped leaves do occur. The branches and leaves of this species are coated in a mat of yellow to grey star-shaped dendritic hairs (Chinnock 2007) which can be either a sulphur-yellow or grey colour (Chinnock 2007).

The flowers are initially a pale violet to purple colour and the base of the filament is white with purple spots (Figure 49). As the flowers age they gradually darken, attaining a dark reddish-brown colouration when dry (Chinnock 2007).

Prior to this survey this species was thought to be restricted to Western Australia, extending from the Austin Botanical District to the eastern part of the Helms Botanical District. In WA it is generally observed in groups within close proximity to the base of mulga trees and shrubs and appears to be absent from open areas. *E. hygrophana* was discovered on this survey for the first time in SA just west of Oak Valley. It was observed growing in drainage depressions on gently undulating calcareous plains in association with tussock grass and sparse mulga (Chinnock 2007).

Figure 49: *Eremophila hygrophana* flowers. (Photo: P. Lang).

MAMMALS

by J. N. Foulkes[1]

INTRODUCTION

This section summarises the knowledge of the mammal fauna of the Maralinga Tjarutja Lands (MT Lands) prior to the biological survey beginning in 2001. It then discusses the results of this survey and integrates it with previously recorded information. All mammals are discussed using their European common and scientific names for clarity.

APPRAISAL OF SPECIES' RECORDS PRIOR TO THE SURVEY

Museum and published records

Gara (1996) has reviewed the earliest non-Aboriginal observations of mammals in the MT Lands, and in the Great Victoria Desert to the south and west. From this review, the first European records of mammals in the area appear to have been made by Richard Maurice, Daisy Bates and Anthony Bolam.

Richard Maurice was a pastoralist who, between 1897 and 1903, funded and led at least nine expeditions into the eastern portion of the Great Victoria Desert (Gara 1996). Maurice was a little-known explorer who recorded much of significance about local Aboriginal groups and natural history (see Gara 1994). Most natural history information for the region prior to the early 1930's has to be gleaned from the few published scientific papers and many unpublished journals and manuscripts of early explorers and scientists.

Between 1931 and 1935, H. H. Finlayson began his mammal survey and research work in central Australia. This thorough work included the collection of museum voucher specimens and the systematic documentation of Traditional Aboriginal knowledge (Finlayson 1935, 1961). Although not directly undertaken in the MT Lands, many of the same landscapes and fauna he sampled occur in the MT Lands, and relate directly to the fauna in the MT Lands.

The Nature Conservation Society of South Australia (NCSSA) undertook survey work in August 1980 (Barritt (1986) in Greenslade *et al.* 1986). The work was conducted along the Cook-Vokes Hill track and west of Vokes Hill corner to Serpentine Lakes. Prior to this the mammal fauna was virtually unknown, and they captured or observed 10 native mammal species including the first capture of *Sminthopsis hirtipes* for SA. The survey also recorded 5 introduced species (Barritt 1986).

During a joint biological survey of the Nullarbor Region between South Australian National Parks and Wildlife Service (SANPWS) and the WA Department of Conservation and Land Management in 1984 (McKenzie & Robinson 1987), trapping was undertaken north of Hughes railway siding and around Muckera Rockhole on the Cook-Vokes Hill corner track.

During the Biological Survey of the Yellabinna Region (Copley and Kemper 1992), further trapping was undertaken around Muckera Rockhole with additional trapping undertaken around Yarle Lakes and Lake Bring in the south-eastern corner of the MT Lands.

There have been two recent surveys of comparable areas in Western Australia (Pearson 1994, McKenzie and Burbidge 1979) and in the APY Lands north of the MT Lands (Robinson *et al.* 2003).

TOTAL MAMMAL FAUNA: CURRENT AND EXTINCT

Since 2001, the biological survey of the MT Lands has added significantly to scientific understanding of the ecological requirements of the region's mammals and of their current distributions. All mammal records from the South Australian Museum, from the Biological Survey and Opportune databases, and from published records with reliable species identifications have now been collated for the study area.

This compilation of records indicates that up to 43 native and 9 introduced mammal species have existed within the MT Lands within the past two hundred years.

Extant species

The fauna-survey activity in the region since 2001 has recorded 26 extant native species. Nine of these represent additions to the list of 43 native species collated for the region

There are therefore at least 27 extant native mammal species currently occurring on the MT Lands including.

- one monotreme
- seven species of carnivorous marsupial
- Southern marsupial mole
- one pygmy possum
- three species of macropod
- six species of native rodent
- seven species of insectivorous bat, and
- the Dingo

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Extinct species

Unfortunately, the information above suggests that, of the 43 native species listed for the MT Lands, at least 17 must now be presumed extinct (Table 15). Species included in this category have not been recorded in the region for at least 50 years despite systematic and relatively intensive searches. These include:

- three species of carnivorous marsupial (Dasyuridae)
- three species of macropod (Potoroidae, Macropodidae)
- four bandicoot and bilby species (Peramelidae),
- the Numbat (Myrmecobidae)
- the Common Brushtail Possum (Phalangeridae)
- five species of native rodent (Muridae)

(Table 15).

RELATIVE ABUNDANCE OF MAMMAL SPECIES

The relative abundance of mammals observed during the survey of the MT Lands is shown in Table 16.

In addition, the proportion of records for each species within each vegetation mapping group were calculated to present an indication of which communities are preferred as a percentage of the total (Table 18).

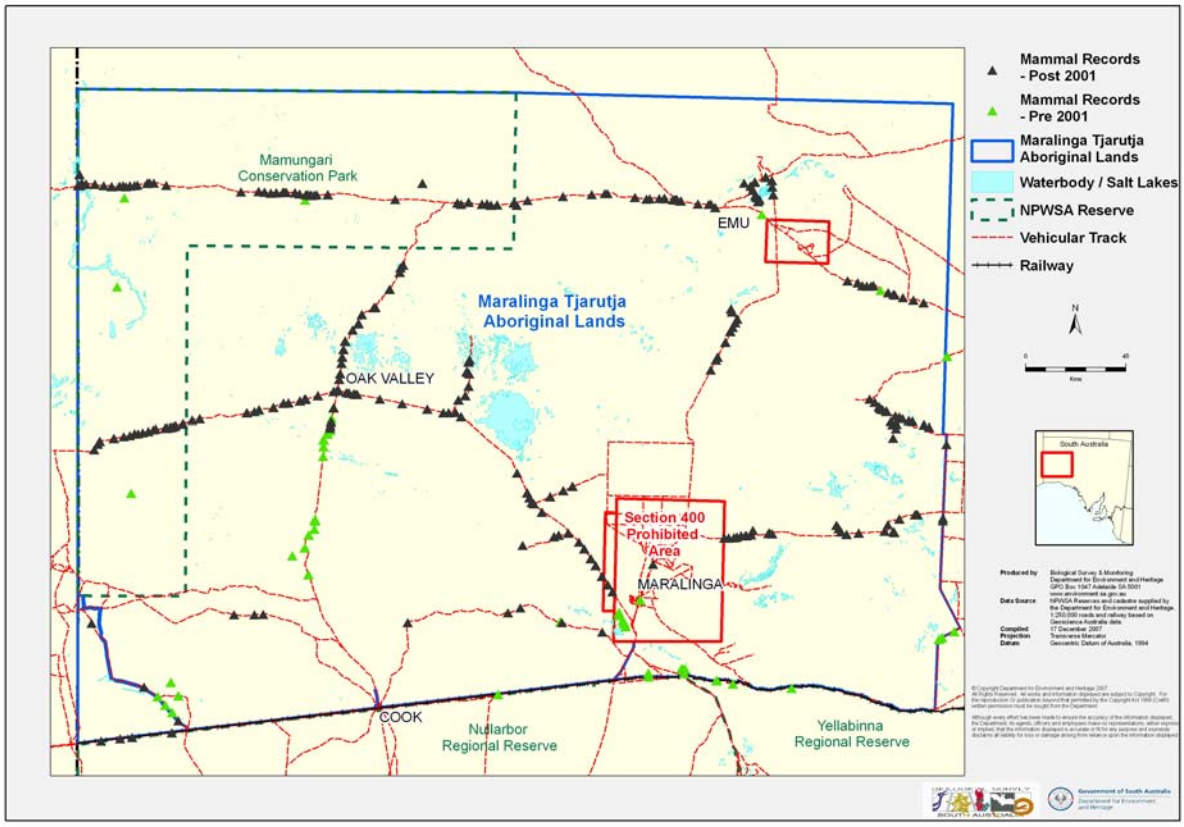

Figure 50: Distribution of mammal records for the Maralinga Tjarutja Lands prior to this survey (pre-2001) and from this survey (2001-2007).

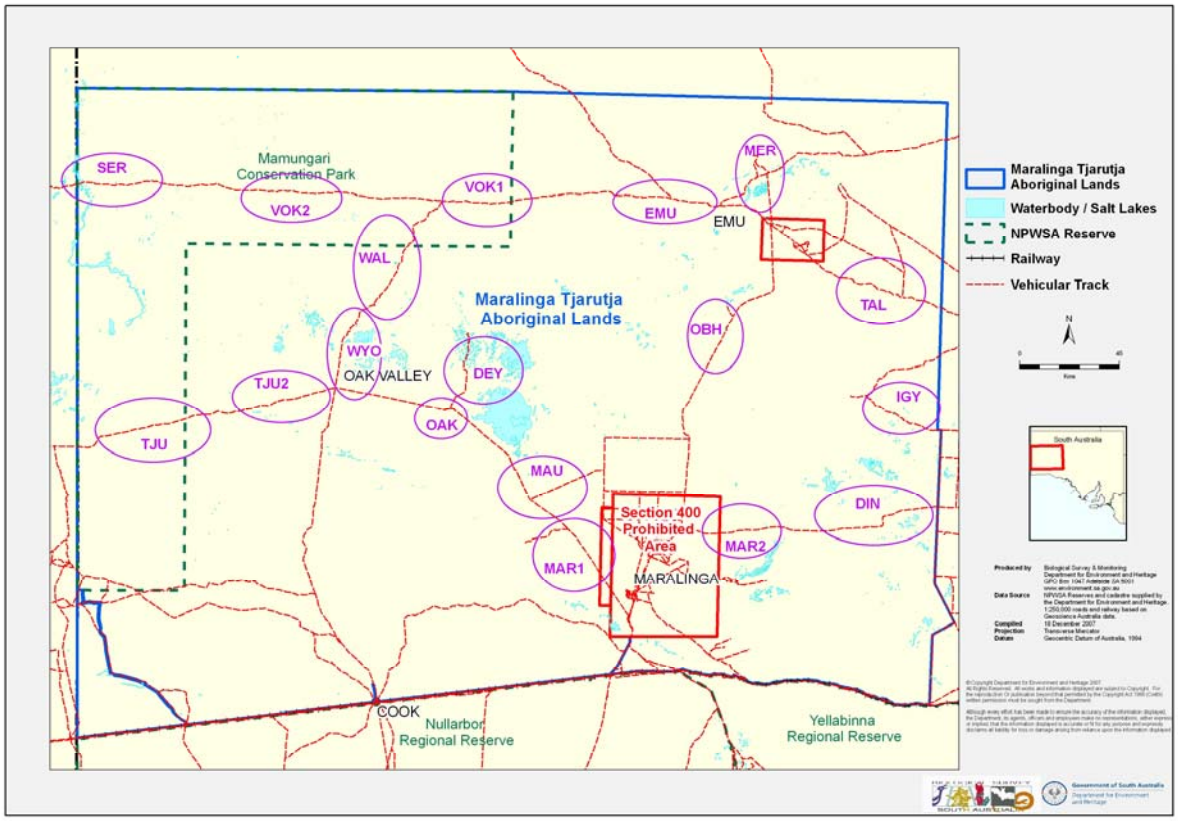

Figure 51: Location of areas sampled (clusters of quadrats and their site code prefix) in the Maralinga Tjarutja Lands during this survey (2001-2007).

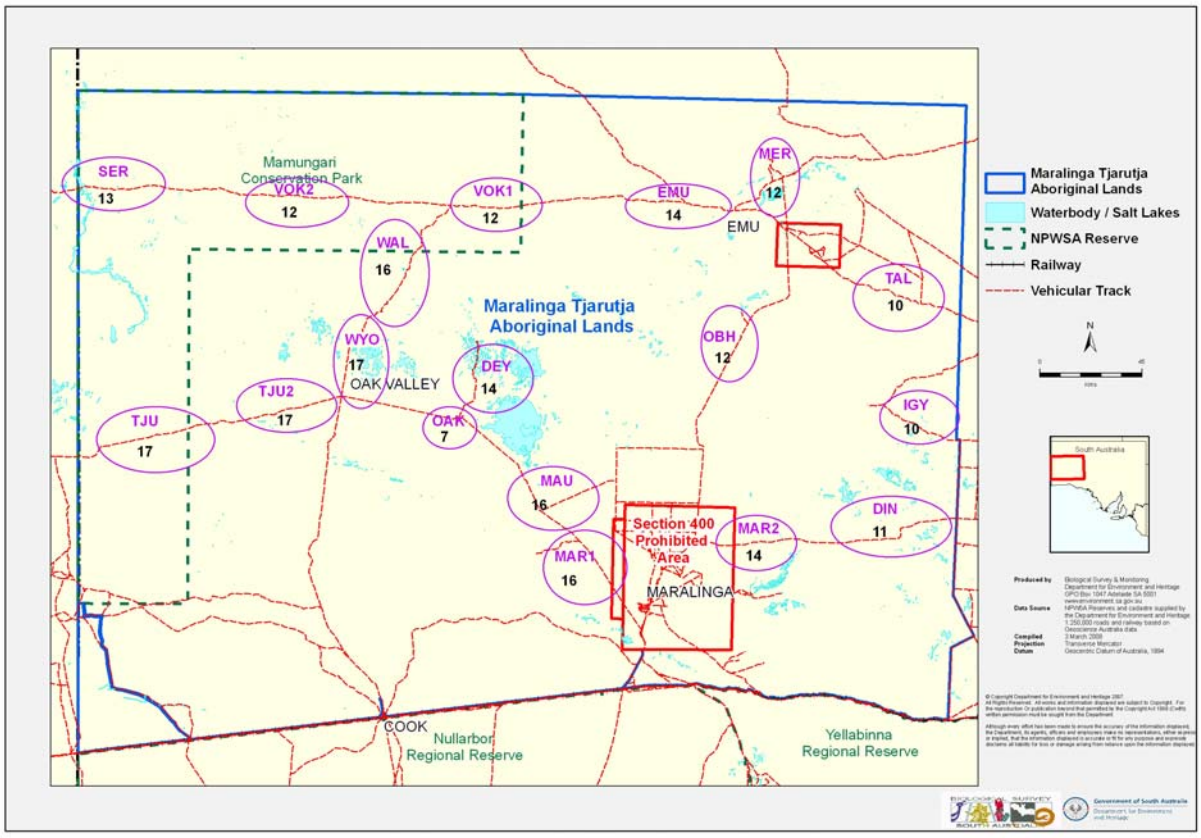

Figure 52: Location of areas sampled (clusters of quadrats) and mammal species richness within each of the Maralinga Tjarutja Lands site clusters during this survey (2001-2007).

Table 14: Number of individual mammal species recorded prior to this survey (pre-2001) and from 2001 onwards across the Maralinga Tjarutja Lands. (# indicates new records for MT Lands, * indicates introduced species, species with national and state conservation status in bold).

FAMILY	Species	Pre-2001	Post-2001	Total
Tachyglossidae	*# Tachyglossus aculeatus* (Short-beaked Echidna)		3	**3**
Dasyuridae	*Dasycercus blythi* (Mulgara)	8		**8**
	Ningaui ridei (Wongai Ningaui)	3	70	**73**
	Ningaui yvonneae (Southern Ningaui)	1	1	**2**
	Sminthopsis crassicaudata (Fat-tailed Dunnart)	8	10	**18**
	Sminthopsis dolichura (Little Long-tailed Dunnart)	3	5	**8**
	***Sminthopsis hirtipes* (Hairy-footed Dunnart) R**	2	2	**4**
	Sminthopsis ooldea (Ooldea Dunnart)	11	58	**69**
	***Sminthopsis psammophila* (Sandhill Dunnart) V**	1		**1**
	Sminthopsis sp.		1	**1**
Notoryctidae	***# Notoryctes typhlops* (Marsupial Mole) EN, E**		3	**3**
Potoroidae	***Bettongia lesueur* (Burrowing Bettong) EN, E**		1	**1**
Macropodidae	*Macropus fuliginosus* (Western Grey Kangaroo)	2	3	**5**
	# Macropus robustus (Euro)		2	**2**
	Macropus rufus (Red Kangaroo)	28	57	**85**
	Macropus sp.	7	5	**12**
Burramyidae	*# Cercartetus concinnus* (Western Pygmy-possum)		36	**36**
Mollossidae	*# Mormopterus* species 3 "little penis" (Inland Freetail-bat)		103	**103**
	# Tadarida australis (White-striped Freetail-bat)		436	**436**
Vespertilionidae	*Chalinolobus gouldii* (Gould's Wattled Bat)	10	1397	**1407**
	Nyctophilus geoffroyi (Lesser Long-eared Bat)	6	439	**445**
	Nyctophilus sp.		1	**1**
	Nyctophilus timoriensis (Greater Long-eared Bat)	9	39	**48**
	Scotorepens balstoni (Inland Broad-nosed Bat)	1	130	**131**
	Vespadelus baverstocki (Inland Forest Bat)	3	79	**82**
Muridae	*# Leggadina forresti* (Forrest's Mouse)		1	**1**
	Leporillus conditor (Greater Stick-nest Rat)	5		**5**
	Leporillus sp.	2	13	**15**
	Mus musculus (House Mouse)	97	395	**492**
	# Notomys alexis (Spinifex Hopping-mouse)		48	**48**
	Notomys mitchellii (Mitchell's Hopping-mouse)	37	8	**45**
	Notomys sp.	1	8	**9**
	# Pseudomys desertor (Desert Mouse)		2	**2**
	Pseudomys bolami (Bolam's Mouse)	2		**2**
	Pseudomys hermannsburgensis (Sandy Inland Mouse)	17	289	**306**
Canidae	*Canis lupus dingo* (Dingo)	16	70	**86**
	****** *Canis lupus familiaris* (Dog (domestic or feral))		2	**2**
	****** *Vulpes vulpes* (Fox)	11	12	**23**
Felidae	****** *Felis catus* (Cat)	9	31	**40**
Camelidae	****** *Camelus dromedarius* (One-humped Camel)	7	178	**185**
Leporidae	****** *Oryctolagus cuniculus* (Rabbit)	36	113	**149**
	Grand Total	**344**	**4048**	**4392**

NB. Number of bat records do not necessarily relate to number of individuals as some animals may have been recorded numerous times using Anabat recorder.

Table 15: Comparison of extant and extinct native mammal species recorded from the Maralinga Tjarutja Lands up to 2008 (By Family and Genus).

Genus	No. Species Extant	No. Species Extinct	Proportion Extinct (%)
Sub-class: Prototheria; Order: Monotremata; Family: Tachyglossidae			
Tachyglossus	1	0	0
Sub-class: Marsupialia; Order: Dasyuromorphia; Family: Myrmecobiidae			
Myrmecobius	0	1	100
Sub-class: Marsupialia; Order: Dasyuromorphia; Family: Dasyuridae			
Dasycercus	0	1	100
Dasyurus	0	1	100
Ningaui	2	0	0
Antechinomys	0 (?)	1 (?)	100 (?)
Sminthopsis	5	0	0
Sub-class: Marsupialia; Order: Peramelemorphia; Family: Peramelidae			
Chaeropus	0	1	100
Isoodon	0	1	100
Perameles	0	1	100
Macrotis	0	1	100
Sub-class: Marsupialia; Order: Notoryctemorphia; Family: Notoryctidae			
Notoryctes	1	0	0
Sub-class: Marsupialia; Order: Diprotodontia; Family: Phalangeridae			
Trichosurus	0	1	100
Sub-class: Marsupialia; Order: Diprotodontia; Family: Potoroidae			
Bettongia	0	1	100
Sub-class: Marsupialia; Order: Diprotodontia; Family: Macropodidae			
Lagorchestes	0	1	100
Macropus	3	0	0
Onychogalea	0	1	100
Sub-class: Marsupialia; Order: Diprotodontia; Family: Burramyidae			
Cercartetus	1	0	0
Sub-class: Eutheria; Order: Chiroptera; Family: Molossidae			
Mormopterus	1	0	0
Tadarida (*Nyctonomus*)	1	0	0
Nyctophilus	2	0	0
Chalinolobus	1	0	0
Scotorepens	1	0	0
Vespadelus	1	0	0
Sub-class: Eutheria; Order: Rodentia; Family: Muridae			
Leggadina	1	0	0
Leporillus	0	2	100
Notomys	2	2	50
Pseudomys	3	1	25
Totals	**26**	**17**	**40%**

Table 16: Relative abundance of mammal species recorded across the Maralinga Tjarutja Lands during this survey. (# indicates new records, introduced species are marked with an *, rated species in bold. Total number of quadrats sampled n=153).

Species	No. Quadrats	No. individuals at quadrats	Proportion of quadrats (%)	No. observed (opportune)	Frequency
Pseudomys hermannsburgensis (Sandy Inland Mouse)	112	287	73.2		
***** *Mus musculus* (House Mouse)	92	395	60.1		
***** *Camelus dromedarius* (One-humped Camel)	77	105	50.3	68	31
Chalinolobus gouldii (Gould's Wattled Bat)	55	1252	36.6	145	101
Nyctophilus geoffroyi (Lesser Long-eared Bat)	55	412	36.6	27	13
Canis lupus dingo (Dingo)	45	57	29.4	12	11
Sminthopsis ooldea (Ooldea Dunnart)	45	58	29.4		
***** *Oryctolagus cuniculus* (Rabbit)	44	62	28.8	50	33
Ningaui ridei (Wongai ningaui)	34	70	22.2		
Tadarida australis (White-striped Freetail-bat)	34	382	22.2	54	22
# Notomys alexis (Spinifex Hopping-mouse)	29	46	19.0	2	2
***** *Felis catus* (Cat)	24	27	15.7	4	4
Macropus rufus (Red Kangaroo)	24	28	15.7	28	15
# Mormopterus species 3 "little penis" (Inland Freetail-bat)	18	103	11.8		
Vespadelus baverstocki (Inland Forest Bat)	12	73	7.8	6	4
***** *Vulpes vulpes* (Fox)	12	12	7.8		
# Cercartetus concinnus (Western Pygmy-possum)	11	36	7.2		
Sminthopsis crassicaudata (Fat-tailed Dunnart)	10	10	6.5		
Notomys sp.	8	8	5.2		
Nyctophilus timoriensis (Greater Long-eared Bat)	8	36	5.2	3	3
Notomys mitchellii (Mitchell's Hopping-mouse)	6	8	3.9		
Scotorepens balstoni (Inland Broad-nosed Bat)	6	123	3.9	7	1
Macropus sp.	5	5	3.3		
Sminthopsis dolichura (Little Long-tailed Dunnart)	5	5	3.3		
# *Notoryctes typhlops* (Marsupial Mole)	2	3	1.3		
# Pseudomys desertor (Desert Mouse)	2	2	1.3		
***Sminthopsis hirtipes* (Hairy-footed Dunnart)**	2	2	1.3		
# Leggadina forresti (Forrest's Mouse)	1	1	0.7		
Ningaui yvonneae (Southern Ningaui)	1	1	0.7		
Nyctophilus sp.	1	1	0.7		
Sminthopsis sp.	1	1	0.7		
# Tachyglossus aculeatus (Short-beaked Echidna)	1	1	0.7	2	2
***** *Canis lupus familiaris* (Dog (domestic or feral))			0.0	1	1
Leporillus sp.			0.0	13	4
Macropus fuliginosus (Western Grey Kangaroo)			0.0	3	2
# Macropus robustus (Euro)			0.0	2	1

Table 17: Summary of Maralinga Tjarutja Lands vegetation mapping codes and description of the dominant plant species present in each mapping group.

Mapping Code	Description
GVD_1 Woodland	*Acacia aneura* complex over *Eremophila latrobei* ssp. *glabra* +/- *A. tetragonophylla* +/- *Senna artemisioides* ssp. *petiolaris*, *Ptilotus* spp., *Eragrostis eriopoda*, *Aristida contorta*, *Monachather paradoxa* Low Open Woodland
GVD_2	*Acacia aneura* complex over *Maireana sedifolia*, *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. *petiolaris*, *Ptilotus obovatus* var. *obovatus*, *Aristida contorta* Low Open Woodland
GAW_11	*Acacia aneura* complex over *Maireana sedifolia* +/- *Ptilotus obovatus* var. *obovatus* +/- *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. +/- *Aristida contorta* Very Low Open Woodland
GVD_3	*Acacia ramulosa* var., *A. aneura* complex over, *Senna artemisioides* ssp. *petiolaris* +/- *Dodonaea viscosa* ssp. *angustissima* +/- *Ptilotus* spp, *Aristida holathera* var. *holathera*, *Eragrostis eriopoda* Low Open Woodland
GAW_10	*Acacia aneura* complex over *Aristida contorta* +/- *Eragrostis eriopoda* +/- *Maireana georgei* +/- *Ptilotus obovatus* var. *obovatus* +/- *Monachather paradoxa* Very Low Open Woodland
GVD_4	+/- *Alectryon oleifolius* ssp. *canescens* +/- *Myoporum platycarpum* ssp. *platycarpum* +/- *Casuarina pauper* +/- *E. concinna* +/- *E. oleosa* ssp. +/- *E. socialis* over +/- *Acacia ramulosa*, *Senna artemisioides* ssp., *Maireana sedifolia*, *Austrostipa nitida* Low Open Woodland
GVD_5	*Casuarina pauper* and/or *Acacia papyrocarpa* over *Maireana sedifolia* or *Cratystylis conocephala*, *Senna cardiosperma* ssp. *gawlerensis* +/- *Senna artemisioides* ssp. *petiolaris*, *Atriplex vesicaria* ssp. Low Open Woodland
GAW_6	*Casuarina pauper* +/- *Acacia papyrocarpa* +/- *A. aneura* complex +/- *Alectryon oleifolius* ssp. *canescens* +/- *Santalum acuminatum* over *Maireana sedifolia*, *Atriplex vesicaria* ssp. +/- *Enchylaena tomentosa* var. *tomentosa* Low Open Woodland
NUL_3	*Casuarina pauper*, *Acacia aneura* complex over *Senna artemisioides ssp.* Low Woodland
GVD_6	*Casuarina pauper* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Acacia aneura* complex over *Senna cardiosperma* ssp. *gawlerensis*, *Ptilotus obovatus* var. *obovatus* Low Open Woodland
GVD_7	*Eucalyptus gongylocarpa*, *E. youngiana* +/- *E. concinna* +/- *E. glomerosa* over *Acacia ligulata* +/- *Acacia ramulosa*, *Ptilotus polystachyus* var. *polystachyus*, *Triodia basedowii*, *Aristida holathera* var. *holathera* Low Open Woodland
GVD_400	*Callitris gracilis* or *C. glaucophylla* or *C. verrucosa* over *Dodonaea viscosa* ssp. *angustissima*, *Rhagodia preissii* ssp. *preissii* Low Woodland
GVD_9 Mallee	*Eucalyptus concinna* +/- *E. canescens* ssp. *canescens* +/- *E. socialis* ssp. +/- *E. eremicola* +/- *Acacia aneura* complex over *Senna artemisioides* ssp. *petiolaris* +/- *Eremophila paisleyi* ssp. *paisleyi*, *Ptilotus obovatus* var. *obovatus*, *Triodia scariosa* Open Mallee
NUL_5	*Eucalyptus concinna* and/or *E. socialis or E. yumburrana* ssp. *yumburrana* over *Triodia scariosa* or *T. lanata* and/or *T. irritans* Open Mallee
GVD_10	*Eucalyptus concinna* +/- *E. socialis* ssp. over *Dodonaea viscosa* ssp. *angustissima*, *Senna artemisioides* ssp. *petiolaris*, *Acacia colletioides* +/- *A. ligulata* +/- *Bossiaea walkeri*, *Aristida contorta* +/- *Triodia* spp. +/- *Lomandra leucocephala* ssp. *robusta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* Open Mallee
GVD_11	*Eucalyptus oleosa* ssp. +/- *Eucalyptus brachycalyx* or *E. concinna* over *Acacia nyssophylla*, *Atriplex vesicaria* ssp., *Maireana radiata*, *M. pentatropis* +/- *Cratystylis conocephala* Open Mallee
GVD_12	+/- *Eucalyptus yumbarrana* ssp. *yumbarrana* +/- *E. brachycalyx* or *E. concinna* +/- *E. gracilis* over *Melaleuca eleuterostachya* +/- *Hakea francisiana* +/- *Westringia rigida* +/- *Eremophila scoparia*, *Triodia* spp. Open Mallee
GVD_14 Shrubland	*Acacia aneura* complex over *Eremophila latrobei* ssp. *glabra*, *Eriachne mucronata*, *Eragrostis eriopoda* +/- *Monachather paradoxa* Tall Open Shrubland
GVD_15	*Acacia ligulata*, *A. ramulosa* var., *Dodonaea viscosa* ssp. *angustissima* over *Aristida holathera* var. *holathera* +/- *Aristida contorta* Tall Open Shrubland
NUL_9	*Acacia ligulata* or *A. ramulosa* or *A. clelandii* or *Acacia aneura* complex over *Dodonaea viscosa ssp. angustissima* Tall Open Shrubland
GVD_16	*Atriplex vesicaria* ssp. over *Hemichroa diandra* +/- *Tecticornia* spp. +/- emergent *Melaleuca nanophylla* Low Open Shrubland
GVD_17	+/- *Dodonaea viscosa* ssp. *angustissima* +/- *Acacia oswaldii* over *Atriplex vesicaria*, *Austrostipa nitida* +/- *Aristida contorta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* and/or *Alectryon oleifolius* ssp. *canescens* Shrubland
GVD_18	*Tecticornia* spp., *Atriplex vesicaria* over +/- *Hemichroa diandra* +/- *Maireana oppositifolia* Low Open Shrubland
GVD_19	*Salsola tragus*, *Eriochiton sclerolaenoides*, *Sclerolaena obliquicuspis*, *S. diacantha*, *Austrostipa nitida*, *Enneapogon avenaceus* +/- emergents *Acacia tetragonophylla* or *Alectryon oleifolius* ssp. *canescens* or *Pittosporum angustifolium* Low Open Shrubland / (Tussock) Grassland
GVD_20	*Sclerolaena diacantha*, *Enneapogon avenaceus*, *Salsola tragus* with emergent senescent *Acacia aneura* complex Low Shrubland
GVD_21	*Senna artemisioides* ssp. *petiolaris* +/- *S. artemisioides* ssp. *coriacea* over *Atriplex vesicaria* ssp., emergent *Acacia oswaldii* +/- emergent *Pittosporum angustifolium* Tall Open Shrubland

Table 18: Two-way table showing proportion of captures of each mammal species within each vegetation mapping group/vegetation community (key to colours: >33%, 20-32%, 10-19%, <10% +). Species with less than 10 records shown only as + or blank if absent. Species sorted alphabetically by scientific name.

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Camelus dromedarius (One-humped Camel)	+	+	+			+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+		
Canis lupus dingo (Dingo)		+		+	+	+	+	+	+	+				+	+	+		+			+	+		
Cercartetus concinnus (Western Pygmy-possum)															+		+							
Chalinolobus gouldii (Gould's Wattled Bat)	+	+	+	+	+	+	+				+		+			+	+		+	+			+	+
Felis catus (Cat)	+	+			+	+	+	+	+															
Leggadina forresti (Forrest's Mouse)														+										
Macropus rufus (Red Kangaroo)	+						+	+			+			+		+								
Mormopterus species 3 "little penis" (Inland Freetail-bat)				+	+					+			+					+	+					
Mus musculus (House Mouse)		+	+	+	+	+			+	+		+		+			+	+	+	+		+	+	
Ningaui ridei (Wongai Ningaui)	+	+	+		+		+						+		+		+							+
Ningaui yvonneae (Southern Ningaui)										+														
Notomys alexis (Spinifex Hopping-mouse)	+										+								+					
Notomys mitchellii (Mitchell's Hopping-mouse)	+		+		+					+			+											+
Notoryctes typhlops (Southern Marsupial Mole)																	+							
Nyctophilus geoffroyi (Lesser Long-eared Bat)	+	+	+	+	+	+			+		+	+	+			+		+		+			+	+
Nyctophilus timoriensis (Greater Long-eared Bat)																								
Oryctolagus cuniculus (Rabbit)	+	+			+		+		+		+	+	+	+		+		+	+			+		
Pseudomys desertor (Desert Mouse)	+				+																			
Pseudomys hermannsburgensis (Sandy Inland Mouse)	+	+	+	+	+	+	+			+	+	+	+	+	+	+		+	+	+		+	+	
Scotorepens balstoni (Inland Broad-nosed Bat)											+													
Sminthopsis crassicaudata (Fat-tailed Dunnart)		+			+		+							+			+	+						
Sminthopsis dolichura (Little Long-tailed Dunnart)					+					+			+		+		+							
Sminthopsis hirtipes (Hairy-footed Dunnart)					+	+																		
Sminthopsis ooldea (Ooldea Dunnart)		+	+	+					+	+	+		+			+		+						
Tachyglossus aculeatus (Short-beaked Echidna)								+																
Tadarida australis (White-striped Freetail-bat)		+				+	+		+		+						+	+	+					
Vespadelus baverstocki (Inland Forest Bat)							+			+			+											
Vulpes vulpes (Fox)			+				+				+		+				25	+						

Table 16 indicates the frequency of recording of mammal species on sample quadrats across the MT Lands. Fourteen of the species recorded during the site surveys were detected at more than 10% of the 154 mammal survey sites sampled in the region. These 14 species included 10 native species (6 terrestrial and 4 bats) and 4 introduced species.

The two most frequently trapped species however, were the two small rodents, the Sandy Inland Mouse, (*Pseudomys hermannsburgensis*), and the introduced House Mouse (*Mus musculus*) which were recorded at 73% and 60% percent of quadrats respectively. These two species are both small murid rodents of similar body size with considerable overlap in dietary and habitat requirements.

The three most abundant (and frequently recorded) terrestrial native mammal species were the rodents, the Sandy Inland Mouse (*Pseudomys hermannsburgensis*) Ooldea Dunnart (*Sminthopsis ooldea*) and the Wongai Ningaui (*Ningaui ridei*). These species have well documented boom and bust or irruptive life-cycles (e.g. Masters 1998; Dickman *et al*. 1999), similar to the House Mouse, and would have been recorded with much higher frequencies had all survey periods followed good seasonal conditions. Unfortunately, over a six-year survey period this did not occur and, consequently, frequency records need to be interpreted with care. Despite their life-cycles, it is interesting to note that *Pseudomys hermannsburgensis* was recorded at almost four times as many survey sites as *Notomys alexis*, indicating that this *Pseudomys* is more of a habitat generalist than the hopping-mouse.

The three most abundant (and frequently recorded) bat species were, Gould's Wattled Bat (*Chalinilobus gouldii*), Lesser Long-eared Bat (*Nyctophilus geoffroyi*) and the White-striped Freetail-bat (*Tadarida australis*) (Table 14).

Other common and widespread introduced species include the One-humped Camel (*Camelus dromedarius*), Rabbit (*Oryctolagus cuniculus)* the Feral Cat (*Felis catus*) and the Red Fox (*Vulpes vulpes*) (Table 14).

Species richness

Mammal species richness (including introduced) ranged from 17 (TJU1, TJU2 and WYO) to 7 (OAK) (Figure 52), however the OAK cluster consisted of only five quadrats whereas other clusters consisted of 8 or nine. There appears to be a general trend of higher species richness in the SW of the MT Lands and lower species richness in the northern and eastern parts of the lands.

Rare species

The three dasyurids recorded least frequently were species on the limits of their geographical distributions: *Ningaui yvonneae*, and *S. dolichura* northern limits and *Sminthopsis hirtipes* southern limits.

While Forrest's Mouse *Leggadina forresti*, the Desert Mouse *Pseudomys desertor* and the Hairy-footed Dunnart *Sminthopsis hirtipes* were also recorded relatively infrequently, this appears to reflect a narrower range of habitats that they occupy and a proportionately lower frequency of sampling intensity for such habitats. This certainly seems to be the case for the Hairy-footed Dunnart, which occurs only in dune habitats with *Triodia* hummock grassland present and has a more restricted westerly distribution.

The other rarely recorded native species were the Southern Marsupial-mole or Itjari-itjari *Notoryctes typhlops*. Records of the marsupial-mole are probably so rare because the animal is so difficult to encounter above ground.

ABORIGINAL NOMENCLATURE AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The Aboriginal names for each species (or group of species) are derived from interviews and discussions with Anangu informants collected during the APY Biological Survey (Robinson *et al*. 2003).

Published accounts

Several studies of arid mammal faunas, focussing on the decline of species have been undertaken in arid Australia and several have interviewed Aboriginal people, usually with the aid of museum skins, to obtain information. For example, Finlayson (1935, 1961) provided the first comprehensive record of Anangu names and distribution information on many of the species now rare or extinct. Burbidge and Fuller (1979) and Burbidge *et al*. (1988) undertook surveys of Aboriginal knowledge of rare and extinct mammal species across the arid zone. Copley *et al*. (1989) surveyed areas within the MT Lands, and Baker *et al*. (1993) undertook similar work to the current survey at Uluru - Kata Tjuta National Park (UKTNP).

Generic names

Anangu use generic names for a wide range of small mammal species. Mostly these fall into two broad groups that are described below.

Mingkiri is consistently used by Anangu in reference to *Mus musculus*, *Pseudomys hermannsburgensis*, *Ningaui ridei*, *Leggadina forresti*, and *Sminthopsis hirtipes* and refers to small mammals up to 20 grams. It is also used for the other *Sminthopsis* species and for *Pseudomys desertor*, although it is less consistently applied. The presence of a pouch and a larger size and body weight above approximately 20 grams appears to place the animal out of the Mingkiri group. It is possible that most of the smaller mammals were not classified separately due to their small size and lack of utility for Anangu (i.e. not, or only rarely, eaten). In addition, their tracks are very small and difficult to distinguish and there appear to be no clearly

identifiable *Sminthopsis* or *Ningaui* burrow systems compared to larger animals such as Spinifex Hopping-mice and Mulgara that have clearly recognisable tracks and burrow systems.

Pinytjantjara is used for all microbat species. A total of 6 bat species captured on survey were named as Pinytjantjara, they included: *Chalinolobus gouldii*, *Mormopterus* species 3 'little penis', *Nyctophilus geoffroyi* and *Tadarida australis.*

Species-specific names
Many of the species in the 20 - 170 grams weight range have individual Anangu names; for example, the Mulgara (Murtja), and Spinifex Hopping-mouse (Tarkawara).

CURRENT MAMMAL FAUNA
***Tachyglossus aculeatus* (Tjilkamata, Tjirilya, Short-beaked Echidna)**
Echidna signs were recorded from only two opportune locations during the survey period. It is likely to be more widespread; occurring in most habitats at low densities. It is apparently secure but there is little information on threats and there is some evidence for predation by foxes and dingoes (Foulkes 2001).

Figure 53: Mingkiri, the Wongai Ningaui (*Ningaui ridei*), was the most commonly captured dasyurid marsupial during the survey. (Photo: P. Canty).

***Ningaui ridei* (Mingkiri, Wongai Ningaui) (Figure 53)**
All records were from pitfall traps associated with *Triodia* hummock grassland amounting to 12 of the 24 mapped vegetation communities, with most captures from NUL_5 and GVD_9 (Table 18). Seventy captures were recorded at a total of 34 quadrats (22%), mostly from survey quadrats in the western two-thirds of the MT Lands (Figure 52). Barritt (1986) captured *N. ridei* in widely separated areas where *Triodia* was present. This species is widespread and common on sandy surfaces supporting *Triodia* hummock grasses in the Australian central deserts (McKenzie and Dickman 2008). Surprisingly, *N. ridei* was the only dasyurid marsupial recorded at sites west of Vokes Hill corner.

***Ningaui yvonneae* (Mingkiri, Southern Ningaui)**
A single capture of *Ningaui yvonneae* was made during the survey on the first survey trip to Oak Valley. The south-eastern corner of the MT Lands represents the most northerly extent of its distribution in South Australia. The Southern Ningaui inhabits semi-arid *Triodia* dominated grasslands and mallee woodlands in southern Australia and is generally sparsely distributed in these habitats.

***Sminthopsis crassicaudata* (Fat-tailed Dunnart)**
Ten individuals were recorded from ten quadrats (6.5% of total) during the survey. It was recorded in 6 of the 24 mapping groups (Table 18) and occurs in a broad range of habitats across central and southern Australia. The population density tends to fluctuate according to rainfall and invertebrate availability. Barritt (1986) captured individuals at two sites between Muckera and the Oak Valley-Cook road junction in the south-east of the MT Lands. It is considered common across its range and is of no conservation concern in the MT Lands.

***Sminthopsis dolichura* (Little Long-tailed Dunnart)**
This species was represented by five captures from five quadrats all in different mapping groups (Table 18), however all captures were from the MAR1 and MAR2 clusters of sites. Across its range it occurs in a variety of different habitats in semi-arid and arid South Australia (west of Pt Augusta) and SW Western Australia. It was recorded from around Ooldea during the Yellabinna Survey (Kemper & Copley 1992), but not by the NCS survey (Barratt 1986) due to their survey effort being in the northwest of the MT Lands. The south-eastern corner of the MT Lands represents the most northerly extent of its distribution in South Australia. It is considered common across its range and is of no conservation concern in the MT Lands.

***Sminthopsis hirtipes* (Mingkiri, Hairy-footed Dunnart) R**
The Hairy-footed Dunnart was recorded from two locations in two different vegetation communities (GVD_5, NUL_5, Table 17, 18) during the survey, one from the TJU2 cluster and the other from the WAL cluster of sites. Barratt (1986) recorded a single individual approximately 60km w of Vokes Hill corner in a *Triodia/Callitris* dominated swale. It was recorded during the Yellabinna Survey at sites around Muckera. Recorded from sand dune habitats with *Triodia* hummocks and Desert Thryptomene. This species appears to be restricted to the Great Victoria Desert Bioregion in South Australia.

The species is listed as Rare in SA and this appears warranted given the low capture rate for the large survey effort to date.

***Sminthopsis ooldea* (Mingkiri, Ooldea Dunnart) (Figure 54)**

This is a very widespread and common species that occurs in a wide variety of habitats across the MT Lands, occurring in 13 of 24 identified vegetation mapping groups (Table 18), however more than 20% of captures were made in mapping GVD_1, mulga woodlands (Table 17,18). Throughout its range in arid Australia it is primarily found in Mulga shrublands and woodlands (Foulkes 2008). Fifty-eight individuals were captured at 45 (29% of survey quadrats) and was the most commonly captured dasyurid marsupial during the survey (Table 16). It was trapped at all clusters except TJU, MAR, MAU, VOK2 & SER. Although not captured at clusters west of Vokes Hill corner on this survey, it was recorded at three locations in this area on the NCS survey (Barratt 1986). It was captured across a wide area during the Yellabinna Survey (Copley & Kemper 1992). This species is widespread, but at low population densities.

Figure 54: Mingkiri, the Ooldea Dunnart was found throughout the extensive sand plain habitats across the Maralinga Tjarutja Lands. (Photo: P. Canty).

***Sminthopsis psammophila* (Sandhill Dunnart) V**

The Sandhill Dunnart was not captured on this survey and there is a single record for the MT from the Yarle Lakes from the Yellabinna Survey in 1987 and two records from southeast of Ooldea in Yellabinna regional Reserve (Copley & Kemper 1992). Churchill (2001) undertook a specific survey to locate the Sandhill Dunnart in the southern Great Victoria Desert and Eyre Peninsula, with some captures in Yellabinna; however none were captured in the MT Lands.

The Sandhill Dunnart occurs on sandy substrates and the most consistent features of the habitat are *Triodia* hummock grass and sand dunes with mallee, Marble Gum or *Callitris* overstorey (Churchill 2001). Sandhill Dunnarts may be dependent on specific growth stages of *Triodia* for their continued presence in an area. Factors such as recent burning or absence of burning may render a location unsuitable for these animals for many years.

***Notoryctes typhlops* (Itjari-itjari, Itjaritjari, Southern Marsupial Mole) E, V (Figure 55)**

The explorer Maurice obtained a specimen of the marsupial mole on one of his early trips, with the help of his Aboriginal guide. Gara (1996) found an undated note among his manuscripts that read:

> 'On our way to Youldeh [Ooldea] we saw many of the pretty little *Notoryctes typhlops*, called by the natives '*arritarita*'. It is a kind of marsupial mole and is very difficult to catch. … They can be traced by a line of rising in the soil which occurs every foot or so. They breed about July or August and it is supposed by the natives that when the young get big the mother leaves them and returns only to give them milk. The young have been seen in the pouch.'

However, on his subsequent trip across the Great Victoria Desert in 1902, Maurice failed to obtain specimens of the marsupial mole for Professor Stirling at the SA Museum. In an interview with the Register in 1902, he stated that 'we were unable to get a marsupial mole, although we saw tracks of the animal, and Mr Murray had the pleasure of seeing for the first time the natives tracking marsupial moles under the ground.'

During the recent biological survey, evidence of marsupial moles was found at only four of the 154 mammal survey sites from tracks trenches and pop-holes only. Benshemesh (pers. comm., 2008) undertook mole trenching at 20 locations in the MT Lands and 15 of these sites exhibited definite mole activity, however there was no sign in the Ooldea Range.

Possibly still widespread, but rarely seen, listed nationally and within SA as Endangered; current research aims to develop techniques for determining status more accurately and objectively.

Figure 55: Itjari-itjari, the Southern Marsupial Mole leaves very characteristic tracks on the rare occasions when it comes to the surface of its sand dune habitat. (Photo: P. Canty).

***Macropus robustus* (Kanyala, Euro)**
A widespread species typically associated with ranges and outlying rocky hills, two Euros were recorded at an opportune location on the Anne Beadell Highway, west of Vokes Hill Corner. These were the first recorded observations of this species for the MT Lands.

***Macropus fuliginosus* (Western Grey Kangaroo)**
There were three opportune records made of this species during the survey period from two locations (Table 14, 15).

Barritt (1986) recorded two individuals west of Vokes Hill corner and a further two from around Muckera Rockhole from the Yellabinna Survey (Copley & Kemper 1992). All records to date are from western third of the MT Lands.

***Macropus rufus* (Malu, Red Kangaroo)**
Red Kangaroo presence was recorded in 13 of 24 vegetation types indicting there was no real preference for vegetation communities. Three individuals were observed during the NCS survey in the dunefields south of Vokes Hill corner (Barratt 1986). It was commonly observed on the more open country of the Nullarbor (McKenzie and Robinson 1987)

Lindsay, the leader of the 1891 Elder Expedition, reported sightings of kangaroos near the Cavenagh (NT) and Barrow (WA) Ranges, but did not see any during the long desert crossing from there to Queen Victoria Springs (see Gara 1996).

By comparison, Murray (1904) reported seeing several kangaroos at Ooldea when setting out on an exploration trip in 1901 but did not see any others until he reached the mountain ranges on the desert's northern edge. He recorded about 10 sightings of kangaroos while exploring the Rawlinson (WA), Tomkinson, Mann and Musgrave Ranges. On his return trip to Fowlers Bay he did not record any kangaroos in the sand dune desert country (see Gara 1996).

Finlayson (1961) observed that:

> 'normally it is absent from the major sand ridge areas and from the larger expanses of spinifex flats, but its phenomenal mobility enables it to exploit all types of country when favourable changes in the vegetation occur'. He also noted that:
>
> '..the big 'mobs' which are familiar sights in many parts of the pastoral country farther south are not ordinarily seen, and constant hunting by the blacks keeps them wary and suspicious' (Finlayson 1935).

Widespread, but mostly at very low densities, especially where Anangu hunt them regularly; continued existence in the MT Lands is probably secure, but very patchy potentially due to hunting pressures, altered fire management regimes and competition from introduced herbivores.

***Cercartetus concinnus* (Western Pygmy Possum) (Figure 56)**
The captures of this species were the first for the MT Lands. Thirty six captures were made at 11 (7%) quadrats all in the MAU and MAR1 cluster of sites. They were recorded from 5 of 24 vegetation mapping groups, however, 55% of captures were made at sites within GVD_9 mapping group, which is a diverse mallee/*Triodia* association. It is likely that the diversity of mallee species provides both a variety of food sources i.e. nectar and arthropods as well as nesting holes within the mature mallees.

Figure 56: The Western Pygmy-possum was recorded for the first time in the Maralinga Tjarutja Lands during this survey between Oak Valley and Maralinga. (Photo: A.C. Robinson)

Mingkiri, Various small mouse-sized species

- The name Mingkiri is applied all small mouse-sized species, however each species is recognised as being different to others either is physical characteristics or habitat use.
- They all live in burrows in a variety of habitats including woodland, sand plain, sand dune.

A variety of plants are important as food for some species in the Mingkiri group; these plants include: *Triodia* spp., *Eragrostis* spp., *Panicum decompositum* and *Acacia* spp.

***Notomys alexis* (Tarkawara, Spinifex Hopping-mouse) (Figure 57)**
Forty six individuals were recorded form 29 quadrats (19%) across the MT Lands (13 survey clusters) with the most southerly record from the MAU cluster (Figure 57). The quadrats were within six mapping groups, however more than one-third of all captures were made in mapping group GVD_15 (*Acacia ramulosa* and *A. ligulata* dunes) (Table 18). Barratt (1986) recorded both *N. alexis* and *N. mitchellii* on the same trapline at Vokes Hill. Until this survey, this was the only recent record of this widely distributed arid

zone rodent in the MT Lands. The Spinifex Hopping Mouse is widespread throughout the arid sandy deserts of central Australia; however the northern half of the MT Lands probably represents the southern extent of its distribution, with no captures of this species from Maralinga Lands sites from both Nullarbor and Yellabinna Surveys. It is an irruptive species with large population increases occurring following major rainfall events, however such events did not occur during the survey period. This was the fourth-most commonly recorded terrestrial native mammal species during the years of the survey.

Figure 57: Tarkawara, the Spinifex Hopping Mouse, is common and widespread in Mulga country. (Photo: A. Robinson).

***Notomys mitchelli* (Mitchell's Hopping Mouse)**
Eight individuals were recorded from six quadrats (4%) during the survey, predominantly from the southern portion of the MT Lands (OAK, MAU, MAR2 clusters), however captures were also made further north in the VOK2 cluster (Figure 51). It is an animal of the semi-arid mallee regions of Australia, and is the largest of the extant species of hopping mice. It was recorded in six of the 24 vegetation mapping groups (Table 18).

***Pseudomys bolami* (Bolam's Mouse)**
This species is known from two records from the MT Lands prior to the survey; however it was not recorded on this survey. It is likely to be present in the chenopod dominated shrublands and woodlands of the southern and eastern MT Lands. It is similar in appearance to the Sandy Inland Mouse and to a lesser degree House Mouse, and overlap in its habitat preferences in parts of its range.

***Pseudomys hermannsburgensis* (Sandy Inland Mouse)**
The most commonly recorded terrestrial native mammal during the surveys, being recorded at 73% of quadrats across 21 of the 24 vegetation mapping groups, being absent from only minor mapping groups (GAW_6, GVD_99 and GVD_999, Table 17,18). It was captured in each survey cluster at least once.

***Pseudomys desertor* (Desert Mouse) (Figure 58)**
An infrequently recorded species, typically found in a range of habitats including *Triodia* hummock grasslands on sand plains and hill slopes and Old Man Saltbush (*Atriplex nummularia*) shrublands on clayey floodout areas. A widespread arid zone species that is apparently secure but only rarely caught, although its numbers increase significantly following good seasons (Read *et al*. 1999). This species was caught on two occasions within the VOK1 and WAL clusters.

Figure 58: Mingkiri, the Desert Mouse (*Pseudomys desertor*), was recorded for the first time in the Maralinga Tjarutja Lands during this survey. (Photo: A. Robinson).

***Leggadina forresti* (Forrest's Mouse) (Figure 59)**
This species was captured once in the DIN cluster of sites (GAW_11 vegetation mapping group). A rarely recorded species during this survey; found in Mitchell Grass cracking clay habitats and in very large *Triodia* hummock grasslands on sandy flats between low hills. This species is much more commonly recorded in the stony desert plains further to the east.

Figure 59: Forrest's Mouse was one of three rodent species recorded in the Maralinga Tjarutja Lands for the first time. (Photo: A.C. Robinson).

Pinytjantjara (microbat species)

Bats were attempted to be surveyed systematically during most field trips. Most of the survey effort was in the form of *Anabat* recordings and from captures of bats in mist-nets and harp-traps.

Prior to this survey, five species of bats were known from the MT Lands, comprised of twenty-nine records. This survey added a further two species and a total of 2,624 records across the MT Lands. All species of micro-chiropteran bat appear to be secure in the MT Lands. All seven species of microbat were recorded in mapping group GVD_6 (Black Oak) and six species in GVD_9, which is an indication of the availability of roosting hollows. No bat records were obtained from five vegetation communities (GAW_6, GAW_11, GVD_12, GVD_19 and GVD_ 20) (Table 18)

***Mormopterus* species 3' little penis' (Inland Free-tail Bat) (Figure 60)**
The first records of this species for the MT lands were made on this survey. It is common in the more arid parts of Australia. It was recorded in 9 of 24 vegetation mapping groups with GVD_6 (Black Oak) and GVD_15 (*Acacia* shrubland) communities where most observations were made, and all of the other MT species were. They roost in trees and forage in open unobstructed areas (Churchill 1998). It was recorded at 11.8% of quadrats, however it was the only species not recorded at opportunistic sites (Table 16).

Figure 60: *Mormopterus* species 3 'little penis' was recorded for the first time in the Maralinga Tjarutja Lands during this survey. (Photo: A. Robinson).

***Tadarida australis* (White-striped Free-tail Bat)**
Surprisingly, this species had not been recorded in the MT Lands prior to this survey, as it is a large distinctive species which is distributed across all of southern Australia (Churchill 1998). It was recorded in 13 of 24 mapping groups (Table 18), with GVD_1 and GVD_3 (mulga dominated communities) where between 20 and 33% of records were made. It was recorded from 22 quadrats (22%) and was the third most commonly recorded bat species (436 records) (Table 16).

***Nyctophilus geoffroyi* (Lesser Long-eared Bat)**
The Lesser Long-eared Bat was the most widely distributed bat species during the survey. It was recorded in 18 of 24 mapping groups (Table 18), with GVD_9 being the community where between 20 and 33% of records were made and from 36.6% of quadrats. It was the second most commonly recorded mammal species during the survey. It is widely distributed throughout most of Australia in a wide range of habitats (Churchill 1998).

***Nyctophilus timoriensis* (Greater Long-eared Bat)**
This species is distributed across southern mainland Australia in semi-arid habitats (Churchill 1998). On this survey it was recorded in 3 of 24 mapping groups (Table 18), with GVD_5 and GVD_6 (Black Oak dominated communities) where greater than 33% of records were made. The survey extended the range of this species extensively. This species is rarely caught and poorly known (Churchill 1998) and it was the least recorded bat species on this survey (39 records, 8 quadrats). Additionally, its calls are very difficult to distinguish from those of *N. geoffroyi*, and until further reference calls are collected the distribution and abundance of this species will remain uncertain.

***Chalinolobus gouldii* (Gould's Wattled Bat)**
Gould's Wattled Bat was the most commonly recorded species during the survey, with almost 1400 records from 55 quadrats (36%) and multiple opportune locations. Recorded in 17 of 24 mapping groups (Table 17, 18), with GVD_7 (Marble Gum communities) appearing to be a strongly preferred habitat. This species is found throughout Australia in a wide range of habitats.

***Scotorepens balstoni* (Inland Broad-nosed Bat)**
Prior to the survey it was known from a single record in the MT Lands, however on the survey 130 observations were made from 6 quadrats (4%) and a single opportune location. It was recorded in 3 of 24 mapping groups (Table 17, 18), with GVD_6 (Black Oak) being the community where between 20 and 33% of records were made.

***Vespadelus baverstocki* (Inland Forest Bat)**
This very small bat is widely distributed in arid and semi-arid Australia (Churchill 1998), however, prior to the survey it was known from three records from the MT Lands collected during the Yellabinna Survey in 1987 (Copley & Kemper 1992). Seventy three records were obtained from 12 quadrats (7.8%) and six opportune records (Table 16). It was recorded in 6 of 24 mapping groups (Table 18), with GVD_1 and GVD_2 (mulga dominated communities) appearing to be the most preferred habitats.

***Canis lupus dingo* (Papa Inura, Dingo)**
Early explorers' accounts of dingoes in the Great Victoria Desert and, what are now, the MT Lands, were relatively rare. For example, Giles (1889) commented only on seeing tracks of Dingoes at Boundary Dam, north of the Nullarbor Plain. On the Maurice – Murray expedition of 1901, there were only two dingo sightings recorded. At Sladen Waters, in the Rawlinson Ranges, Murray (1904) commented that

they 'saw tracks of a dingo, which have been markedly scarce all through the trip; and certainly this back country is not such a prolific breeding ground for them as many imagine.' However, during their expedition in the following year, Murray reported dingoes in 'great numbers' in the Ooldea area and at Tallaringa noting also, that 'for many years I have not known them so plentiful anywhere'. But, by this time, rabbits had reached as far north as Tallaringa and beyond.

The spread of rabbits seems to have had a major positive effect on populations of the Dingo.
Dingoes are still widespread across the MT Lands and can be relatively common following good seasons. During the biological survey, Dingoes were recorded across virtually all of the MT Lands (45 quadrats). Evidence for their presence was most commonly noted through tracks, scats and howling at night. They were rarely seen.

Dingoes are widespread and appear to be secure on the MT Lands.

INTRODUCED MAMMALS

***Vulpes vulpes* (Tuuka, Red Fox)**

Foxes were first reported in the Eucla area around the SA-WA border in 1911-12 (Long 1988) and they occurred throughout WA, except for the Kimberley region, by 1940. Daisy Bates recorded the presence of the fox in the Eucla area in 1913 (see Gara 1996), but noted in the following year that: 'this pest has not yet become numerous' in the Fowlers Bay area'.

A few years later, however, Brown (1919) noted that the fox was already numerous 'all along the west coast' (of SA), and was being accused, even then, for causing the decline of bush turkeys (bustards) and Malleefowl.

By the early 1920's, foxes had become common in the Ooldea area, and Bolam, who lived there at the time, noted that the fox was:

> 'multiplying at an alarming rate and the sandhills are covered with their tracks.'(Bolam 1923).

During the biological survey, foxes were found to be sparsely distributed, as evidenced mostly by tracks and scats.

***Felis catus* (Ngaya, Mulku, Tjarnga, Feral Cat)**

Cats were in the MT Lands a very long time before rabbits, foxes or Europeans arrived. The first records of Feral Cats in central Australia were made by surveyor J. Carruthers during his trigonometric surveys in the Musgrave, Mann and Tomkinson Ranges between 1888 and 1890. Carruthers (1892) noted that feral cats were widespread at that time and occurred at least as far west as Mt Aloysius in the western Tomkinson Ranges (WA) in 1889. Two years later, this observation was supported by members of the Elder Expedition who believed that cats were spreading north-eastwards from the settled areas of Western Australia into the central deserts (Lindsay 1893; Helms 1896). Helms, the expedition's anthropologist, noted the presence of Feral Cats in the Tomkinson Range and, in the Blyth Range, further south against the Western Australian border, recorded that he saw an Aboriginal man with a cat's tail ornament in his hair (Helms 1896).

Significantly, the explorer Giles had not recorded feral cats during their earlier expeditions.

Mason (1897), who was sent to investigate the spread of rabbits into Western Australia in 1896, reported 'innumerable tracks of wild cats' in the coastal sandhills at Eucla and noted that the cats helped to keep rabbit numbers down. Two years later, another official, Page, sent to investigate the spread of rabbits, also noted that:

> 'cat tracks may be seen everywhere. They are numerous in the coast sandhills especially so near Point Culver. For 50 miles west of Point Culver they have almost exterminated the rabbits; further east and inland cat tracks can always be found, but there the cats are not in sufficient numbers to seriously affect the pest.' (Page 1898).

Rabbits had only arrived at Eucla in 1894, but from the early records, it appears that Feral Cats were already present, rather than following behind the dispersing 'front' of the invading rabbits. But what was there range at this time and where had they come from?

> Richard Maurice's early journals include no references to encounters with cats. However, Murray recorded several sightings during his 1901 and 1902 expeditions with Maurice. The first, was of two 'domestic cats' brought in by their Aboriginal guides as food, when they were between Ooldea and Tallaringa.

One explanation for the presence of cats in the central deserts so soon after European settlement has been made by Tom Brown who established Nullarbor Station in the 1880's. He observed that:

> 'The domestic cat, run wild, has spread all over the West Coast (of South Australia), from Port Lincoln to Eucla and beyond, and has been seen as far north as the Musgrave Ranges. It is conjectured that they are the descendants of cats brought ashore on the West Coast by whalers.' (Brown 1919).
>
> However, Finlayson (1935) believed that the cat had been present in central Australia for much longer than other introduced animals because a unique Aboriginal (Pitjantjatjara) name Mulcoo was applied to it, whereas all other feral animals were known by

corruptions of English / European terms such as Rapita, Kamula, Tuuka, etc. Burbidge *et al.* (1988) supported this idea and suggested that cats may have entered the central deserts from the west from shipwrecks on the western coast of Australia.

For the most recent detailed discussion of the earliest records of the cat in Australia see Abbott (2002).

It is worth noting that, whereas Bolam commented on the impacts of foxes on some of the native fauna in the Ooldea area in the early 1920's, Richard Maurice was expressing concern about the impacts of feral cats as early as 1901-02. Maurice observed that in the Ooldea area:.

> 'The anteater, Myrmicobius, perameles or rabbit bandicoot, large- nesting rats and kangaroos and emus used to be got here but now it is mostly rabbits and cats gone wild' (quoted in Gara 1996).

However, 40 years later, Finlayson (1961), observed that:

> 'the feral domestic cat which is widely spread in Central Australia is also no doubt a destructive force of some magnitude here as elsewhere; but as it preceded the white man in the Centre by several decades at least, and the rabbit and the fox by a still greater interval, without producing comparable effect to the latter, it is presumably of less virulence.'

The view expressed by Finlayson is generally regarded as being of great accuracy and is supported by more recent research.

Camelus dromedarius **(Kamula, Feral Camel, Dromedary) (Figure 61)**

Camels are very numerous and widespread across the MT Lands, being recorded in 22 of 24 vegetation communities.

Ernest Giles was the first explorer to use camels in the far-west of South Australia in 1875. Subsequent explorers relied heavily on camels and they were used extensively as pack-animals well into the 1930's and 1940's.

During the surveys on the MT Lands, camels were recorded at 50% of all sites. However, this is an under-estimate of their distribution as virtually all flat areas, and all sand dune and sand plain areas, show signs (especially tracks) of the recent presence of this large and highly mobile species. They were rarely seen due to the density of the vegetation obscuring them

When Anangu saw camels for the first time they were extremely frightened by them, according to Daisy Bates, who described this alarm among Anangu at Ooldea. (see Gara 1996).

Figure 61: Feral Camels are an increasing problem across the Maralinga Tjarutja Lands and the central deserts in general. (Photo: P. Canty).

Feral Camels are now a serious problem across the MT Lands and the central deserts in general. They drink accessible rock-holes dry, leaving nothing for native wildlife. They also disturb or damage important Tjukurpa sites.

Their grazing/browsing impacts are slight because they are such mobile animals. However, where they can access them, camels can kill Quandongs and other high moisture content foliage such as Plumbush by breaking all branches to access the highly favoured foliage Foulkes 2001, Dorges and Heucke 2008). This impact is exacerbated during extended dry periods.

Widespread and increasing in abundance (estimated at doubling every 8 years), the camel has flourished because of lack of disease and predators and relative drought resistance due to high mobility and arid-adapted physiology.

Mus musculus **(Mingkiri, House Mouse)**

The most abundant of the terrestrial mammals (395 observations from 92 quadrats (60%)), but not the most widespread which was *Pseudomys hermannsbergensis*. It was recorded from 18 of 24 vegetation mapping groups. Like *P. hermannsbergensis*, it did not show a strong preference for any vegetation community.

Finlayson (1961) observed that in 1932-35, house mice were in considerable numbers in parts of central Australia and noted that it is a species that is 'subject to periodic increases to plague proportions'. He also correctly stated that it was very likely that the species would ultimately be universally distributed across Australia.

House mice were the second most widely captured and the most abundant small mammal species recorded during the survey program. They were captured at 51% of survey sites. A ubiquitous species; found in all habitat types; rare during dry conditions, but irruptive following good rainfalls.

***Oryctolagus cuniculus* (Rapita, Rabbit)**
Rabbits were recorded in 15 of 24 vegetation communities in the MT Lands. The arrival and spread of the rabbit in central Australia has been well documented by many authors (e.g. Rolls 1969). Strong (1983) noted that rabbits first appeared in the Lake Eyre area in 1886 and then moved via the Finke and other river catchments into the Musgrave and adjacent desert mountain ranges. From there they spread quickly throughout the centre.

However, rabbits also appear to have spread northwards from the far-west coast of South Australia at about the same time. Gara (1996) suggests that rabbits were plentiful in the Streaky Bay district in 1887, but were not reported at Nullarbor Station until August 1893 when they had also reached the northern edge of the Nullarbor Plain. By 1894 they had reached Eucla.

While the rabbit's progress westwards is well documented, it is not so widely known how quickly this species penetrated the inland. Gara (1996) notes that in 1897, Maurice noted rabbit tracks at Boundary Dam 250 km north of Eucla (where Mason had seen none the previous year). Then, by May 1901, Murray's (1904) journal of his expedition to the Rawlinson Ranges with Maurice, noted that rabbits were numerous in the Ooldea area and common as far north as Punthanna (half-way between Ooldea and the southern AP Lands). However, beyond Punthanna, no more signs were observed until the Petermann Ranges were reached.

On their return journey, Maurice and Murray observed that rabbits were present in the sandhill country south of the Musgrave Ranges and at Oolarinna, but less abundant. South of Oolarinna, they encountered only a few rabbits until they reached Paraminna and Paling Rock-holes, where they became plentiful again. And at Ooldea, rabbits were causing considerable damage to the vegetation:

> 'the country here is much more poorer than when I have previously visited it; the rabbits are numerous and are barking, and consequently killing many of the bushes and shrubs, whilst any young ones springing up to take their place are nipped off directly they appear above ground' (Murray 1904, in Gara 1996).

In the MT Lands, rabbits were recorded at 44 (29%) of sites, which is considerably less than the 60% recorded on the APY Survey (Robinson *et al.*2003) and their current impact is much less than observed in the APY Lands.

EXTINCT MAMMAL FAUNA
A number of hypotheses exist to explain the loss of many of the medium-sized mammals from the MT Lands. included:

- The extreme drought in the 1930's.
- Predation from the combined effects of dingoes, cats and foxes wiped them out.
- Rabbits took over the country where the native animals were living.
- exploration surveys travelled across the Lands collecting large numbers of these species and 'white fellas then took them back to Adelaide'.
- Extinctions in some areas were the result of nuclear testing at Maralinga in the 1950's.

The first three points above are jointly considered as the major contributors (see Morton (1990) for a proposed model. Recent research (Foulkes 2001) has shed further light on the combination of factors responsible for the decline in mammal populations and characteristics of habitats where animals may remain.

***Myrmecobius fasciatus* (Walputi, Numbat)**
Regionally Extinct. Finlayson (1961) commented that the Numbat appeared to have suffered from the arrival of the fox. The last confirmed record in SA appears to have been from the Everard Ranges area in the mid-1930's (Copley *et al.* 1989). Maurice noted the presence of the numbat at Ooldea around 1900 and Tallaringa in 1902 (Gara 1996). Bolam did not record the numbat and Daisy Bates referred to a 'banded bandicoot' but didn't record seeing them. The last reported sighting of the species in central Australia appears to have been from the Clutterbuck Hills area (Patjarr), NW of Warburton in WA in the late 1960's (Friend *et al.* 1982).

***Dasycercus blythi* (Murtja, Mulgara)**
Presumed extinct from the MT Lands; despite extensive and relatively intensive search efforts the last confirmed specimen was collected from the MT Lands in 1933. Bolam (1930) noted that the mulgara was common on the Nullarbor and in the sandhill country around its edge. He also collected numerous specimens for the SA Museum (Gara 1996). However, this species is still relatively common in Uluru – Kata Tjuta National Park (Foulkes *et al.* 1992, Reid *et al.* 1993) and in the Warburton area in Western Australia. There is therefore a possibility that the species may still be located in the MT Lands in appropriate areas of spinifex – sand plain habitats. This appears to be a species that is favoured by ongoing mosaic or patch-burning practices that were lost (in the most part) from the MT Lands in about the 1930's. Fox predation may also be implicated in their demise from the southern parts of their former range.

***Dasyurus geoffroii* (Partjata, Western Quoll)**
Regionally Extinct. The Western Quoll occurred over much of mainland Australia, however it is believed to have disappeared by the mid 1940's. Gara (1996)

believed that Daisy Bates had seen them as she was able to accurately describe and identify it, suggesting it was still present in the Ooldea area up to 1917. Johnson and Roff (1982) have discussed this species decline and disappearance from central Australia.

***Antechinomys laniger* (Pitji-pitji or Anula, (Ilpalya) - unknown ?, Kultarr)**
Finlayson (1961) observed that they were 'fairly plentiful … in the Everard and Musgrave Ranges … from 1932-35.' There was a single capture of a Kultarr during the Yellabinna Survey (Copley & Kemper 1992) which indicates it is still possible that it is extant within the region. However, Kultarrs have proved to be relatively elusive in trapping projects elsewhere, except in Sturt's Stony Desert where they remain common (Brandle 1998).

***Chaeropus ecaudatus* (Kanytjilpa, Pig-footed Bandicoot)**
Extinct. Last specimen-based record on the MT Lands was from 1901 and Maurice was familiar with the species, noting that it occurred in the sandhill country north of Ooldea. He observed that '… we are now in the country of the notoryctes and castanotis … the latter is a peculiar little animal called the pig-footed bandicoot, possessing front feet like the common pig. These animals use little water.' Maurice obtained the first of his specimens of the Pig-footed Bandicoot at Ooldea during an early visit there, and obtained several more on a trip along the northern edge of the Nullarbor Plain, westwards from Ooldea in 1897. He also noted in various manuscripts that they were common around Ooldea, Waldana and Punthana (Gara 1996). Bolam (1930) noted that tracks of the Pig-footed Bandicoot were occasionally seen in the Ooldea area but didn't record any captures. Burbidge *et al.* (1988) suggested they became extinct in the GVD during the 1920's, which is supported by Bolam's and Finlaysons's (1961) accounts.

***Perameles eremiana* [*P. bougainville*] (Walilya, Makura, Desert Bandicoot)**
Extinct. Last museum records are from near Mt Crombie, registered in 1931, though Finlayson (1961) commented that it was still 'a well known and fairly plentiful species' in the region in 1932-35. He attributed the species' demise to foxes.

***Isoodon auratus* (Nyulu, Wintaru, Makura Golden Bandicoot)**
Regionally Extinct. Last SA Museum record from the area was collected in 1934. Finlayson (1961) noted that it was more numerous than *P. eremiana* in the period 1932-35. He suggested that it was still present in the vicinity of the MT Lands in the early 1960's, although it was rare or extinct from most other parts of its former range. Anangu suggest that it 'finished up' in about the 1940's or 1950's (see Burbidge *et al.* 1988).

***Macrotis lagotis* (Ninu, Marura, Tjalku (Y), Greater Bilby)**
Regionally Extinct. Last specimen record from the area in the 1930's. Finlayson wrote that bilbies were 'formerly one of the most plentiful and universally distributed of central Australian mammals'. However, by 1961 they were 'rapidly being reduced to the status of a rare form and [have] been completely eliminated from much of the [southern part of their arid range] in the last 25 years, by the fox' (Finlayson 1961).

Daisy Bates wrote in 1929 that:

> 'there is only one object that can be called money – the soft white tail-tip of the rabbit bandicoot. Several of these attached to a man's beard make him a rich man for the time being. Milbu is the central Australian term for this money, and every milbu has big purchasing power. Evidently the rabbit bandicoot has never been numerous in central areas, and so its tail-tip becomes the only money of the interior. The milbu will buy many spears, a big bundle of hair or fur string; or even a wife.' (Gara 1996).

***Bettongia lesueur* (Mitika, Burrowing Bettong)**
Extinct. Old Burrowing Bettong warrens may still be seen in some areas where they remain as large, flattened, circular mounds 15-20 m across. A single old warren was recorded on a quadrat in the MAR 1 cluster of sites. They appear to have shared warrens with rabbits for a few years after their arrival. Finlayson (1961) noted that this species was 'formerly exceedingly plentiful, and … almost universally distributed in [north-western South Australia], where it was one of the most important of aboriginal accessory food sources'. By 1961, he wrote that it had 'now been almost eliminated from the [area]'. Burbidge *et al*. (1988) suggest that the species became extinct from central Australian deserts in about the 1960's.

***Bettongia penicillata* (Karpitji, Brush-tailed Bettong)**
Regionally Extinct. Finlayson (1961) noted that he had recorded this species: at Pundi (= Punti) c. 80 km south of the Musgrave Ranges; near Mt Harriet, about half way between Pundi and the ranges; at Waldana Spring, about 160 km south of Pundi; at Unyaba Hill, between the Everard and Musgrave Ranges; and near Mt Conner (just across the border in the Northern Territory). By 1961, he reported that he thought it was still extant in very small numbers in most of these areas. Burbidge et al. (1988) concluded from Aboriginal accounts that the species became extinct in the central deserts in about the 1950's to 1960's.

***Trichosurus vulpecula* (Wayuta Common Brushtail Possum)**
Regionally Extinct. Influences, including extended droughts and altered food productivity due to changed fire frequencies and the impact of predators and rabbits

have been implicated (Finlayson 1961; Kerle *et al.* 1992, Foulkes 2001).

Several early explorers made reference to possums in the Great Victoria Desert and the ranges of north-western South Australia, and from these observations some things can be pieced together about their local behaviours.

> During the Elder expedition, Helms (1896) noted their presence in stunted mallee trees in the vicinity of the Everard Ranges where he also obtained a skin of this species (Stirling 1893). Lewis, another member of the Elder expedition, surprised an old Aboriginal woman cooking a possum in a fire while he was exploring what is now the north-west corner of the Unnamed Conservation Park (Lindsay 1893). During their expeditions to the central ranges in 1901 and 1902 Maurice and Murray also recorded several sightings of possums. Near the Cavenagh Range in July 1901, Murray noted some possums inhabiting the bloodwood trees near their camp; noting also that they were 'somewhat rare in this country'. He also reported sighting more possums near the Mann Ranges in August and two other sightings between Oolarinna and Koonunda, during their return journey to Fowlers Bay. During the 1902 expedition Maurice noted seeing a possum about 130km north of Tallaringa (Gara 1996).

Possums appear to have become extinct in the MT Lands in about the 1950's or early 1960's (Burbidge *et al.* 1988) however there was an unsubstantiated record from Ooldea during the survey. It is possible a live possum was brought to the area to be eaten and subsequently escaped.

It is widely thought that predation by foxes has been the primary cause of their demise over most of their former arid distribution (e.g. Finlayson 1961).

***Lagorchestes hirsutus* (Mala, Rufous Hair Wallaby)**
Extinct. In the early 1930's, Finlayson (1961) recorded their presence south of the Cavanagh Range, at Koonapandi and Pundi south of the Musgrave Ranges, and in localities between the Everard and Musgrave Ranges. However, he then noted that:

> 'in 1956, testimony of natives who still hunt yearly in the sand tracts south of the Musgrave, Mann and Tomkinson Ranges (where it was once their chief food supplies in 1932-35), was that it was finished'

Helms, the anthropologist on the Elder expedition in 1891-2, recorded that 'spinifex wallabies' or 'mala' (*L. hirsutus*), were the main animal food of the desert Aborigines. The Aborigines flushed them from their hiding places by setting fire to the spinifex and then knocked down the fleeing animals with throwing sticks. They were also caught by driving them into 'wallaby traps' (Helms 1896). Streich, another member of the Elder expedition, noted that Mala were common throughout the northern Great Victoria Desert (Stirling 1893, quoted in Gara 1996).

***Onychogalea lunata* (Tawalpa, Crescent Nailtail Wallaby)**
Extinct. The Crescent Nailtail Wallaby appears to have become extinct by the 1940's or 1950's. Finlayson (1961) had little experience or knowledge of this animal.

Burbidge *et al.* (1988) indicate that Crescent Nailtail Wallabies inhabited a wide range of habitats in the central deserts. They sheltered beneath a low shady tree or shrub, or sometimes beneath a spinifex hummock, and early accounts record that they often sought refuge in a hollow log or tree, or in a burrow, when pursued.

Helms (1896) recorded the name '*daualpa*' (= Tawalpa) in the Blyth Range. Daisy Bates recorded the name also for vocabularies in the Ooldea area. But few first-hand accounts seem to exist. Finlayson (1961) noted that 'in 1932-35 it was still being reported and occasionally obtained by natives … but I have personal knowledge of only two specimens taken in that period'.

Burbidge *et al.* (1988) note that they were 'hunted by building brush fences and enclosures and driving the animals into them or through a gap behind which people waited with clubs to make killing easier'.

Several early explorers who traversed the Great Victoria Desert reported finding brushwood 'wallaby fences' or 'traps' while exploring just to the north of the boundary of the current-day Mamungari Conservation Park. Wells reported finding 'brush traps, erected for trapping wallabies or rats' (Lindsay 1893). Murray also reported finding 'brush fences for wallaby and rat hunting' near Parraminna Dam and others near Ooldabinna, Waldana and in the sandhill country south of the Cavanagh Range.

***Leporillus* spp. (Tjuwalpi, Lesser and Greater Stick nest Rat)**
Extinct. The last records of this species (anywhere) were made by Tindale in 1933, near Mt Crombie, south of the Musgrave Ranges. Tindale (1933) recorded the burning of the stick-nest rat's nest and the capture of the fleeing inhabitants on his black and white movie reel entitled *Mann Ranges – 1933*. He also retained two specimens for the SA Museum. Some old nests had been recorded from the low cliffs on the edge of Serpentine Lakes (Barritt 1986) and on this survey, as well as additional sites which appeared top be the remains of nests at sites in the IGY and MER cluster of sites on the eastern side of the MT Lands. The former

range and extinction of this species on the mainland has been described by Copley (1999).

DISCUSSION

SPECIES OF CONSERVATION SIGNIFICANCE

Threatened species

Conservation status ratings for each species, as listed in Table 14, follow those applied nationally, as Critically Endangered, Endangered or Vulnerable under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 2000* and the State listings of Endangered, Vulnerable or Rare, as per Schedules 7, 8 and 9 of the *National Parks and Wildlife Act 1972* (most recently revised in 2008).

The Southern Marsupial-mole or Itjari-itjari, *Notoryctes typhlops*, is the only extant mammal in the region listed nationally as Endangered. It is also listed as Endangered at the State level. The Sandhill Dunnart *Sminthopsis psammophila* is listed as Vulnerable at the State level.

Regional conservation status for each mammal species on the MT Lands has been assessed from the results of the survey and the relative numbers of records made over the past 110 years.

Future research and management recommendations for selected mammal species on the MT Lands are made in the Conclusions and Recommendations chapter.

BIRDS

by J. N. Foulkes[1]

INTRODUCTION

This chapter includes a summary of the knowledge of the bird fauna of the Maralinga Tjarutja Lands (MT Lands) prior to the biological survey beginning in 2001.

Early knowledge of birds relies significantly on the records of early explorers and naturalists. All birds are discussed using their European common and scientific names for clarity however the work conducted by Robinson *et al*. (2003) records Anangu names for birds recorded in the APY Lands, many of which occur in the MT Lands.

APPRAISAL OF SPECIES' RECORDS PRIOR TO THE SURVEY

Museum and published records

Gara (1996) has reviewed the earliest non-Aboriginal observations of mammals in the MT Lands, and in the Great Victoria Desert to the south and west. From this review, the first European records of mammals in the area appear to have been made by Richard Maurice, Daisy Bates and Anthony Bolam, and supplementing these observations were records of bird observations.

Richard Maurice was a pastoralist who, between 1897 and 1903, funded and led at least nine expeditions into the eastern portion of the Great Victoria Desert (Gara 1996). He is a little-known explorer who recorded much of significance about local Aboriginal groups and natural history (see Gara 1994). Most natural history information for the region prior to the early 1930's has to be gleaned from the few published scientific papers and many unpublished journals and manuscripts of early explorers and scientists.

There have been no detailed reports of the birds of the MT region or Great Victoria Desert in South Australia. Much of the knowledge has been derived from the journals of early explorers such as Giles (1889) and Maurice (1901, 1902). White (1919), Cleland (1923) and McGilp (1932) documented birds from the Nullarbor and fringes of the Great Victoria Desert around Ooldea and the Barton sand dunes. There was a long hiatus in the literature and collecting between the early 1930's until the late 1960's and early 1970's where Ford and Sedgewick (1967) and Ford (1971, 1974) recorded ecological and distributional information on GVD and arid zone birds, as did Ford and Parker (1974) and Douglas (1979). The GVD bird fauna in general was discussed by Schodde (1982) in his review on the evolution of birds in Australia. Black and Badman (1986) documented the distribution and habitat preference of birds in the eastern Great Victoria Desert as part of The Nature Conservation Society survey in 1980, particularly between Cook and Vokes Hill corner and west from Vokes Hill corner to Serpentine Lakes. Reid and Carpenter (1987) observed the importance of the link the GVD mallee communities provide between Western Australia and Eyre Peninsula, and how it has been severely disrupted by clearance.

McKenzie and Robinson (1987) also undertook survey work in the south-western corner of the MT lands in Nullarbor and Great Victoria Desert habitats. Cohen *et al.* (1992) in Copley and Kemper (1992) undertook bird survey in the southern Maralinga Tjarutja Lands around Muckera Rockhole, Lake Bring and Yarle Lakes as part of the Yellabinna Biological Survey. The Australian Bird Census coordinated by Birds Australia over two periods (1977-1981) and (1998-2002) has also provided additional valuable information on the distribution, abundance and breeding ecology of birds in the MT Lands.

The earliest reliably dated museum bird specimen (a Splendid Fairy Wren) from the region preserved at the South Australian Museum was collected by A. S. Le Souef from near Ooldea in 1921. There are a number of other specimens, which are probably older but the reliability of their date and locality data is poor. Prior to this survey there were 52 bird specimens in the SA Museum. The distribution of bird records, including specimens, prior to this survey are shown in Figure 62. A total of 133 bird species have been recorded from the MT Lands (Table 19) including six new species recorded on this survey. This chapter discusses and describes species of significance, predominantly those with a national or State conservation status as many of the taxa recorded in the MT Lands are common and widespread.

Table 22 cross tabulates all species recorded against vegetation mapping groups (Table 21) so that affinities/habitat preferences of particular bird species with vegetation communities can be quickly identified and plant communities with high bird species richness can also be identified.

1Science Resource Centre, Information Science and Technology Directorate, SA Department for Environment and Heritage, GPO Box 1047, ADELAIDE, SA 5001.

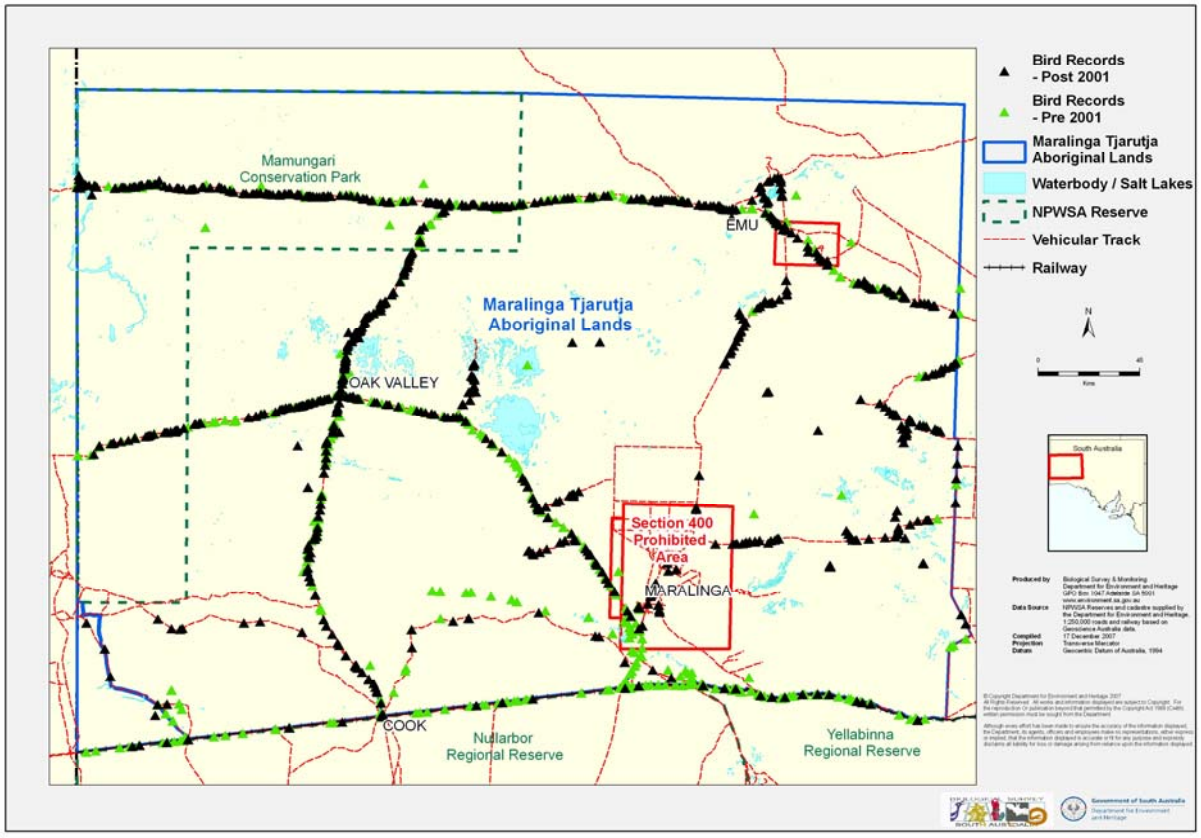

Figure 62: Distribution of bird records for the Maralinga Tjarutja Lands prior to this survey (pre-2001) and from this survey (2001-2007).

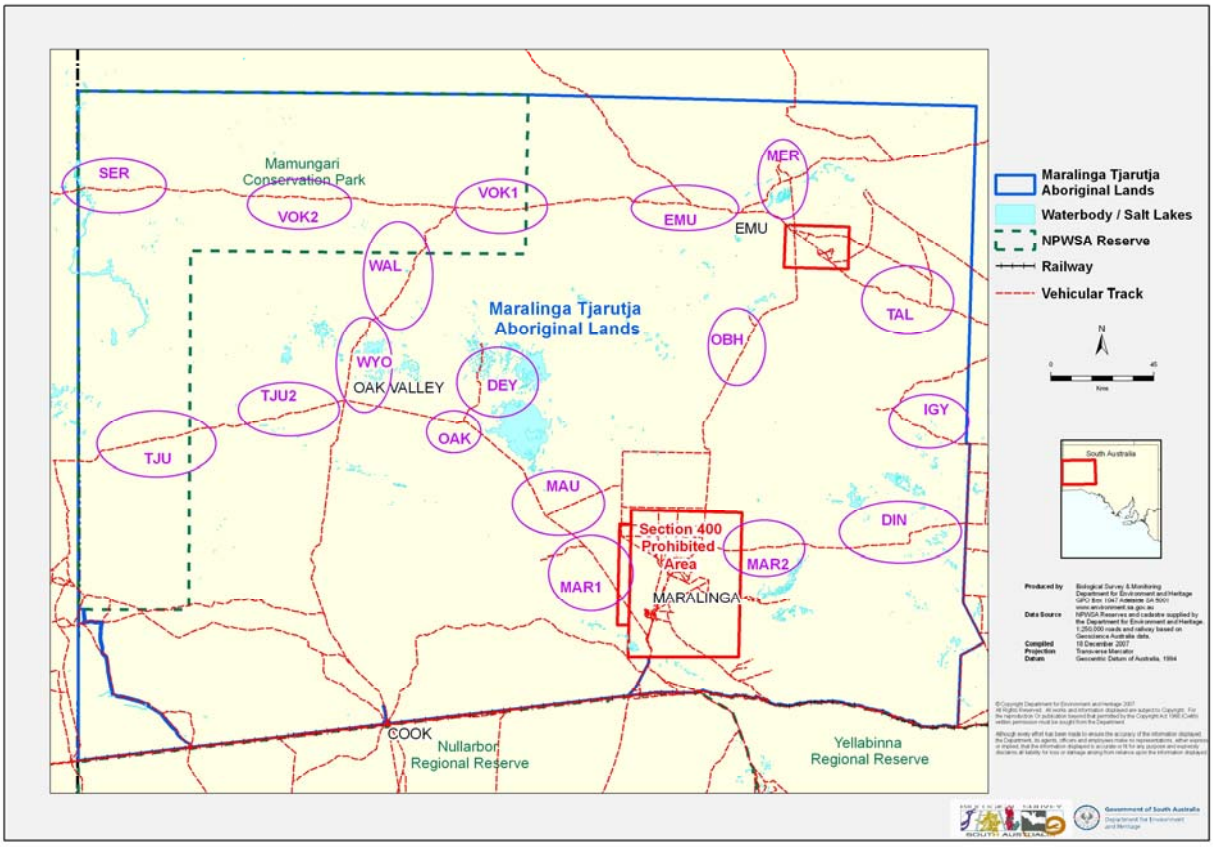

Figure 63: Location of areas sampled (clusters of quadrats and their site code prefix) in the Maralinga Tjarutja Lands during this survey (2001-2007).

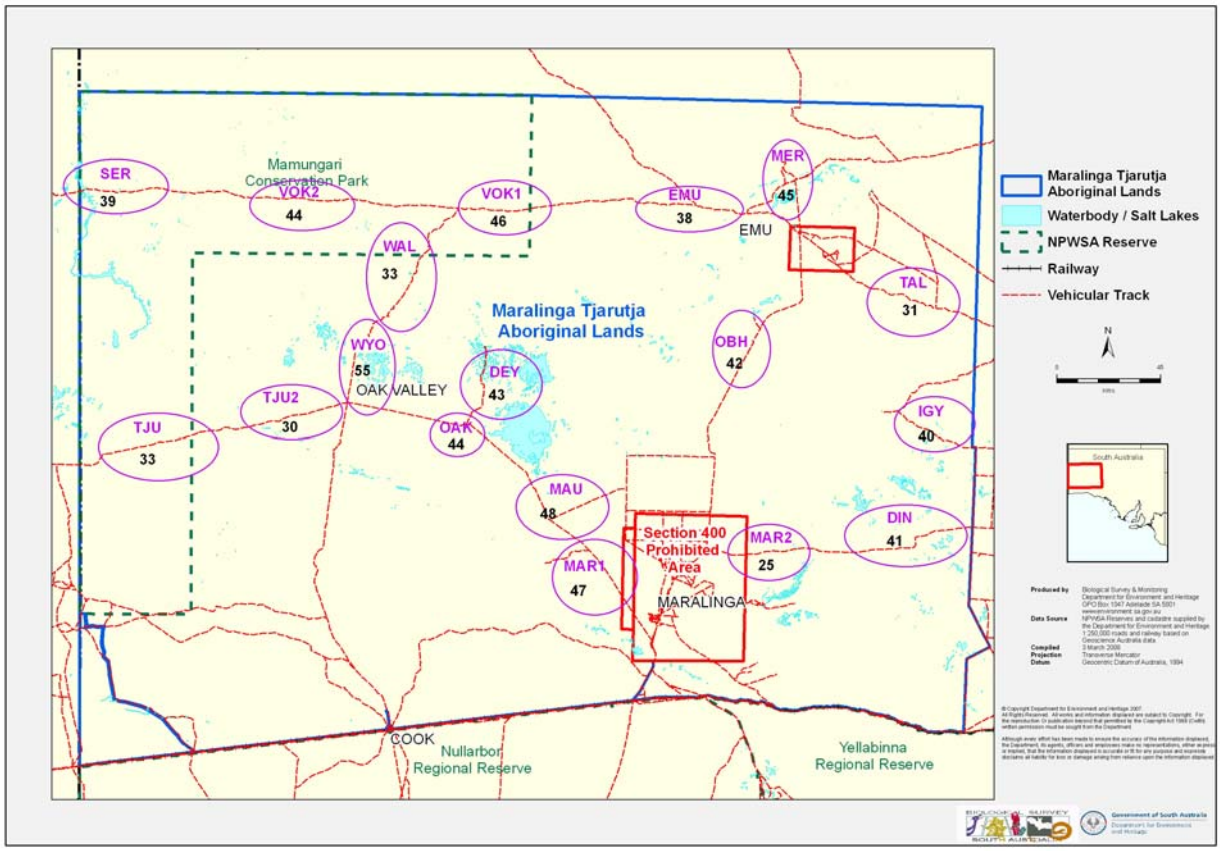

Figure 64: Location of areas sampled (clusters of quadrats) and bird species richness within each of the Maralinga Tjarutja Lands survey site clusters during this survey (2001-2007).

Table 19: Number of records for each bird species prior to this survey (pre-2001), this survey (post 2001-2007) and Birds Atlas (2003) across the Maralinga Tjarutja Lands. (# indicates new species for MT Lands, * indicates introduced species. Taxa with national and state conservation status rating in bold)

Species	Pre-2001	This Survey	Bird Atlas	Total
Acanthagenys rufogularis (Spiny-cheeked Honeyeater)	436	711	144	1291
Acanthiza apicalis (Inland Thornbill)	178	192	36	406
Acanthiza chrysorrhoa (Yellow-rumped Thornbill)	36	157	24	217
Acanthiza iredalei (Slender-billed Thornbill)	12	2	1	15
Acanthiza robustirostris (Slaty-backed Thornbill)	16	26	6	48
Acanthiza uropygialis (Chestnut-rumped Thornbill)	417	828	105	1350
Accipiter cirrhocephalus (Collared Sparrowhawk)	5	8	3	16
Accipiter fasciatus (Brown Goshawk)	2	7	5	14
Acrocephalus stentoreus (Clamorous Reedwarbler)	1			1
Aegotheles cristatus (Australian Owlet-nightjar)	18	28	15	61
***Amytornis striatus* (Striated Grasswren) R**	3		1	4
Amytornis textilis (Thick-billed Grasswren)	2			2
Anas gracilis (Grey Teal)			1	1
Anthochaera carunculata (Red Wattlebird)	8	7	3	18
Anthus novaeseelandiae (Richard's Pipit)	203	48	30	281
Aphelocephala leucopsis (Southern Whiteface)	265	485	65	815
***Aphelocephala pectoralis* (Chestnut-breasted Whiteface) V**	2			2
Aphelocephala sp.		10		10
Aquila audax (Wedge-tailed Eagle)	70	36	25	131
***Ardeotis australis* (Australian Bustard) V**	11	44	10	65
Artamus cinereus (Black-faced Woodswallow)	233	711	70	1014
Artamus cyanopterus (Dusky Woodswallow)	17	7	7	31
Artamus minor (Little Woodswallow)	1			1
Artamus personatus (Masked Woodswallow)	68	827	129	1024
Artamus sp.		8		8
Artamus superciliosus (White-browed Woodswallow)		1		1
Barnardius zonarius (Australian Ringneck, (Ring-necked Parrot)	117	227	42	386
***Cacatua leadbeateri* (Major Mitchell's Cockatoo) R**	30	45	21	96
Cacatua roseicapilla (Galah)	81	363	44	488
Cacatua sp.		4		4
# Cacomantis flabelliformis (Fan-tailed Cuckoo)		2		2
Calamanthus campestris (Rufous Fieldwren)	29		2	31
***Calamanthus cautus* (Shy Heathwren (Shy Hylacola) R**	1	1		2
Calidris acuminata (Sharp-tailed Sandpiper)	1			1
Certhionyx niger (Black Honeyeater)	1			1
Certhionyx variegatus (Pied Honeyeater)	7	37	42	86
Charadrius australis (Inland Dotterel)	153	16	2	171
Charadrius ruficapillus (Red-capped Plover)	1		3	4
# Chenonetta jubata (Australian Wood Duck, (Maned Duck))		4		4
Cheramoeca leucosternus (White-backed Swallow)	33	40	10	83
Chrysococcyx basalis (Horsfield's Bronze-cuckoo)	18	76	33	127
Chrysococcyx osculans (Black-eared Cuckoo)	7	10	12	29
Cincloramphus cruralis (Brown Songlark)	3	2	10	15
# Cincloramphus mathewsi (Rufous Songlark)		36	10	46
Cinclosoma castanotus (Chestnut Quail-thrush)	24	47	10	81
Cinclosoma cinnamomeum (Cinnamon Quail-thrush)	6		3	9
Cinclosoma cinnamomeum alisteri (Nullarbor Quail-thrush)	8	9		17
Circus assimilis (Spotted Harrier)	6	11	10	27
***Climacteris affinis* (White-browed Treecreeper) R**	20	36	13	69
Climacteris rufa (Rufous Treecreeper)	22	40	18	80

Species	Pre-2001	This Survey	Bird Atlas	Total
Colluricincla harmonica (Grey Shrike-thrush)	170	212	87	469
Coracina maxima (Ground Cuckoo-shrike)	14	30	2	46
Corvus bennetti (Little Crow)	94	135	32	261
Corvus coronoides (Australian Raven)	6	8		14
Corvus orru (Torresian Crow)	3	2	2	7
Corvus sp.	27		4	31
Coturnix pectoralis (Stubble Quail)			3	3
Cracticus nigrogularis (Pied Butcherbird)	16	12	19	47
Cracticus torquatus (Grey Butcherbird)	94	249	72	415
Cuculus pallidus (Pallid Cuckoo)	43	35	39	117
Daphoenositta chrysoptera (Varied Sittella)	45	83	7	135
Dicaeum hirundinaceum (Mistletoebird)	36	39	20	95
Dromaius novaehollandiae (Emu)	11	15	1	27
Egretta novaehollandiae (White-faced Heron)			2	2
Elanus axillaris (Black-shouldered Kite)	1	2	2	5
Epthianura aurifrons (Orange Chat)	66	34	10	110
Epthianura tricolor (Crimson Chat)	39	263	47	349
Eurostopodus argus (Spotted Nightjar)	2	4	1	7
Falco berigora (Brown Falcon)	66	79	49	194
Falco cenchroides (Nankeen Kestrel)	48	94	25	167
Falco longipennis (Australian Hobby)	8	6	2	16
***Falco peregrinus* (Peregrine Falcon) R**	1	1		2
Falco sp.		2		2
# Falco subniger (Black Falcon)		1		1
***Gerygone fusca* (Western Gerygone) R**	4		1	5
Glossopsitta porphyrocephala (Purple-crowned Lorikeet)		2		2
Grallina cyanoleuca (Magpie-lark)	2	5	2	9
Gymnorhina tibicen (Australian Magpie)	35	84	34	153
Haliastur sphenurus (Whistling Kite)	1			1
Hieraaetus morphnoides (Little Eagle)	5	5	7	17
Hirundo neoxena (Welcome Swallow)	8	4	7	19
Lalage tricolor (White-winged Triller)	28	138	41	207
***Leipoa ocellata* (Malleefowl) VU, V**	2	1		3
Lichenostomus leucotis (White-eared Honeyeater)	12	2	3	17
Lichenostomus ornatus (Yellow-plumed Honeyeater)	20	8		28
Lichenostomus plumulus (Grey-fronted Honeyeater)	525	829	127	1481
Lichenostomus virescens (Singing Honeyeater)	152	343	87	582
Malacorhynchus membranaceus (Pink-eared Duck)	1			1
Malurus lamberti (Variegated Fairy-wren)	103	138	28	269
Malurus leucopterus (White-winged Fairy-wren)	66	72	23	161
Malurus sp.		1		1
Malurus splendens (Splendid Fairy-wren)	178	358	29	565
Manorina flavigula (Yellow-throated Miner)	538	1027	136	1701
Melanodryas cucullata (Hooded Robin)	90	110	40	240
# Melithreptus brevirostris (Brown-headed Honeyeater)		2		2
Melopsittacus undulatus (Budgerigar)	636	1170	72	1878
Merops ornatus (Rainbow Bee-eater)	74	22	26	122
Microeca fascinans (Jacky Winter)	78	91	50	219
Milvus migrans (Black Kite)	1			1
***Myiagra inquieta* (Restless Flycatcher) R**	1			1
***Neophema splendida* (Scarlet-chested Parrot) R**	61	11	9	81
Neopsephotus bourkii (Bourke's Parrot)	5	8	1	14

Species	Pre-2001	This Survey	Bird Atlas	Total
Ninox novaeseelandiae (Southern Boobook)	5	1	5	11
Northiella haematogaster (Blue Bonnet)	7	62	1	70
Nymphicus hollandicus (Cockatiel)	5	36	19	60
Ocyphaps lophotes (Crested Pigeon)	8	28	6	42
Oreoica gutturalis (Crested Bellbird)	214	319	122	655
***Pachycephala inornata* (Gilbert's Whistler) R**	23	8	5	36
Pachycephala rufiventris (Rufous Whistler)	130	175	64	369
Pachycephala sp.		1		1
Pardalotus punctatus (Spotted Pardalote)	3	1	1	5
Pardalotus rubricatus (Red-browed Pardalote)	1	1		2
Pardalotus striatus (Striated Pardalote)	67	52	23	142
***Passer domesticus* (House Sparrow)	1			1
Petrochelidon nigricans (Tree Martin)	18	88	18	124
Petroica goodenovii (Red-capped Robin)	189	193	46	428
Phaps chalcoptera (Common Bronzewing)	3	6	3	12
Phylidonyris albifrons (White-fronted Honeyeater)	571	849	134	1554
Podargus strigoides (Tawny Frogmouth)	16	3	1	20
***Polytelis alexandrae* (Princess Parrot) VU, V**	16	15		31
Pomatostomus superciliosus (White-browed Babbler)	380	683	107	1170
Psephotus varius (Mulga Parrot)	272	677	77	1026
Psophodes occidentalis (Chiming Wedgebill)	21	103	21	145
Pyrrholaemus brunneus (Redthroat)	30	3		33
Recurvirostra novaehollandiae (Red-necked Avocet)	1			1
Rhipidura albiscapa (Grey Fantail)	1	1	1	3
Rhipidura leucophrys (Willie Wagtail)	102	207	64	373
Smicrornis brevirostris (Weebill)	335	328	59	722
Stiltia isabella (Australian Pratincole)	4			4
Strepera versicolor (Grey Currawong)	5			5
***Sturnus vulgaris* (Common Starling)	1			1
Taeniopygia guttata (Zebra Finch)	35	122	9	166
Threskiornis spinicollis (Straw-necked Ibis)			1	1
Todiramphus pyrrhopygia (Red-backed Kingfisher)	29	19	15	63
***Tringa glareola* (Wood Sandpiper) R**	2			2
Turnix velox (Little Button-quail)	5	13	7	25
Tyto alba (Barn Owl)	2	1	2	5
***Tyto novaehollandiae* (Masked Owl) E**	1			1
# Vanellus miles (Masked Lapwing)		1		1
Vanellus tricolor (Banded Lapwing)	2	2	5	9
Grand Total	**8519**	**14967**	**2954**	**26440**

Further field observations were made to record bird species distributions for *The Atlas of Australian Birds* (Blakers *et al.*1984) and more recently *The New Atlas of Australian Birds* Barrett *et al* .(2003). These records are largely observations obtained by amateur ornithologists along the main routes through the MT Lands.

TOTAL BIRD FAUNA: CURRENT AND EXTINCT

Since 2001, the biological survey of the MT Lands has added significantly to scientific understanding of the current distributions and ecological requirements of the region's birds. All bird records from the South Australian Museum (Table 19), from the Biological Survey and Opportune databases, from the Birds Australia *Atlas of Australian Birds* (using both first and second Atlas databases) and from published records with reliable species identifications, have now been collated for the study area.

The bird survey data in Table 20 shows:

- The number of quadrats each species was recorded in (No. quadrats).
- The number of records for each species within sample quadrats (No observed).
- The number of individuals of each species recorded within sample quadrats (Frequency (quadrats)).
- The number of opportune records made for each species outside of quadrats (Opportune Frequency).
- The number of individuals of each species recorded outside of quadrats (Opportune No. Observed).

Table 20. Frequency of bird species at survey quadrats and opportune locations across the Maralinga Tjarutja Lands during the survey period (2001-2007). (# indicates new species for MT Lands Taxa with national and state conservation status rating in bold**)**

Species	No. observed	No. quadrats	Proportion (%)	No. observed (Opportune)	Frequency (Opportune)
Oreoica gutturalis (Crested Bellbird)	265	117	76.0	54	40
Acanthagenys rufogularis (Spiny-cheeked Honeyeater)	625	114	74.0	86	36
Manorina flavigula (Yellow-throated Miner)	932	112	72.7	95	35
Acanthiza uropygialis (Chestnut-rumped Thornbill)	733	94	61.0	95	30
Pomatostomus superciliosus (White-browed Babbler)	515	94	61.0	168	44
Colluricincla harmonica (Grey Shrike-thrush)	176	90	58.4	36	23
Cracticus torquatus (Grey Butcherbird)	219	86	55.8	30	22
Phylidonyris albifrons (White-fronted Honeyeater)	752	81	52.6	97	21
Lichenostomus virescens (Singing Honeyeater)	286	80	51.9	57	29
Psephotus varius (Mulga Parrot)	488	80	51.9	189	41
Artamus cinereus (Black-faced Woodswallow)	548	73	47.4	163	40
Rhipidura leucophrys (Willie Wagtail)	161	72	46.8	46	21
Pachycephala rufiventris (Rufous Whistler)	142	69	44.8	33	25
Petroica goodenovii (Red-capped Robin)	161	63	40.9	32	20
Lichenostomus plumulus (Grey-fronted Honeyeater))	753	59	38.3	76	16
Smicrornis brevirostris (Weebill)	278	58	37.7	50	17
Barnardius zonarius (Australian Ringneck)	189	53	34.4	38	14
Aphelocephala leucopsis (Southern Whiteface)	369	52	33.8	116	31
Melopsittacus undulatus (Budgerigar)	870	50	32.5	300	19
Malurus splendens (Splendid Fairy-wren)	295	49	31.8	63	19
Acanthiza apicalis (Inland Thornbill)	160	41	26.6	32	14
Chrysococcyx basalis (Horsfield's Bronze-cuckoo)	56	37	24.0	20	12
Artamus personatus (Masked Woodswallow)	725	36	23.4	102	9
Cacatua roseicapilla (Galah)	248	36	23.4	115	23
Falco berigora (Brown Falcon)	44	35	22.7	35	32

Melanodryas cucullata (Hooded Robin)	79	35	22.7	31	19
Species	**No. observed**	**No. quadrats**	**Proportion (%)**	**No. observed (Opportune)**	**Frequency (Opportune)**
Corvus bennetti (Little Crow)	100	34	22.1	35	12
Lalage tricolor (White-winged Triller)	123	29	18.8	15	7
Psophodes occidentalis (Chiming Wedgebill)	67	29	18.8	36	25
Coracina novaehollandiae (Black-faced Cuckoo-shrike)	60	27	17.5	23	13
Epthianura tricolor (Crimson Chat)	136	27	17.5	127	19
Falco cenchroides (Nankeen Kestrel)	46	27	17.5	48	29
Gymnorhina tibicen (Australian Magpie)	55	27	17.5	29	18
Microeca fascinans (Jacky Winter)	67	24	15.6	24	9
Malurus lamberti (Variegated Fairy-wren)	106	22	14.3	32	9
Acanthiza chrysorrhoa (Yellow-rumped Thornbill)	100	21	13.6	57	14
Dicaeum hirundinaceum (Mistletoebird)	32	21	13.6	7	5
Pardalotus striatus (Striated Pardalote)	50	21	13.6	2	2
Aegotheles cristatus (Australian Owlet-nightjar)	20	18	11.7	8	8
Cuculus pallidus (Pallid Cuckoo)	25	16	10.4	10	10
Anthus novaeseelandiae (Richard's Pipit)	30	15	9.7	18	10
Cheramoeca leucosternus (White-backed Swallow)	33	14	9.1	7	4
***Climacteris affinis* (White-browed Treecreeper) R**	26	14	9.1	10	8
Petrochelidon nigricans (Tree Martin)	67	14	9.1	21	6
Certhionyx variegatus (Pied Honeyeater)	32	13	8.4	5	4
Cinclosoma castanotus (Chestnut Quail-thrush)	36	12	7.8	11	8
Malurus leucopterus (White-winged Fairy-wren)	54	12	7.8	18	8
Todiramphus pyrrhopygia (Red-backed Kingfisher)	15	12	7.8	4	4
Taeniopygia guttata (Zebra Finch)	53	10	6.5	69	18
Aquila audax (Wedge-tailed Eagle)	10	9	5.8	26	20
Daphoenositta chrysoptera (Varied Sittella)	70	9	5.8	13	3
***Ardeotis australis* (Australian Bustard) V**	14	8	5.2	30	18

***Neophema splendida* (Scarlet-chested Parrot) R**	9	8	5.2	2	1
Northiella haematogaster (Blue Bonnet)	25	8	5.2	37	13
Species	**No. observed**	**No. quadrats**	**Proportion (%)**	**No observed (Opportune)**	**Frequency (Opportune)**
Acanthiza robustirostris (Slaty-backed Thornbill)	24	7	4.5	2	2
# Cincloramphus mathewsi (Rufous Songlark)	35	7	4.5	1	1
Climacteris rufa (Rufous Treecreeper)	33	7	4.5	7	4
Nymphicus hollandicus (Cockatiel)	25	7	4.5	11	2
***Cacatua leadbeateri* (Major Mitchell's Cockatoo) R**	22	6	3.9	23	11
Chrysococcyx osculans (Black-eared Cuckoo)	8	6	3.9	2	2
Coracina maxima (Ground Cuckoo-shrike)	20	6	3.9	10	5
Circus assimilis (Spotted Harrier)	8	5	3.2	3	3
Merops ornatus (Rainbow Bee-eater)	11	5	3.2	11	4
Ocyphaps lophotes (Crested Pigeon)	18	5	3.2	10	5
***Pachycephala inornata* (Gilbert's Whistler) R**	6	5	3.2	2	2
Turnix velox (Little Button-quail)	11	5	3.2	2	2
Accipiter fasciatus (Brown Goshawk)	4	4	2.6	3	3
Artamus cyanopterus (Dusky Woodswallow)	7	4	2.6		
Cracticus nigrogularis (Pied Butcherbird)	12	4	2.6		
Dromaius novaehollandiae (Emu)	5	4	2.6	10	4
Accipiter cirrhocephalus (Collared Sparrowhawk)	5	3	1.9	3	3
Anthochaera carunculata (Red Wattlebird)	7	3	1.9		
Hieraaetus morphnoides (Little Eagle)	4	3	1.9	1	1
Podargus strigoides (Tawny Frogmouth)	3	3	1.9		
Epthianura aurifrons (Orange Chat)	3	2	1.3	31	2
Neopsephotus bourkii (Bourke's Parrot)	2	2	1.3	6	2
Phaps chalcoptera (Common Bronzewing)	4	2	1.3	2	1
Vanellus tricolor (Banded Lapwing)	2	2	1.3		
Acanthiza iredalei (Slender-billed Thornbill)	2	1	0.6		

Cacatua sp.	4	1	0.6		
# Cacomantis flabelliformis (Fan-tailed Cuckoo)	2	1	0.6		
Corvus coronoides (Australian Raven)	2	1	0.6	6	3
Species	**No. observed**	**No. quadrats**	**Proportion (%)**	**No observed (Opportune)**	**Frequency (Opportune)**
Elanus axillaris (Black-shouldered Kite)	2	1	0.6		
Falco longipennis (Australian Hobby)	1	1	0.6	5	5
Glossopsitta porphyrocephala (Purple-crowned Lorikeet)	2	1	0.6		
Lichenostomus ornatus (Yellow-plumed Honeyeater)	3	1	0.6	5	2
Ninox novaeseelandiae (Southern Boobook)	1	1	0.6		
Pardalotus rubricatus (Red-browed Pardalote)	1	1	0.6		
***Polytelis alexandrae* (Princess Parrot) VU, V**	1	1	0.6	14	3
Pyrrholaemus brunneus (Redthroat)	1	1	0.6	2	2
Tyto alba (Barn Owl)	1	1	0.6		
Artamus superciliosus (White-browed Woodswallow)			0.0	1	1
***Calamanthus cautus* (Shy Heathwren (Shy Hylacola)) R**			0.0	1	1
Charadrius australis (Inland Dotterel)			0.0	16	2
# Chenonetta jubata (Australian Wood Duck)			0.0	4	1
Cincloramphus cruralis (Brown Songlark)			0.0	2	2
Cinclosoma cinnamomeum alisteri (Nullarbor Quail-thrush)			0.0	9	6
Corvus orru (Torresian Crow)			0.0	2	1
Eurostopodus argus (Spotted Nightjar)			0.0	4	4
***Falco peregrinus* (Peregrine Falcon) R**			0.0	1	1
# Falco subniger (Black Falcon)			0.0	1	1
Grallina cyanoleuca (Magpie-lark)			0.0	5	2
Hirundo neoxena (Welcome Swallow)			0.0	4	1
***Leipoa ocellata* (Malleefowl) VU, V**			0.0	1	1
Lichenostomus leucotis (White-eared Honeyeater)			0.0	2	1
# Melithreptus brevirostris (Brown-headed Honeyeater)			0.0	2	1

Pardalotus punctatus (Spotted Pardalote)			0.0	1	1
Rhipidura albiscapa (Grey Fantail)			0.0	1	1
# Vanellus miles (Masked Lapwing)			0.0	1	1
Grand Total	**11844**			**3123**	

Table 21: Summary of Maralinga Tjarutja Lands vegetation mapping codes and description of dominant plant species present in each mapping group.

Mapping Code	Description
Woodlands GVD_1	*Acacia aneura* complex over *Eremophila latrobei* ssp.*glabra* +/- *A. tetragonophylla* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus* spp., *Eragrostis eriopoda, Aristida contorta, Monachather paradoxa* Low Open Woodland
GVD_2	*Acacia aneura* complex over *Maireana sedifolia, Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus obovatus* var. *obovatus, Aristida contorta* Low Open Woodland
GAW_11	*Acacia aneura* complex over *Maireana sedifolia* +/- *Ptilotus obovatus* var. *obovatus* +/- *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. +/- *Aristida contorta* Very Low Open Woodland
GVD_3	*Acacia ramulosa* var., *A. aneura* complex over, *Senna artemisioides* ssp. *petiolaris* +/- *Dodonaea viscosa* ssp. *angustissima* +/- *Ptilotus* spp, *Aristida holathera* var. *holathera, Eragrostis eriopoda* Low Open Woodland
GAW_10	*Acacia aneura* complex over *Aristida contorta* +/- *Eragrostis eriopoda* +/- *Maireana georgei* +/- *Ptilotus obovatus* var. *obovatus* +/- *Monachather paradoxa* Very Low Open Woodland
GVD_4	+/- *Alectryon oleifolius* ssp. *canescens* +/- *Myoporum platycarpum* ssp. *platycarpum* +/- *Casuarina pauper* +/- *E. concinna* +/- *E. oleosa* ssp. +/- *E. socialis* over +/- *Acacia ramulosa, Senna artemisioides* ssp., *Maireana sedifolia, Austrostipa nitida* Low Open Woodland
GVD_5	*Casuarina pauper* and/or *Acacia papyrocarpa* over *Maireana sedifolia* or *Cratystylis conocephala, Senna cardiosperma* ssp. *gawlerensis* +/- *Senna artemisioides* ssp. *petiolaris, Atriplex vesicaria* ssp. Low Open Woodland
GAW_6	*Casuarina pauper* +/- *Acacia papyrocarpa* +/- *A. aneura* complex +/- *Alectryon oleifolius* ssp. *canescens* +/- *Santalum acuminatum* over *Maireana sedifolia, Atriplex vesicaria* ssp. +/- *Enchylaena tomentosa* var. *tomentosa* Low Open Woodland
NUL_3	*Casuarina pauper, Acacia aneura* complex over *Senna artemisioides ssp*. Low Woodland
GVD_6	*Casuarina pauper* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Acacia aneura* complex over *Senna cardiosperma* ssp. *gawlerensis, Ptilotus obovatus* var. *obovatus* Low Open Woodland
GVD_7	*Eucalyptus gongylocarpa, E. youngiana* +/- *E. concinna* +/- *E. glomerosa* over *Acacia ligulata* +/- *Acacia ramulosa, Ptilotus polystachyus* var. *polystachyus, Triodia basedowii, Aristida holathera* var. *holathera* Low Open Woodland
GVD_400	*Callitris gracilis* or *C. glaucophylla* or *C. verrucosa* over *Dodonaea viscosa* ssp. *angustissima, Rhagodia preissii* ssp. *preissii* Low Woodland
Mallee GVD_9	*Eucalyptus concinna* +/- *E. canescens* ssp. *canescens* +/- *E. socialis* ssp. +/- *E. eremicola* +/- *Acacia aneura* complex over *Senna artemisioides* ssp. *petiolaris* +/- *Eremophila paisleyi* ssp. *paisleyi, Ptilotus obovatus* var. *obovatus, Triodia scariosa* Open Mallee
NUL_5	*Eucalyptus concinna* and/or *E. socialis or E. yumburrana* ssp. *yumburrana* over *Triodia scariosa* or *T. lanata* and/or *T. irritans* Open Mallee
GVD_10	*Eucalyptus concinna* +/- *E. socialis* ssp. over *Dodonaea viscosa* ssp. *angustissima, Senna artemisioides* ssp. *petiolaris, Acacia colletioides* +/- *A. ligulata* +/- *Bossiaea walkeri, Aristida contorta* +/- *Triodia* spp. +/- *Lomandra leucocephala* ssp. *robusta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* Open Mallee
GVD_11	*Eucalyptus oleosa* ssp. +/- *Eucalyptus brachycalyx* or *E. concinna* over *Acacia nyssophylla, Atriplex vesicaria* ssp., *Maireana radiata, M. pentatropis* +/- *Cratystylis conocephala* Open Mallee
GVD_12	+/- *Eucalyptus yumbarrana* ssp. *yumbarrana* +/- *E. brachycalyx* or *E. concinna* +/- *E. gracilis* over *Melaleuca eleuterostachya* +/- *Hakea francisiana* +/- *Westringia rigida* +/- *Eremophila scoparia, Triodia* spp. Open Mallee
Shrublands GVD_14	*Acacia aneura* complex over *Eremophila latrobei* ssp. *glabra, Eriachne mucronata, Eragrostis eriopoda* +/- *Monachather paradoxa* Tall Open Shrubland
GVD_15	*Acacia ligulata, A. ramulosa* var., *Dodonaea viscosa* ssp. *angustissima* over *Aristida holathera* var. *holathera* +/- *Aristida contorta* Tall Open Shrubland
NUL_9	*Acacia ligulata* or *A. ramulosa* or *A. clelandii* or *Acacia aneura* complex over *Dodonaea viscosa ssp. angustissima* Tall Open Shrubland
GVD_16	*Atriplex vesicaria* ssp. over *Hemichroa diandra* +/- *Tecticornia* spp. +/- emergent *Melaleuca nanophylla* Low Open Shrubland
GVD_17	+/- *Dodonaea viscosa* ssp. *angustissima* +/- *Acacia oswaldii* over *Atriplex vesicaria, Austrostipa nitida* +/- *Aristida contorta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* and/or *Alectryon oleifolius* ssp. *canescens* Shrubland
GVD_18	*Tecticornia* spp., *Atriplex vesicaria* over +/- *Hemichroa diandra* +/- *Maireana oppositifolia* Low Open Shrubland
GVD_19	*Salsola tragus, Eriochiton sclerolaenoides, Sclerolaena obliquicuspis, S. diacantha, Austrostipa nitida, Enneapogon avenaceus* +/- emergents *Acacia tetragonophylla* or *Alectryon oleifolius* ssp. *canescens* or *Pittosporum angustifolium* Low Open Shrubland / (Tussock) Grassland
GVD_20	*Sclerolaena diacantha, Enneapogon avenaceus, Salsola tragus* with emergent senescent *Acacia aneura* complex Low Shrubland
GVD_21	*Senna artemisioides* ssp. *petiolaris* +/- *S. artemisioides* ssp. *coriacea* over *Atriplex vesicaria* ssp., emergent *Acacia oswaldii* +/- emergent *Pittosporum angustifolium* Tall Open Shrubland

Table 22: Two-way table showing proportion of observations of each bird species within each vegetation mapping group/vegetation community (key to colours: >33%, 20-32%, 10-19%, <10% +). Species with less than 10 records shown only as + or absent. Species sorted alphabetically by scientific name.

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Acanthagenys rufogularis (Spiny-cheeked Honeyeater)		+	+	+	+	+		+			+	+		+	+	+		+		+	+		+	
Acanthiza apicalis (Inland Thornbill)	+	+		+	+	+			+	+	+		+			+		+			+			
Acanthiza chrysorrhoa (Yellow-rumped Thornbill)			+		+					+	+		+	+										
Acanthiza iredalei (Slender-billed Thornbill)	+																							
Acanthiza robustirostris (Slaty-backed Thornbill)																								
Acanthiza uropygialis (Chestnut-rumped Thornbill)		+		+	+			+	+	+	+	+		+		+		+			+	+	+	
Accipiter cirrhocephalus (Collared Sparrowhawk)					+												+						+	
Accipiter fasciatus (Brown Goshawk)	+				+					+														
Aegotheles cristatus (Australian Owlet-nightjar)							+	+								+								
Anthochaera carunculata (Red Wattlebird)		+			+					+														
Anthus novaeseelandiae (Richard's Pipit)		+		+										+		+								
Aphelocephala leucopsis (Southern Whiteface)		+	+	+			+	+		+	+	+	+			+	+	+			+	+		
Aquila audax (Wedge-tailed Eagle)	+				+		+	+						+			+	+						
***Ardeotis australis* (Australian Bustard) V**	+					+							+				+							
Artamus cinereus (Black-faced Woodswallow)		+	+	+		+	+	+		+	+	+	+	+		+	+	+		+	+	+		
Artamus cyanopterus (Dusky Woodswallow)		+								+			+		+									
Artamus personatus (Masked Woodswallow)			+		+									+	+	+	+	+		+		+	+	
Barnardius zonarius (Australian Ringneck)		+	+	+	+	+		+		+	+					+			+		+			
***Cacatua leadbeateri* (Major Mitchell's Cockatoo) R**																+	+						+	
Cacatua roseicapilla (Galah)		+					+	+	+			+	+	+		+	+	+			+			
Certhionyx variegatus (Pied Honeyeater)			+				+			+						+					+		+	
Cheramoeca leucosternus (White-backed Swallow)	+	+	+			+																		
Chrysococcyx basalis (Horsfield's Bronze-cuckoo)		+			+			+	+					+						+		+	+	+
Chrysococcyx osculans (Black-eared Cuckoo)	+	+					+			+							+								
Cincloramphus mathewsi (Rufous Songlark)							+		+	+														
Cinclosoma castanotus (Chestnut Quail-thrush)																								
Circus assimilis (Spotted Harrier)			+				+		+															
***Climacteris affinis* (White-browed Treecreeper) R**										+			+											
Climacteris rufa (Rufous Treecreeper)																								
Colluricincla harmonica (Grey Shrike-thrush)		+	+	+	+	+		+			+	+	+	+	+	+	+	+			+			+
Coracina maxima (Ground Cuckoo-shrike)	+				+		+	+						+										
Coracina novaehollandiae (Black-faced Cuckoo-shrike)	+		+	+	+	+					+					+	+							+
Corvus bennetti (Little Crow)		+			+				+					+		+		+						
Corvus coronoides (Australian Raven)										+														
Cracticus nigrogularis (Pied Butcherbird)	+				+				+															

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Cracticus torquatus (Grey Butcherbird)		+		+	+	+		+	+	+	+	+	+			+		+	+				+	+
Cuculus pallidus (Pallid Cuckoo)			+		+		+		+								+						+	
Daphoenositta chrysoptera (Varied Sittella)				+	+		+	+									+							
Dicaeum hirundinaceum (Mistletoebird)	+		+	+	+					+	+										+			
Dromaius novaehollandiae (Emu)	+	+			+					+														
Elanus axillaris (Black-shouldered Kite)										+														
Epthianura aurifrons (Orange Chat)					+													+						
Epthianura tricolor (Crimson Chat)	+						+			+			+			+	+			+				
Falco berigora (Brown Falcon)			+				+				+			+								+		
Falco cenchroides (Nankeen Kestrel)	+		+					+		+		+		+		+	+					+		
Falco longipennis (Australian Hobby)		+																						
Glossopsitta porphyrocephala (Purple-crowned Lorikeet)															+									
Gymnorhina tibicen (Australian Magpie)				+		+	+	+	+	+				+		+	+	+						
Hieraaetus morphnoides (Little Eagle)					+				+	+														
Lalage tricolor (White-winged Triller)	+		+						+				+	+		+	+				+	+		
Lichenostomus ornatus (Yellow-plumed Honeyeater)										+														
Lichenostomus plumulus (Grey-fronted Honeyeater)	+	+	+		+		+				+		+		+	+	+			+			+	+
Lichenostomus virescens (Singing Honeyeater)		+		+				+	+	+		+		+		+		+			+	+		
Malurus lamberti (Variegated Fairy-wren)		+		+			+		+							+	+							
Malurus leucopterus (White-winged Fairy-wren)											+						+							
Malurus splendens (Splendid Fairy-wren)		+	+	+	+		+	+	+	+	+	+	+	+		+		+	+		+			
Manorina flavigula (Yellow-throated Miner)	+	+	+	+				+			+	+	+	+		+	+	+			+	+	+	+
Melanodryas cucullata (Hooded Robin)		+	+					+	+	+		+		+		+					+			
Melopsittacus undulatus (Budgerigar)	+	+	+		+		+	+	+					+	+	+	+	+			+			+
Merops ornatus (Rainbow Bee-eater)	+						+		+	+		+												
Microeca fascinans (Jacky Winter)	+			+		+			+		+						+		+					
***Neophema splendida* (Scarlet-chested Parrot) R**					+				+	+					+								+	
Neopsephotus bourkii (Bourke's Parrot)	+				+																			
Ninox novaeseelandiae (Southern Boobook)	+																							
Northiella haematogaster (Blue Bonnet)	+													+								+		
Nymphicus hollandicus (Cockatiel)		+			+										+		+							
Ocyphaps lophotes (Crested Pigeon)					+			+						+			+							
Oreoica gutturalis (Crested Bellbird)		+	+	+	+	+		+			+	+	+	+	+	+					+		+	+
***Pachycephala inornata* (Gilbert's Whistler) R**	+		+							+							+							
Pachycephala rufiventris (Rufous Whistler)		+		+	+						+	+	+			+					+		+	
Pardalotus rubricatus (Red-browed Pardalote)										+														
Pardalotus striatus (Striated Pardalote)			+		+		+		+		+		+											

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Petrochelidon nigricans (Tree Martin)		+			+		+		+						+									
Petroica goodenovii (Red-capped Robin)		+		+	+	+			+	+	+		+	+		+				+			+	
Phaps chalcoptera (Common Bronzewing)			+				+																	
Phylidonyris albifrons (White-fronted Honeyeater)	+	+	+	+	+	+	+		+	+				+	+	+	+	+			+		+	
Podargus strigoides (Tawny Frogmouth)		+	+														+							
***Polytelis alexandrae* (Princess Parrot) VU, V**			+																					
Pomatostomus superciliosus (White-browed Babbler)		+		+	+	+		+	+		+		+	+		+		+	+		+			+
Psephotus varius (Mulga Parrot)		+	+	+	+	+		+	+	+	+	+		+		+		+			+	+		
Psophodes occidentalis (Chiming Wedgebill)		+					+							+				+			+			
Pyrrholaemus brunneus (Redthroat)										+														
Rhipidura leucophrys (Willie Wagtail)		+		+		+		+	+	+	+	+	+	+		+		+			+		+	
Smicrornis brevirostris (Weebill)		+			+	+	+		+		+		+			+								+
Taeniopygia guttata (Zebra Finch)														+		+	+							
Todiramphus pyrrhopygia (Red-backed Kingfisher)		+	+		+		+			+			+	+	+	+								
Turnix velox (Little Button-quail)		+					+			+														
Tyto alba (Barn Owl)									+															
Vanellus tricolor (Banded Lapwing)							+			+														

Common species and habitat preferences

During the systematic site-based surveys 108 bird species were identified. Forty (37%) of these species were recorded at more than 15 of the 154 bird survey quadrats (i.e. > 10% of quadrats surveyed) and fifty-one (47%) were detected at more than 8 quadrats sampled in the region (i.e. at > 5% of sample quadrats). Notably, all of these species are native. A further 18 species were recorded at 'opportunistic' sites only.

The most widespread species (i.e. recorded at most survey quadrats - see Table 20), was the Crested Bellbird that was recorded on 117 quadrat surveys (or at 76% of quadrats). The ten most commonly recorded species ware listed below

Crested Bellbird (117 quadrats, 76% of total)
Spiny-cheeked Honeyeater (114, 74%)
Yellow-throated Miner (112, 73%)
Chestnut-rumped Thornbill (94, 61%)
White-browed Babbler (94, 61%)
Grey Shrike-thrush (90, 58%)
Grey Butcherbird (86, 56%)
White-fronted Honeyeater (81, 53%)
Mulga Parrot (81, 52%)
Singing Honeyeater (80, 52%)

All these species were recorded from between 16 and 21 vegetation communities, with only one of these (Grey-fronted Honeyeater) having a strong preference for particular vegetation communities (GVD_7 and GVD_9) (Table 22).

Figure 65: Piil-piilpa, the Yellow-throated Miner (*Manorina flavigula*), is a common bird of the eucalypt canopies. (Photo: A. Robinson).

The 10 most frequently recorded species on the survey quadrats (i.e. based on multiple records over more than one sampling per quadrat) were Yellow-throated Miners, Spiny-cheeked Honeyeaters, Bellbirds, Galahs, Willie Wagtails, Black-faced Woodswallows, Mulga Parrots and Crested Pigeons. By comparison the 10 most abundant species on survey quadrats were:

Yellow-throated Miner (932)
Budgerigar (870)
Grey-fronted Honeyeater (753)
White-fronted Honeyeater (752)
Chestnut-rumped Thornbill (733)
Masked Woodswallow (725)
Spiny-cheeked Honeyeater (625)
Black-faced Woodswallow (548)
White-browed Babbler (515)
Mulga Parrot (488)

Of these species, only one, the Budgerigar, had a very strong preference for a particular vegetation community (GVD_9, Table 22), despite being recorded in 14 other vegetation communities. The other species were recorded from between 14 and 21 vegetation communities (Table 22).

Fourteen species appeared to have very strong affinities (>33% of observations) with particular vegetation communities (Table 22). These were:

Zebra Finch (GVD_1)
Major Mitchell's Cockatoo (GVD_1, GVD_7)
Yellow-rumped Thornbill (GVD_2)
Rufous Songlark (GVD_2)
Blue Bonnett (GVD_5)
Red-backed Kingfisher (GVD_7)
Pied Honeyeater (GVD_7)
Tree Martin (GVD_9)
Cockatiel (GVD_9)
Budgerigar (GVD_9)
Striated Pardalote (GVD_9)
Inland Thornbill (GVD_15)
White-backed Swallow (GVD_15)
White-winged Fairy-wren (GAW_11)

Opportune records

Opportune records, made outside of survey quadrats, could have been (a) biased in favour of records of rarer species that observers went searching for or (b) biased against the very common species. However, they were also used intentionally as a means of quickly sampling

birds in habitats that were either poorly or not represented in the quadrat sampling. The most common and the most abundant species on quadrats were also (generally) the most common and/or abundant species across 'opportune' locations. Opportune locations usually included lists made at each campsite during the survey program.

The 10 most commonly recorded species at opportune locations during the survey were:

Budgerigar (300 observations)
Mulga Parrot (189 observations)
White-browed Babbler (168 observations)
Black-faced Woodswallow (163 observations)
Crimson Chat (127 observations)
Southern Whiteface (116 observations)
Galah (115 observations)
Masked Woodswallow (102 observations)

The species recorded only at 'opportune' sites (i.e. not detected on quadrats-Table 20) were typically in low numbers, with most recorded at less than five locations. For example, nine Nullarbor Quail-thrush were recorded at six locations and 16 Inland Dotterels were recorded at two locations. Other species included:

White-browed Woodswallow
Shy Heathwren (Shy Hylacola)
Inland Dotterel
Australian Wood Duck
Brown Songlark
Nullarbor Quail-thrush
Torresian Crow
Spotted Nightjar
Peregrine Falcon
Black Falcon
Magpie-lark
Welcome Swallow
Malleefowl
White-eared Honeyeater
Brown-headed Honeyeater
Spotted Pardalote
Grey Fantail
Masked Lapwing

Species Richness

Bird species richness ranged between 55 (WYO cluster) and 25 (MAR2 cluster) (Figure 64). Clusters with lower species richness reflected a higher proportion sites with lower structural diversity such as that found in Nullarbor habitats (TJU-33 species, TJU2-30 species) or dry seasonal conditions e.g., MAR2 (25 species) and TAL (31 species). Season of sampling also influences species observations. Median species richness for clusters sampled in autumn was 40 species (range of 30-55) whereas spring median species richness was 42 species (range 25-48 species).

During the Yellabinna Biological Survey (Copley & Kemper 1992), bird species richness ranged between 24 species (Lake Bring) and 56 species (Muckera Rockhole). Notably, the two most species rich clusters of sites, Muckera and Yarle Lakes (55 species) from the Yellabinna Survey, were both in the southern MT Lands.

New for Maralinga Tjarutja

The following species are new records for the MT;

Australian Wood Duck, (Maned Duck)
Brown Songlark
Black Falcon
Brown-headed Honeyeater
Masked Lapwing

Species Not Found

There were 21 species have been previously recorded on the MT Lands previously but were not recorded on this survey (Table 19). Most of these were vagrants or naturally uncommon species with 3 or less observations. Four of the species: Chestnut-breasted Whiteface, Western Gerygone, Masked Owl and the Restless Flycatcher have State Conservation Status ratings and are discussed later.

Introduced species

Significantly, there are records of only two introduced species for the Maralinga Tjarutja Lands. There were single records of Common Starling (Cook in 2000) and House Sparrow (Yarle Lakes in 1987) prior to the biological survey program. Neither species was recorded on the MT Lands on subsequent survey trips.

CONSERVATION STATUS ASSESSMENTS

Fifteen rated species, (two nationally and 13 state) occur or have been recorded in the Maralinga Tjarutja Lands, and nine of these were recorded during the survey period.

Common Name	Federal	SA
Malleefowl	VU	V
Princess Parrot	VU	V
Masked Owl		E
Striated Grasswren		R
Major Mitchell's Cockatoo		R
Shy Heathwren (Shy Hylacola)		R
White-browed Treecreeper		R
Peregrine Falcon		R
Western Gerygone		R
Restless Flycatcher		R

Scarlet-chested Parrot	R
Gilbert's Whistler	R
Wood Sandpiper	R
Chestnut-breasted Whiteface	R
Australian Bustard	V

The summaries given below attempt to clarify the current status of selected bird species across the MT Lands. The only species discussed are those:

- having increased in range and/or abundance in central Australia since European settlement, or
- having decreased in range and/or abundance in central Australia since European settlement, or that have been difficult to locate, and for which Close and Jaensch (1984) could only document a few historical and/or recent records for the MT Lands

Species with increased range and abundance

Reid and Fleming (1992) reviewed the conservation status of birds in arid Australia. In that review they included an assessment of species that have apparently declined since European settlement and also of species that have increased over the same period. Their review identified 45 land bird species that have been reported to increase in range or abundance over at least part of the arid zone. Twenty-nine of those species have been recorded for the MT Lands. In APY, only seven of these 41 as species for which there appeared to have been demonstrable increases in north-western SA since the observations of White (1915), McGilp (1935) and Cleland (1934).

Many of these increases can be attributed to the provision of water for stock in pastoral country. Within the Maralinga Tjarutja Lands however, no cattle grazing is carried out and shed tanks are largely secure and do not permit birds to access the water.

Peaceful Doves, Banded Whitefaces and Australian Ravens were recorded rarely, both before and during the survey

Species with a decreased range and abundance, or rarely recorded

The following annotated summaries are intended to highlight those species that have a national (*Environment Protection and Biodiversity Conservation Act*) or State (*National Parks and Wildlife Act*) conservation status rating, and/or those that are naturally rare or difficult to locate. They do not include occasionally recorded migratory species or waterfowl that may come and go irregularly with seasonal conditions.

State conservation ratings are constantly being reviewed and, as a consequence, many of the listings for species mentioned below may well alter in the near future.

1. Species with a national conservation status rating

***Leipoa ocellata* (Nganamara, Malleefowl) VU, V**

One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992). 'Vulnerable' nationally, because of the extent of decline over the past three generations in both extent of occurrence and area of occupancy, and likely continued decline due to predation and wildfire (and other effects of habitat and population fragmentation) (Garnett and Crowley 2000).

- 1 record at 1 opportune site during the survey (though other sites have since been recorded by Keith Bellchambers (2007) and Joseph *et al.* in late 2007).

Bellchambers (2007) recorded 1 active and 4 inactive mounds, as well as 8 locations with tracks and observations of 8 birds at 5 locations. The majority of observations were in the southern MT Lands between the Cook-Vokes Hill and Tjuntjuntjara Track intersection and Maralinga Village.

As noted above, Malleefowl had been considered extinct from central Australia before the APY Lands Biological Survey (Robinson *et al.* 2003) (e.g. Marchant and Higgins 1993). For example, Kimber (1985) documented their former central Australian range and showed that the species used to occur as far north as the southern Tanami Desert in the Northern Territory well into the 1900's (see Marchant and Higgins 1993).

The discovery of active nests in several areas of the APY Lands has been a significant outcome of the biological survey program. As a result, additional specific survey work has been undertaken to document the species current range within the MT Lands and to identify the species' major conservation requirements (see Benshemesh 1997). Wildfire and predation of eggs and chicks, especially by foxes, appear to be the main threats.

Figure 66: Nganamara, the Malleefowl typically makes its distinctive nesting mounds in long unburnt Mulga areas. (Photo: P. J. Lang).

Malleefowl are so sparsely distributed in their highly fragmented preferred habitats that each 'population' appears to be at considerable risk of local extinction due to wildfire and/or predation. The species therefore warrants a regional conservation rating of at least 'endangered'. Further targeted surveys are suggested.

Polytelis alexandrae **(Wilyurukuruku, Princess Parrot) V, R**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992). 'Near threatened' nationally (recommended), because of an apparent decline in range over the past 50-70 years away from southern and eastern parts of the arid zone. However, there is no evidence of a decline in abundance (Garnett and Crowley 2000). Baxter and Henderson (2000) undertook a review of distribution, breeding and diet of the Princess Parrot in Australia

There appeared to be a pair nesting in a Marble Gum on a single quadrat (VOK2 cluster) and this appears to be the preferred breeding habitat of this species in South Australia, with most observations in or close to Marble Gum woodlands, west of Vokes Hill corner.

A further 14 individuals were observed at 3 opportune locations including a group of seven birds, which were in mulga woodland. There are older records from 1986 and 1989, 24 & 136km west of Vokes Hill Junction respectively (Higgins 1999) and Baxter and Henderson (2000) made observations of a likely breeding event in Mamungari CP.

Blyth and Burbidge (1997) suggest that these parrots may be resident breeders of the Great Sandy Desert region of Western Australia where they have a specialist diet of spinifex (*Triodia* spp.) seeds. These authors suggest that the species occasional occurrence outside of that region may be irruptive rather than nomadic in nature, and occur only when spinifex seed is in very poor supply locally. However, spinifex is a dominant feature across the Gibson and Great Victoria Deserts and there seems little reason for Princess Parrots not to be recorded there more regularly, unless there is considerably less frequent and less abundant seed set.

In the absence of any better suggestions, one highly speculative explanation worth considering for the Princess Parrot's apparent decline from southern and eastern parts of central Australia could be the decline in available water supplies, at soaks and rock-holes. This may have arisen through saltation and through competition with feral camels. Otherwise there should be ample food resources and nesting sites across virtually all of the species documented previous range. Occasional, rare, nomadic visitor in suitable seasonal conditions.

Species with a State conservation status rating

Strepera versicolor intermedia **(Pilal(pa), Grey Currawong) R**
Not recorded on this survey and the most recent observations were from the SE corner of the MT Lands during the Bird Atlas reporting period (2000), and prior to that in 1987 during the Yellabinna Biological survey (Copley & Kemper 1992).

During the APY survey, one Anangu informant stated that she had heard them recently at Yalata, Maralinga and Eucla where they are still resident (Robinson *et al.* 2003).

Ardeotis australis **(Kipara, Australian Bustard) V**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

Figure 67: The Australian Bustard appears reasonably common through the MT Lands. (Photo: D. Hopton).

'Near threatened' nationally, because of the extent of decline in abundance and area occupied in southern Australia (Garnett and Crowley 2000).

- 14 records at 8 quadrats across the MT Lands; 30 records at 18 opportune locations during the survey. It was recorded in 8 vegetation communities (Table 22), however two of these (GVD_3 and GVD_9) appeared to be preferred over other communities.
- Paltridge *et al.* (2007a) found Bustards to be reasonably common throughout the MT Lands during a tracking survey with Anangu.

Bustards have suffered a major decline in southern and central Australia, a decline that is well recognised by Anangu across the APY and MT Lands. They are a favoured source of meat and are hunted by Anangu. However, bustard tracks are encountered much more commonly than the birds. While the species has been recorded breeding throughout much of its range, such records are now seldom made south of the tropics. The major area of decline appears to coincide with the

known range of the introduced Red Fox and it is inferred by some authorities that fox predation of chicks has had a major part to play in that decline (Marchant and Higgins, 1993; Garnett and Crowley 2000).

Amytornis textilis **(Thick-billed Grasswren) V**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

There are two records from 2000, approximately 34 km SW of Maralinga, however there were no observations made during this survey.

Amytornis striatus **(Warukultrikultriny(pa), Striated Grasswren) V**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

'Near threatened' nationally, (Garnett and Crowley 2000); extensive wildfires are considered the major threat to the species. Work at Uluṟu Kata Tjuṯa NP in 1990 by Pedler (unpublished) suggested that a mosaic of burnt and unburnt country may be suitable for this species rather than long unburnt spinifex habit only.

This species was not recorded during this survey and there are four database records known from the MT Lands. The most recent is from near Maralinga Village in 2004, with the remaining three observations from Mamungari CP west of Vokes Hill Corner in 1983 and 1990. Ford and Parker (1974) recorded it between Cook and Vokes Hill corner, however Black and Badman (1986) didn't record it despite extensive searching.

This can be a difficult bird to find, and its preferred mixed hummock grassland/shrubland habitats are very widespread and possibly even increasing in area due to the increased extent and frequency of wildfires favouring these plant communities. Targeted surveys are recommended.

Cacatua leadbeateri **(Kakalalya, Pink Cockatoo) V**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

'Least concern' nationally (Garnett and Crowley 2000).

- 22 birds recorded at 6 quadrats (VOK2 cluster 2 quadrats, WAL cluster 2 quadrats, SER cluster 2 quadrats). It was recorded in only 5 vegetation communities, and two (GVD_1 and GVD_7, Table 21,22) were very strongly preferred by this species.
- Another 23 birds observed at 11 opportune sites during the survey period.

Black and Badman (1986) found it to be sparsely distributed and mainly in the northern part of their survey area, with birds observed around Serpentine Lakes. This is a widespread but sparsely scattered species in the region. No apparent reason for concern.

Falco peregrinus **(Kirkin(pa), Peregrine Falcon) R**
'Least concern' nationally (Garnett and Crowley 2000).

- A single bird was sighted opportunistically during the survey period near Cook in 2006.
- There is only 1 previous record for the MT Lands.

A species most likely to be encountered rarely across the MT Lands, however it is not of conservation concern within the region.

Neophema splendida **(Iilykiilykari? Scarlet-chested Parrot) R**
One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).
'Least concern' nationally, with no evidence of a significant decline in either area of occupancy or abundance (Garnett and Crowley 2000).

- Nine records from eight quadrats (SER cluster 3, VOK2 cluster 2 MAU cluster 3 and two from another opportune location in the WYO cluster during the survey period.
- Henderson (1977) recorded Scarlet Chested Parrots breeding in Marble Gums, 100km west of Vokes Hill Corner, and also notes that Shane Parker (SAM) found birds 10km west of Emu and at Vokes Hill.

A nomadic species that can be irruptive in some areas during exceptional seasonal conditions, and various observers have failed to locate it on specific searches (see account in Blacks and Badman (1986)). It is probably more likely to be encountered more often in the north-western part of the MT Lands where Marble Gums occur, where it was observed by Ford (1971) and Black and Badman (1986).

Calamanthus cautus **(Rufous (or Western) Calamanthus) R**
A single opportune observation was made of one bird during the survey period (OBH cluster). There was only one previous historical record (1983) by SAOA. This species is relatively common in stony deserts to the east, but on the margins of its distribution in the MT Lands

Climacteris affinis **(Kalingka-apanapan(pa), White-browed Treecreeper) R**
'Least concern' nationally – *Climacteris affinis affinis* (Garnett and Crowley 2000).

- 26 birds observed at 14 quadrats within 5 survey site clusters (OAK 2, VOK1 1, WYO 3, TJU 6 and SER 2) all in the western half of the MT Lands. It was recorded from 6 vegetation communities, with

three of these strongly preferred (GVD_1, GVD_5, GVD_6, Table22)
- 10 birds recorded at 8 opportune locations during the survey.
- The Bird Atlas contains an additional 13 records.

Historically, both White and McGilp had found this to be quite a common species, the latter mainly in Mulga. It appears to be a widespread, but sparsely scattered species of open woodland and tall open shrublands.

***Acanthiza robustirostris* (Tia-tia, Mininminin(pa), Slaty-backed Thornbill) R**

- 24 birds observed at 7 quadrats (VOK1, TJU 1, EMU1, and TAL 3). This species was recorded from five vegetation communities, however three (GVD_1, GVD_14 and GVD_15, Table 22) were strongly preferred.
- 2 birds recorded at 2opportune locations during the survey period.
- Close and Jaensch (1984) noted several records for the MT Lands, almost all of them in Mulga habitats.

There are similar numbers of historical records, White having first collected the species in the northern MT Lands in 1914. Black and Badman (1986) didn't record Slaty-backed Thornbills on their survey and they questioned identifications from west of Vokes Hill corner, however this survey and other subsequent survey effort validates the presence of the species in the MT Lands. Matthew and Kernot (1992) described the species distribution pattern within SA as it was known at the time and concluded that they occur where there is open Mulga woodland over an open understorey of *Eremophila latrobei* var. *glabra* and *Eremophila gilesii* ssp. *gilesii* and various grass species. A sparsely but widely distributed species. No reason for conservation concern.

***Aphelocephala pectoralis* (Chestnut-breasted Whiteface) V**

One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

'Near threatened' nationally - no evidence of a decline in range though there appears to have been a decline in abundance across their range (Garnett and Crowley 2000).

- No birds observed during the survey period. The only other known record from the MT Lands is a single record from 1979, from north of Maralinga Village.

This is a widespread and sparsely scattered species, typically of stony desert, therefore there is no reason for concern locally (also see Pedler 1991, 1992, 2000).

***Myiagra inequieta* (Restless Flycatcher) R**

There is a single recent database record of this species from the southern MT Lands from the near Barton railway siding in 2000. There are further observations (cited in Black and Badman (1986) from north of Ooldea and Observatory Hill in 1979, however they didn't record it on their survey.

***Tyto navaehollandiae* (Masked Owl) R**

The distribution of this species is not well known because it is confused with the Barn Owl and because it is rarely seen on the Australian mainland (Higgins 1999). There is a single SA Museum database record of this species from Ooldea in 1933 and other confirmed records from around Ooldea in 1920 and 1933 (Higgins 1999). This species is an uncommon visitor and warrants no further investigations in the MT Lands.

***Tringa glareola* (Wood Sandpiper) R**

The Wood Sandpiper is a small slim wader, dark grey-brown above, with light flecks or spots, and a white underbody. There is a single record of this migratory wader from the Cook sewerage works in 1996.

***Pachycephala inornata* (Gilberts Whistler) R**

- Six individuals were observed on five quadrats (OAK (2), OBH, WYO and WAL site clusters) and and 2 opportune observations were made during the survey period. It was recorded from four vegetation communities but abundance was too low to attribute any habitat preferences.
- The first record was a specimen collected by J.B. Cleland in 1922, however the next record for the MT Lands wasn't made until the Yellabinna Survey in 1987 (Copley and Kemper 1992). Further observations were made during the latest Bird Atlas reporting period.

Higgins and Peter (2002) report it as being scattered in much of semi-arid Australia. Ford (1971) described it as a widely but uncommon resident of the Great Victoria Desert. Black and Badman (1986) recorded it at four locations, west of Vokes Hill, twice near Ooldea and 100km north of Muckera rockhole.

***Gerygone fusca* (Western Gerygone) R**

- No birds observed during the survey period. There only 5 known records from the MT Lands during the Bird Atlas reporting period, all from sites west of Vokes Hill Junction. Not recorded by Black and Badman (1986).

This is another widespread but sparsely scattered species in the region. No reason for concern.

***Pyrrholaemus brunneus* (Redthroat) R**

One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).

'Least concern' nationally – 'Redthroats remain widespread in the large part of their range that is essentially ungrazed' (Garnett and Crowley 2000).

- 1 bird observed at 1 quadrat (MAR2 cluster) and two opportune sightings (OBH cluster) only during the survey period.
- The first record of this species from the MT Lands was by J. B. Cleland in 1922, however most records are from the mid 1980's to 1990's, primarily from the east and south east of the MT lands. It was not recorded during the Bird Atlas reporting period. Black and Badman (1986) recorded it in sandhills near Ooldea Soak on their survey and they reported observations from west of Vokes Hill corner.

***Cinclosoma castanotus* (Miilka, Chestnut Quail-thrush) R**

One of 29 species of major conservation concern in the arid zone (Reid and Fleming 1992).
'Least concern' nationally (Garnett and Crowley 2000).

- 36 observations were made at 11 quadrats from five vegetation communities. Strong preferences appear to be for GVD_3, GVD_14 and GVD_15 vegetation communities (Table 22).

- 11 opportune sightings during the survey period.

Close and Jaensch (1984) contrasted their lack of success with the fact that White and Williams had collected specimens and White had collected eggs in the early 1900's.

Despite the concerns expressed by Reid and Fleming (1992) and Close and Jaensch (1984), the more recent survey results do not suggest that there is likely to have been any contraction in range or abundance of this species within this region. Ford (1971) considered it a widely distributed species, which is supported by the data from this survey. Nevertheless, this species does nest on the ground and may be vulnerable to predation of at least its eggs and chicks. Further research to determine this species' ecological requirements would help to clarify if there needs to be action for its conservation. Targeted surveys recommended.

OTHER RARELY RECORDED SPECIES <10

Acanthiza iredalei (Slender-billed Thornbill)
Accipiter cirrhocephalus (Collared Sparrowhawk)
Accipiter fasciatus (Brown Goshawk)
Anthochaera carunculata (Red Wattlebird)
Artamus cyanopterus (Dusky Woodswallow)
Artamus superciliosus (White-browed Woodswallow)
Cacomantis flabelliformis (Fan-tailed Cuckoo)
Calamanthus cautus (Shy Heathwren (Shy Hylacola))
Chenonetta jubata (Australian Wood Duck, (Maned Duck))
Chrysococcyx osculans (Black-eared Cuckoo)
Cincloramphus cruralis (Brown Songlark)
Cinclosoma cinnamomeum alisteri (Nullarbor Quail-thrush)
Circus assimilis (Spotted Harrier)
Corvus coronoides (Australian Raven)
Corvus orru (Torresian Crow)
Elanus axillaris (Black-shouldered Kite)
Eurostopodus argus (Spotted Nightjar)
Falco longipennis (Australian Hobby)
Falco peregrinus (Peregrine Falcon)
Falco subniger (Black Falcon)
Glossopsitta porphyrocephala (Purple-crowned Lorikeet)
Grallina cyanoleuca (Magpie-lark)
Hieraaetus morphnoides (Little Eagle)
Hirundo neoxena (Welcome Swallow)
Leipoa ocellata (Malleefowl)
Lichenostomus leucotis (White-eared Honeyeater)
Lichenostomus ornatus (Yellow-plumed Honeyeater)
Melithreptus brevirostris (Brown-headed Honeyeater)
Neophema splendida (Scarlet-chested Parrot)
Neopsephotus bourkii (Bourke's Parrot)
Ninox novaeseelandiae (Southern Boobook)
Pachycephala inornata (Gilbert's Whistler)
Pardalotus punctatus (Spotted Pardalote)
Pardalotus rubricatus (Red-browed Pardalote)
Phaps chalcoptera (Common Bronzewing)
Podargus strigoides (Tawny Frogmouth)
Pyrrholaemus brunneus (Redthroat)
Rhipidura albiscapa (Grey Fantail)
Tyto alba (Barn Owl)
Vanellus miles (Masked Lapwing)
Vanellus tricolor (Banded Lapwing)

Figure 68: Piiwi, the Tawny Frogmouth (*Podargus strigoides*), a nocturnal bird that is

beautifully camouflaged in trees during the day. (Photo: P. D. Canty).

***Dromaius novaehollandiae* (Kalaya, Emu)**

- 15 records at 11 quadrats; 7 records at 5 opportune locations during the survey period.
- Close and Jaensch (1984) observed this species and/or its tracks and distinctive droppings at a few scattered locations and noted that, historically, White, Simpson and McGilp had, like them, noted Emus as uncommon.

Emus are a relatively rare sight in the MT Lands. Despite this, they are hunted for meat by Ananngu at almost every opportunity. Hunting will certainly contribute to the relative rarity of this species across the lands, however the area of country readily accessible for hunting is relatively small. Other more significant factors limiting Emu distribution and abundance in the region are a lack of water (generally) especially during dry periods and predation of chicks by Dingoes, cats and foxes.Uncommon, but widely and sparsely distributed.

***Falco subniger* (Kirrkin(pa), Black Falcon) V**

- 1 bird observed on a quadrat which was the first record for this species in the MT Lands

No historical records.

A nomadic visitor. Not of conservation concern within the region. A rodent specialist, it becomes locally abundant in response to rodent irruptions.

***Tyto alba* (Wiratju, Parkapungku, Barn Owl)**

- 1 observation was made at 1 quadrat during the survey period.

***Eurostopodus argus* (Kurnkutakuta, Kurnkara, Spotted Nightjar)**

- 4 records at 4 opportune locations during the survey period.
- only 2 historical records, the first from 1987 (Yellabinna Survey) and two more recent records in 1999 and 2002 from the Bird Atlas

This nocturnal and cryptic species can be difficult to locate during the day, but is easily identified at night by its distinctive calls and when seen spotlighting. Although this species nests on the ground, it seems to be maintaining its range across the arid zone. No apparent reason for conservation concerns at this stage.

***Rhipidura albiscapa* (Tjintir-tjintirpa, Grey Fantail)**

- A single opportune record made during the survey period.
- The first record of this species for the MT Lands was from a dead bird found near Ooldea. Also a single Bird Atlas record.

Reid and Fleming note that this species has resident breeders and winter non-breeding visitors in the central Australian population. There is no evidence for decline in the MT Lands and there is no apparent cause for concern.

***Artamus minor* (Tjalpu-tjalpu, Little Woodswallow)**

There is a single record of this species from near Serpentine Lakes in 1998, reported in the Bird Atlas. No reason for concern

***Corvus coronoides* (Kaanka, Australian Raven)**

- 2 observed at 1 quadrat; 6 opportune records from 3 locations during the survey – all in the far eastern MT Lands.
- Australian Ravens were not recorded in the review by Close and Jaensch (1984), and are relatively new records for the eastern extremities of the MT Lands. While they have probably been advantaged by pastoral activities, there is no definite evidence of a recent range expansion.

No reason for concern.

SPECIES NOT LOCATED

During the survey, several species were searched for, and asked about on a regular basis, either:

- because there were historical records for the region, but no recent records or
- because Close and Jaensch (1984) had indicated that the species was likely to occur there on the basis of known distribution in adjacent areas and the presence of apparently suitable habitats.

Presumed Extinct

Species for which there have been no confirmed records for at least 50 years.

***Cinclosoma castaneothorax marginatum* (? Miilka, Chestnut-breasted Quail-thrush)**

- Close and Jaensch (1984) note that this species is recorded in the extreme south-western NT and adjoining parts of WA. They also refer to McGilp's observation of a quail-thrush that may have been this species at a location in or near the Everard Ranges (McGilp 1944).

This species was searched for whenever survey ornithologists were in apparently suitable habitats but no sign was found. However, this absence of records is rather unconvincing given the documented occurrences in adjacent areas and this species cryptic behaviour. Targeted surveys recommended.

***Stipiturus ruficeps* (Rufous-crowned Emu-wren) R**

- Close and Jaensch (1984) noted that this species was suggested to be in the far NW of the State by Condon (1969), based on a distribution map produced by Keast (1957). However, there are no confirmed records from NW SA, all records coming from the Simpson Desert.

Despite the lack of records, the species is known from adjacent areas of WA and similar habitats occur over substantial areas of the western part of the MT Lands. Targeted surveys recommended.

***Pezoporus occidentalis* (Night Parrot) E, E**

- Close and Jaensch (1984) did not refer to this species.
- There is potentially to undertake further targeted survey work as a result of Australia wide modelling work being undertaken by the Night Parrot Network (L. Joseph, pers. comm.). There is a likelihood that this species may occur in association with the *Triodia* spp. associations adjacent to Serpentine Lakes and other lake systems with fringing samphire communities in the MT Lands.

SPECIES OF CONSERVATION SIGNIFICANCE
Threatened species
As indicated in the summaries above, many bird species on the MT Lands have conservation ratings as applied nationally under:

- The Commonwealth's *Environment Protection and Biodiversity Conservation Act 2000* (critically endangered, endangered or vulnerable).
- The State's *National Parks and Wildlife Act 1972* (endangered, vulnerable or rare, as per schedules 7, 8 and 9 that were most recently revised in 2000).

These ratings are also noted in Robinson *et al*. (2003).

Six species with Commonwealth or State conservation ratings require, or could benefit from, particular management actions on the MT Lands. Other species with current conservation ratings do not appear to warrant any conservation action within the MT Lands, at least at the present time. Others need further targeted survey work to determine whether any management actions are required and, if so, where such actions may be needed. And a small number of species require some basic ecological / population biology research to gain a better understanding of their environmental requirements and to determine whether there are particular threats to their conservation that may need additional management action. There is also one species without a national or State conservation status rating – the Emu – that should receive particular management focus on the MT Lands, primarily for cultural reasons.

a) Species for which management action is recommended

Malleefowl, Bustards, Striated Grasswrens, Emus, Princess Parrots and Scarlet-chested Parrots may all benefit from a reduction in the scale and frequency of wildfires at the broad landscape-scale. Management would need to focus on protection of habitats known to be occupied and/or used by these species and, in the longer term, to encourage an increase in the total area of such habitats of an appropriate age (since last fire).

Malleefowl, Bustards and Emus would also be likely to benefit from a sustained reduction in levels of predation on eggs and nestlings (and also adults) by foxes and Dingoes and some hunting by Anangu. There is however additional problems with increases in rabbit and cat populations where fox/dingo control are carried out.

Emus, Princess Parrots and Scarlet-chested Parrots would benefit from the provision of secure water supplies either where currently there is none, or where feral camels are causing a much-diminished supply. Pink Cockatoos may also benefit from this action.

Malleefowl, Bustards and Emus are recognised as 'kuka' by Anangu and management strategies are needed to ensure an increase in productivity of each of these species for their future survival on the MT Lands.

These management issues, and more, are discussed in greater detail in the 'conclusions and recommendations' chapter of this report.

b) Species for which targeted surveys are recommended

As discussed in the annotated summaries above, targeted surveys are recommended for the following bird species on the MT Lands:

- Striated Grasswren
- Western Fieldwren or (Western Calamanthus)
- White-browed Treecreeper
- Grey Honeyeater
- Chestnut Quailthrush
- Rufous-crowned Emu-wren

c) Species for which ecological / population biology research is recommended
As mentioned also in the annotated summaries above, some basic ecological or population biology research would help to identify threats and management requirements (if any) for the following species:

- Striated Grasswren
- Redthroat
- Chestnut Quailthrush

d) Species with current conservation ratings for which no action is recommended at this time.

Several species with conservation ratings do not appear to need any particular management action for the conservation of populations on the MT Lands. These include:

- Pink Cockatoo
- Peregrine Falcon
- Slaty-backed Thornbill
- Chestnut-breasted Whiteface
- Western Gerygone
- Grey-headed Honeyeater
- Brown Honeyeater
- Western Fieldwren

REPTILES AND AMPHIBIANS

by J. N. Foulkes[1]

INTRODUCTION

This section summarises the knowledge of the reptile and frog fauna of the Maralinga Tjarutja (MT Lands) prior to the biological survey beginning in 2001 and then discusses the results of this survey.

Reptiles and frogs are discussed using their European common and scientific names for clarity, however where known, Anangu names are provided which were largely derived from Robinson *et al.* (2003) during the APY Lands survey.

The reptile and amphibian fauna of the MT Lands combines elements of two major habitat regions, the sand-plains and dune systems of the Great Victoria Desert and the Nullarbor Plain. In addition, elements of the fauna of the Gawler Bioregion occur in the south-eastern parts of the MT Lands.

APPRAISAL OF SPECIES RECORDS PRIOR TO THE SURVEY

Prior to this survey the collections of the South Australian Museum and Biological Survey of SA Databases contained 1334 records of 85 species of reptiles (Table 23). There were also no records of frogs (Table 23) from the MT Lands.

The first white man to cross the Great Victoria Desert was Ernest Giles in 1875, who described it as

"….the worst desert on the face of the earth." and

Tietkins who accompanied Giles wrote that "There is no sign of life even in the rainy season".

Murray remarked upon the scarcity of animal life in the desert, whereas Maurice saw the country much differently, commenting on the abundance of many species as well as lamenting the decline of others.

There are three main sources of information of the MT region; the writings and collections of Richard Maurice, Daisy Bates and Anthony Bolam. Maurice funded and led nine expeditions into the Great Victoria Desert in SA between 1897 and 1903, documenting the soils, landforms, vegetation, fauna and anthropological details.

Daisy Bates lived at Ooldea between 1919 and 1934 and documented some specimens but also Aboriginal names of many of the animals she saw or had brought to her.

Anthony Bolam was the station-master at Ooldea Siding in the 1920's and he collected and photographed the flora and fauna whilst stationed there, and documented it in his book *The Trans-Continental Wonderland* published in 1923.

Hedley Finlayson began his mammal survey and research work in central Australia. Finlayson recorded information on reptiles. This thorough work included the collection of museum voucher specimens and the systematic documentation of ecological and natural history information obtained from his observations and those of Aboriginal informants (see Finlayson 1935, 1961).

Bird (1986), in Greenslade *et al.* (1986) documented the distribution and habitat preference of reptiles in the eastern Great Victoria Desert as part of The Nature Conservation Society survey in 1980, in particular the region between Cook and Vokes Hill corner and west from Vokes Hill corner to Serpentine Lakes. Thirty eight species were recorded on the survey.

McKenzie and Robinson (1987) also undertook survey work in the south-western corner of the MT lands in Nullarbor and Great Victoria Desert habitats. Armstrong (1992) in Copley and Kemper (1992) undertook reptile survey in the southern Maralinga Tjarutja Lands around Muckera Rockhole, Lake Bring and Yarle Lakes as part of the Yellabinna Biological Survey. These are the most recent undertakings to document the fauna of the region, with all the above survey conducting work in the southern portion of the MT Lands.

TOTAL REPTILE AND AMPHIBIAN FAUNA

The present biological survey has added considerably to our understanding of the herpetology of the region. This survey recorded 81 species, including 10 additional reptile species and a single amphibian species and a considerable expansion in our knowledge of the status, range and habitat preferences of a number of species previously known from very few specimens. The additional species recorded were:

Diporiphora reginae (Plain-back Two-lined Dragon)

Pogona vitticeps (Central Bearded Dragon)

Tympanocryptis lineata (Five-lined Earless Dragon)

Diplodactylus vittatus (Eastern Stone Gecko)

Strophurus ciliaris (Northern Spiny-tailed Gecko)

Ctenotus calurus (Blue-tailed Skink)

Ctenotus leonhardii (Common Desert Ctenotus)

Lerista taeniata (Ribbon Slider)

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Varanus brevicauda (Short-tailed Pygmy Goanna)

Demansia reticulata (Desert Whipsnake)

Neobatrachus centralis (Trilling Frog)

All reptile records from the South Australian Museum, from the Opportune and Biological Survey databases, and from published records with reliable species identifications have now been collated for the study area. This compilation of records indicates that ninety-five reptile species and a single species of frog are now known from the MT Lands (Table 23).

The following species previously recorded from the MT Lands were not recorded on this survey, however most are on the limits on their distribution, with a number of Nullarbor Plain or coastal taxa. The only species likely to have a wider distribution within the MT Lands are the Barking Gecko and the Woomera Slider.

Tympanocryptis houstoni (Nullarbor Earless Dragon)
Tympanocryptis tetraporophora (Eyrean Earless Dragon)
Nephrurus milii (Barking Gecko)
Nephrurus stellatus (Starred Knob-tailed Gecko)
Delma petersoni (Peterson's Snake-lizard)
Ctenotus euclae (Bight Coast Ctenotus)
Ctenotus orientalis (Eastern Spotted Ctenotus)
Egernia richardi (Western Tree Skink)
Lerista edwardsae (Myall Slider)
Lerista elongata (Woomera Slider)
Tiliqua rugosa (Sleepy Lizard)
Varanus tristis (Black-headed Goanna)
Antaresia stimsoni (Stimson's Python)
Acanthophis pyrrhus (Desert Death Adder) **V**
Pseudonaja inframacula (Peninsula Brown Snake)

With 154 standard fauna quadrats sampled over the survey period, only three species (*Christinus marmoratus*, *Pogona nullarbor* and *P. vitticeps*) were recorded opportunistically and not at a quadrat (Table 23). An indication of the relative frequency of capture at quadrats is provided by Table 24 which shows that 46 species or 10% of all quadrat records were recorded less than 10 times across the whole survey. The three most commonly sampled species are all widespread across sand plain and dune system environments in South Australia, emphasising the widespread nature of these habitats across the MT Lands (Table 24).

SPECIES RICHNESS AND DISTRIBUTION

Reptile species richness within clusters of survey sites ranged between 42 species (SER cluster) and 15 species (OAK cluster) (Figure 25). Species richness at the Muckera (MU) and Yarle Lakes (YL) sampled by Copley and Kemper (1992) had 33 and 26 reptile species respectively. Species richness was generally higher in *Triodia* dominated habitats, particularly in the north-west corner of the MT Lands, however seasonal and weather conditions contributed to differences in species captured. Spring survey periods generally recorded higher captures and species richness compared to autumn when conditions were cooler.

Habitat Preferences

Fourteen species appeared to have very strong affinities (>33% of observations) with eight particular vegetation communities (Table 26). These were:

Bynoes Gecko (GVD_5)
Tree Dtella (GVD_6)
Pale Knob-tailed Gecko (GVD_7)
Broad-banded Sandswimmer (GVD_7, GVD15)
Many-lined Ctenotus (GVD_7)
Sandhill Ctenotus (GVD_7, GVD15)
Narrow-lined Ctenotus (GVD_7)
Centralian Striped Skink (GVD_7, GVD_9)
Southern Spinifex Ctenotus (GVD_9)
Military Dragon (GVD_9)
Common Desert Ctenotus (GAW_11)
Black-collared Dragon (GVD_15)
Centralian Blind Snake (GVD_15)
Painted Dragon (GVD_16)

GVD_7 (Marble Gum/*Triodia* spp. woodlands), GVD_15 (*Acacia ligulata*, *A. ramulosa* shrublands) and GVD_9 (open mallee) are clearly important communities for reptiles.

The most widely recorded species on survey quadrats were;

Sandplain Ctenotus (83 quadrats, 54%)
Eastern Desert Ctenotus (53 quadrats, 34%)
Thorny Devil (53 quadrats, 34%)
Great Desert Slider (50 quadrats, 33%)
Military Dragon (49 quadrats, 32%)
Beaked Gecko (49 quadrats, 32%)

Figure 69: The Crested Dragon (*Ctenophorus cristatus*) is widespread across the MT Lands. (Photo: D. Armstrong).

The most abundantly recorded species on quadrats were;
Sandplain Ctenotus (338 records)
Military Dragon (203 records)
Pale Knob-tailed Gecko (148 records)
Eastern Desert Ctenotus (141 records)
Beaked Gecko (129 records)
Sandplain Gecko (117 records)

Opportune records were made largely by recording animals on tracks whilst spotlighting (mainly geckoes) and travelling between quadrats (mainly dragons and

goannas). Forty-one species were recorded opportunistically, with the most frequently and numerous species being the;

Pale Knob-tailed Gecko
Thorny Devil
Crested Dragon
Beaded Gecko
Smooth Knob-tailed Gecko
Beaked Gecko.

Figure 70: The Desert Pygmy Goanna (*Varanus eremius*) inhabits the extensive sand plains of the Great Victoria Desert in the Maralinga Tjarutja Lands. (Photo: A. Robinson).

Figure 71: Ngiyari the Thorny Devil (*Moloch horridus*) is common across the Maralinga Tjarutja Lands. (Photo: A. Robinson).

Figure 72: The Central Netted Dragon (*Ctenophorus nuchalis*), is one of the most abundant and obvious of the many reptile species of the Maralinga Tjarutja Lands. (Photo: A. Robinson).

Figure 73: The Jewelled Gecko (*Strophurus elderi*) spends its whole life in and around spinifex hummocks. (Photo: A. Robinson).

Figure 74: Mulyapurkutitja the Five-ringed Snake (*Pseudonaja modesta*), is a small attractive snake widespread across the drier areas of the State. (Photo: A. Robinson).

Figure 75: The Western Bluetongue (*Tiliqua occipitalis*) was encountered rarely during the survey period. (Photo: A. Robinson).

Figure 76: The Dwarf Beared Dragon (*Pogona minor*) is widespread in the MT Lands. (Photo: A. Robinson).

Figure 77: The Desert Banded Snake (*Simoselaps bertholdi*) was the most widely encountered elapid snake during the survey. (Photo: P. Canty).

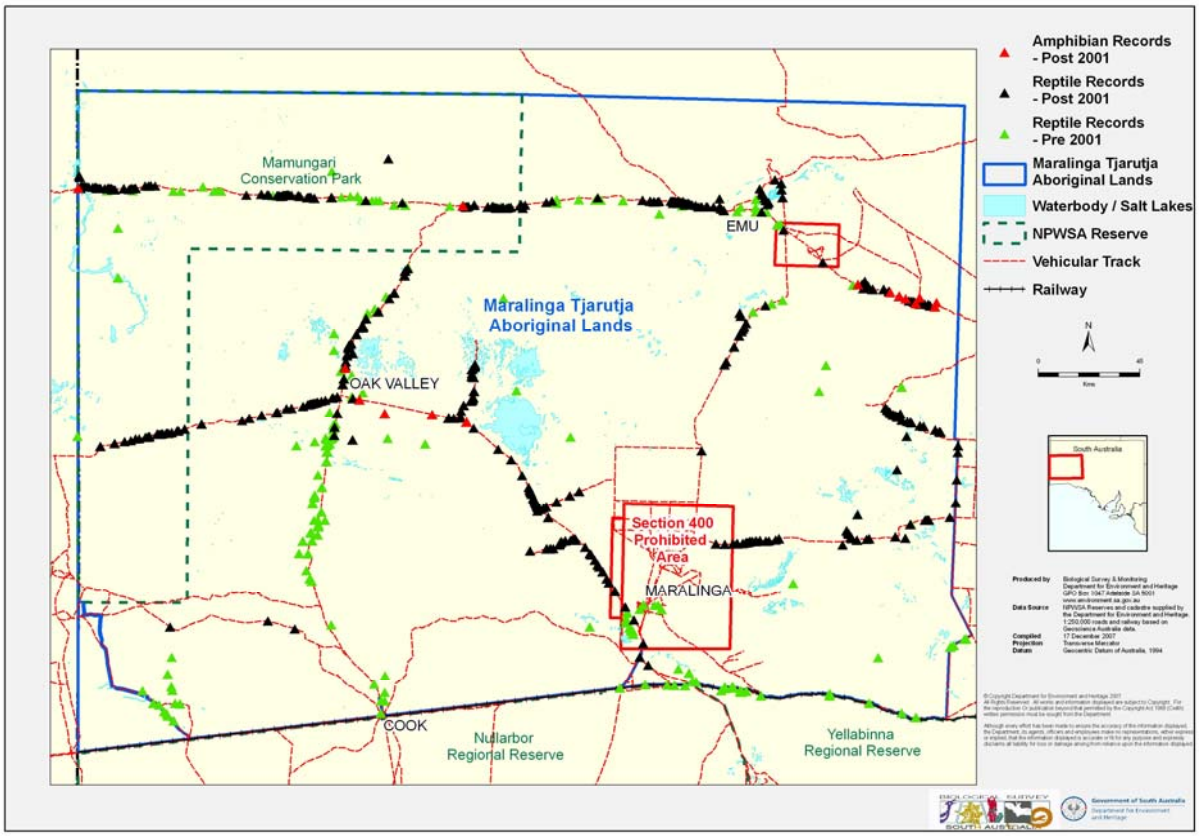

Figure 78: Distribution of reptile and amphibian records for the Maralinga Tjarutja Lands prior to this survey (pre-2001) and from this survey (post-2001).

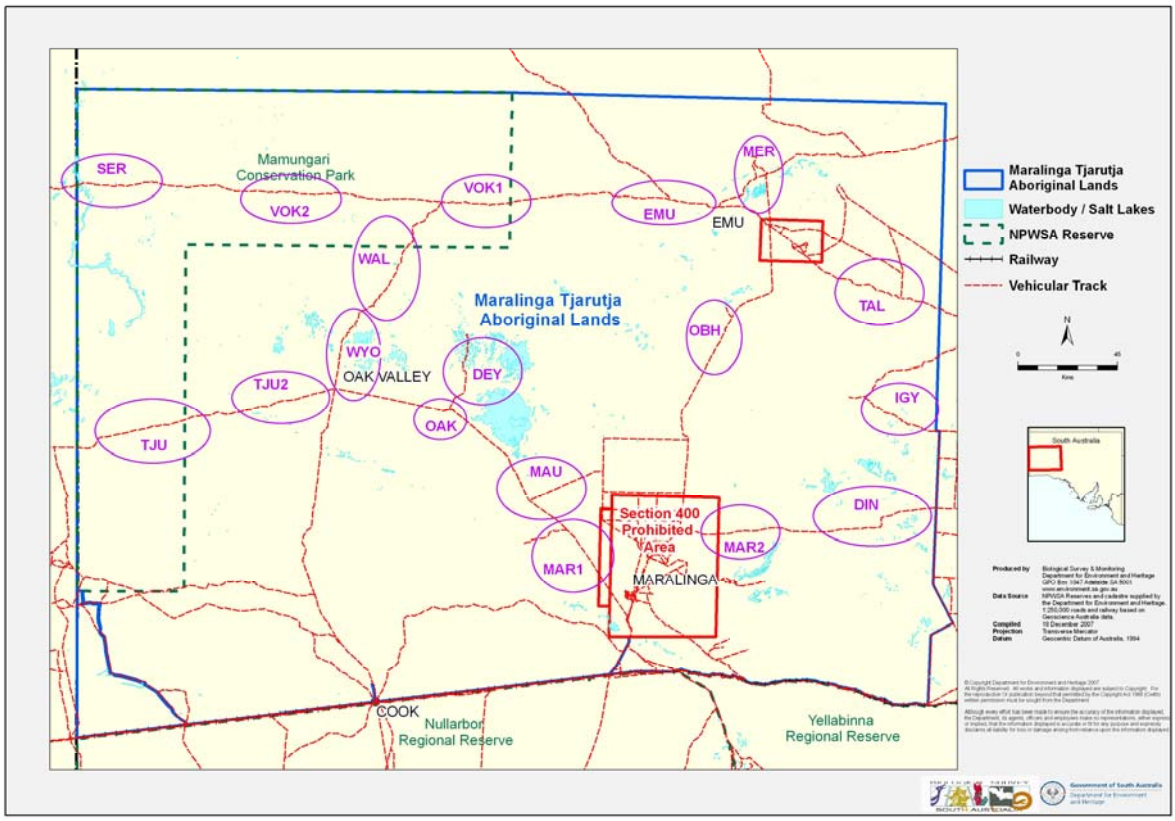

Figure 79: Location of areas sampled in the Maralinga Tjarutja Lands during this survey and their site cluster prefix.

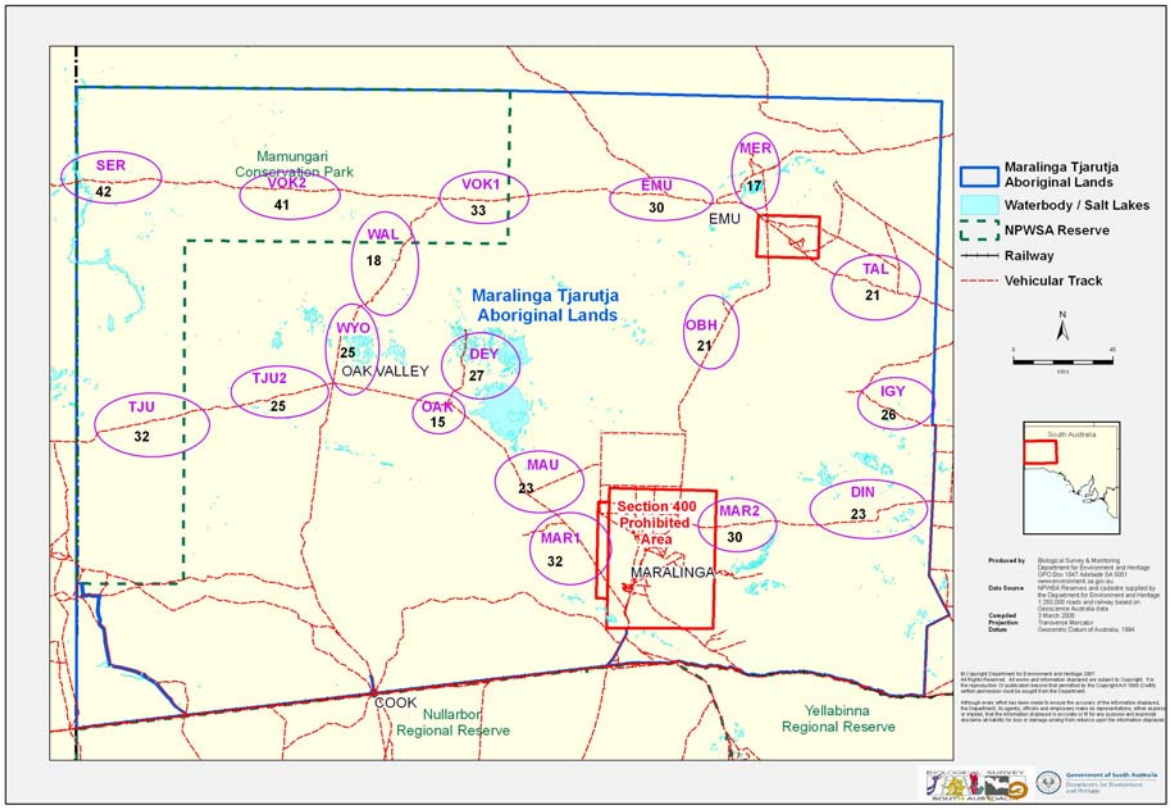

Figure 80: Map showing survey site clusters and reptile species richness within each cluster in the Maralinga Tjarutja Lands.

Table 23: Number of reptile and amphibian species recorded prior to this survey (pre-2001) and from 2001 onwards across the Maralinga Tjarutja Lands. (# indicates new to MT Lands, species with state or national conservation status rating in bold).

Family	Species	Pre-2001	Post-2001	Total
Agamidae	*Amphibolurus longirostris* (Long-nosed Dragon)	3	7	10
Dragon Lizards	*Ctenophorus clayi* (Black-collared Dragon)	6	19	25
	Ctenophorus cristatus (Crested Dragon)	39	94	133
	Ctenophorus fordi (Mallee Dragon)	87	8	95
	Ctenophorus isolepis (Military Dragon)	62	207	269
	Ctenophorus nuchalis (Central Netted Dragon)	23	79	102
	Ctenophorus pictus (Painted Dragon)	14	14	28
	Ctenophorus reticulatus (Western Netted Dragon)	26	3	29
	***Ctenophorus salinarum* (Claypan Dragon) R**	14	4	18
	Diporiphora linga (Linga Dragon)	37		37
	# *Diporiphora reginae* (Plain-back Two-lined Dragon)		2	2
	Moloch horridus (Thorny Devil)	28	146	174
	Pogona minor (Dwarf Bearded Dragon)	53	45	98
	Pogona nullarbor (Nullarbor Bearded Dragon)	4	2	6
	# *Pogona vitticeps* (Central Bearded Dragon)		1	1
	Tympanocryptis houstoni (Nullarbor Earless Dragon)	5		5
	# *Tympanocryptis lineata* (Five-lined Earless Dragon)		1	1
	Tympanocryptis tetraporophora (Eyrean Earless Dragon)	2		2
Gekkonidae	*Christinus marmoratus* (Marbled Gecko)	2	1	3
Geckoes	*Diplodactylus conspicillatus* (Fat-tailed Gecko)	11	94	105
	Lucasium damaeum (Beaded Gecko)	45	135	180
	Diplodactylus granariensis (Western Stone Gecko)	9	1	10
	***Diplodactylus pulcher* (Patchwork Gecko) R**	6	1	7
	Diplodactylus sp.		1	1
	Lucasium stenodactylum (Sandplain Gecko)	5	120	125
	# *Diplodactylus vittatus* (Eastern Stone Gecko)		2	2
	Gehyra purpurascens (Purple Dtella)	4	18	22
	Gehyra sp.	17	19	36
	Gehyra variegata (Tree Dtella)	55	62	117
	Heteronotia binoei (Bynoe's Gecko)	50	30	80
	Nephrurus laevissimus (Pale Knob-tailed Gecko)	84	216	300
	Nephrurus levis (Smooth Knob-tailed Gecko)	30	85	115
	Nephrurus milii (Barking Gecko)	30		30
	Nephrurus sp.		1	1
	Nephrurus stellatus (Starred Knob-tailed Gecko)	14		14
	Rhynchoedura ornata (Beaked Gecko)	17	146	163
	# *Strophurus ciliaris* (Northern Spiny-tailed Gecko)		3	3
	Strophurus elderi (Jewelled Gecko)	8	8	16
	Strophurus intermedius (Southern Spiny-tailed Gecko)	2	1	3
Legless Lizards	*Delma australis* (Barred Snake-lizard)	7	14	21
	Delma butleri (Spinifex Snake-lizard)	6	9	15
	Delma petersoni (Peterson's Snake-lizard)	1		1
	Lialis burtonis (Burton's Legless Lizard)	3	7	10
	Pygopus nigriceps (Black-headed Scaly-foot)	4	7	11
Scincidae	*Cryptoblepharus australis* (Desert Wall skink)	7	4	11
Skinks	*Ctenotus atlas* (Southern Spinifex Ctenotus)	29	70	99
	Ctenotus brooksi (Sandhill Ctenotus)	22	18	40
	# Ctenotus calurus (Blue-tailed Skink)		8	8
	Ctenotus dux (Narrow-lined Ctenotus)	2	17	19
	Ctenotus euclae (Bight Coast Ctenotus)	3		3
	Ctenotus leae (Centralian Coppertail)	3	1	4

	# *Ctenotus leonhardii* (Common Desert Ctenotus)		25	25
	Ctenotus orientalis (Eastern Spotted Ctenotus)	1		1
	Ctenotus pantherinus (Leopard Skink)	9	23	32
	Ctenotus quattuordecimlineatus (Many-lined Ctenotus)	9	71	80
	Ctenotus regius (Eastern Desert Ctenotus)	35	146	181
	Ctenotus saxatilis (Centralian Striped Skink)	17	15	32
	Ctenotus schomburgkii (Sandplain Ctenotus)	39	341	380
	Ctenotus sp.	1	4	5
	Cyclodomorphus melanops (Spinifex Slender Bluetongue)	18	8	26
	Egernia inornata (Desert Skink)	19	65	84
	Egernia richardi (Western Tree Skink)	1		1
	Eremiascincus richardsonii (Broad-banded Sandswimmer)	25	21	46
	Lerista bipes (Western Two-toed Slider)	5	6	11
	Lerista desertorum (Great Desert Slider)	45	78	123
	Lerista edwardsae (Myall Slider)	1		1
	Lerista elongata (Woomera Slider)	1		1
	Lerista labialis (Eastern Two-toed Slider)	48	91	139
	Lerista muelleri (Dwarf Three-toed Slider)	5	5	10
	Lerista sp.		2	2
	# *Lerista taeniata* (Ribbon Slider)		6	6
	Menetia greyii (Dwarf Skink)	41	22	63
	Morethia adelaidensis (Adelaide Snake-eye)	4	7	11
	Morethia boulengeri (Common Snake-eye)	6	18	24
	Morethia butleri (Butler's Snake-eye)	3	9	12
	Morethia obscura (Mallee Snake-eye)	2	1	3
	Morethia sp.		2	2
	Proablepharus reginae **(Silvereye Skink) R**	1	2	3
	Tiliqua occipitalis (Western Bluetongue)	5	13	18
	Tiliqua rugosa (Sleepy Lizard)	15		15
Varanidae	**#** ***Varanus brevicauda*** **(Short-tailed Pygmy Goanna) R**		3	3
Goannas	*Varanus eremius* (Desert Pygmy Goanna)	7	25	32
	Varanus gilleni (Pygmy Mulga Goanna)	16	12	28
	Varanus gouldii (Sand Goanna)	14	56	70
	Varanus tristis (Black-headed Goanna)	1		1
Boidae	*Antaresia stimsoni* (Stimson's Python)	1		1
Pythons				
Elapidae	***Acanthophis pyrrhus*** **(Desert Death Adder) V**	1		1
Fanged Snakes	*Demansia psammophis* (Yellow-faced Whipsnake)	1		1
	# *Demansia reticulata* (Desert Whipsnake)		1	1
	Pseudechis australis (Mulga Snake)	6	5	11
	Pseudonaja inframacula (Peninsula Brown Snake)	1		1
	Pseudonaja modesta (Five-ringed Snake)	2	5	7
	Pseudonaja nuchalis (Western Brown Snake)	3	2	5
	Simoselaps anomalus (Centralian Banded Snake)	1	2	3
	Simoselaps bertholdi (Desert Banded Snake)	18	13	31
	Simoselaps bimaculatus (Western Black-naped Snake)	1	1	2
	Simoselaps semifasciatus (Half-girdled Snake)	13	7	20
	Suta monachus (Hooded Snake)	3	1	4
Typhlopidae	*Ramphotyphlops bicolor* (Southern Blind Snake)	2	1	3
Blind Snakes	*Ramphotyphlops bituberculatus* (Rough-nosed Blind Snake)	4	1	5
	Ramphotyphlops endoterus (Centralian Blind Snake)	4	17	21
Myobatrachidae	**#** *Neobatrachus centralis* (Trilling Frog)		18	18
Southern Frogs	Grand Total-Reptiles and Amphibians	1334	2883	4217

Table 24: Relative abundance of reptile and amphibian species at survey quadrats and opportune localities across the Maralinga Tjarutja Lands (2001-2007). **(# indicates new to MT Lands. Species with state or national conservation status rating in bold).**

Species	No. quadrats	No. individuals observed (quadrats)	Proportion (%)	No. observed (Opportune)	Frequency (Opportune)
Ctenotus schomburgkii (Sandplain Ctenotus)	83	338	53.9	3	3
Ctenotus regius (Eastern Desert Ctenotus)	53	141	34.4	5	4
Moloch horridus (Thorny Devil)	53	98	34.4	48	46
Lerista desertorum (Great Desert Slider)	50	77	32.5	1	1
Ctenophorus isolepis (Military Dragon)	49	203	31.8	4	4
Rhynchoedura ornata (Beaked Gecko)	49	129	31.8	17	16
Lucasium stenodactylum (Sandplain Gecko)	48	117	31.2	3	3
Egernia inornata (Desert Skink)	46	64	29.9	2	2
Nephrurus laevissimus (Pale Knob-tailed Gecko)	44	148	28.6	68	62
Lerista labialis (Eastern Two-toed Slider)	43	90	27.9	1	1
Lucasium damaeum (Beaded Gecko)	42	93	27.3	42	32
Diplodactylus conspicillatus (Fat-tailed Gecko)	41	86	26.6	8	7
Ctenophorus nuchalis (Central Netted Dragon)	40	68	26.0		
Nephrurus levis (Smooth Knob-tailed Gecko)	35	66	22.7	19	19
Ctenophorus cristatus (Crested Dragon)	34	50	22.1	44	40
Pogona minor (Dwarf Bearded Dragon)	29	38	18.8	7	7
Varanus gouldii (Sand Goanna)	28	34	18.2	22	22
Ctenotus quattuordecimlineatus (Many-lined Ctenotus)	27	71	17.5		
Gehyra variegata (Tree Dtella)	26	56	16.9	6	6
Ctenotus atlas (Southern Spinifex Ctenotus)	22	70	14.3		
Heteronotia binoei (Bynoe's Gecko)	20	29	13.0	1	1
Menetia greyii (Dwarf Skink)	15	21	9.7	1	1
Gehyra sp.	14	17	9.1	2	2
Morethia boulengeri (Common Snake-eye)	14	17	9.1	1	1
Ctenotus pantherinus (Leopard Skink)	13	22	8.4	1	1
Eremiascincus richardsonii (Broad-banded Sandswimmer)	13	20	8.4	1	1
Varanus eremius (Desert Pygmy Goanna)	13	23	8.4	2	2
Ctenotus brooksi (Sandhill Ctenotus)	12	18	7.8		
Ctenophorus clayi (Black-collared Dragon)	11	19	7.1		
Delma australis (Barred Snake-lizard)	11	14	7.1		
Simoselaps bertholdi (Desert Banded Snake)	11	11	7.1	2	2
Gehyra purpurascens (Purple Dtella)	10	11	6.5	7	7
Ctenotus saxatilis (Centralian Striped Skink)	9	15	5.8		
# Neobatrachus centralis (Trilling Frog)	9	11	5.8	7	5
Ramphotyphlops endoterus (Centralian Blind Snake)	9	15	5.8	2	2
Ctenotus dux (Narrow-lined Ctenotus)	8	17	5.2		
Delma butleri (Spinifex Snake-lizard)	8	9	5.2		
Morethia butleri (Butler's Snake-eye)	8	9	5.2		
Varanus gilleni (Pygmy Mulga Goanna)	8	9	5.2	3	3
Tiliqua occipitalis (Western Bluetongue)	7	9	4.5	4	4
# Ctenotus leonhardii (Common Desert Ctenotus)	6	25	3.9		
Cyclodomorphus melanops (Spinifex Slender Bluetongue)	6	8	3.9		
Lerista bipes (Western Two-toed Slider)	6	6	3.9		
Lialis burtonis (Burton's Legless Lizard)	6	7	3.9		
Amphibolurus longirostris (Long-nosed Dragon)	5	7	3.2		
Lerista muelleri (Dwarf Three-toed Slider)	5	5	3.2		
# Lerista taeniata (Ribbon Slider)	5	6	3.2		
Cryptoblepharus australis (Desert Wall Skink)	4	4	2.6		

Species	No. quadrats	No. individuals observed (quadrats)	Proportion (%)	No. observed (Opportune)	Frequency (Opportune)
Ctenophorus pictus (Painted Dragon)	4	12	2.6	2	2
Pseudonaja modesta (Five-ringed Snake)	4	4	2.6	1	1
Pygopus nigriceps (Black-headed Scaly-foot)	4	4	2.6	3	3
Strophurus elderi (Jewelled Gecko)	4	8	2.6		
Ctenophorus fordi (Mallee Dragon)	3	8	1.9		
# Ctenotus calurus (Blue-tailed Skink)	3	8	1.9		
Ctenotus sp.	3	4	1.9		
Morethia adelaidensis (Adelaide Snake-eye)	3	6	1.9	1	1
Simoselaps semifasciatus (Half-girdled Snake)	3	3	1.9	4	4
# Strophurus ciliaris (Northern Spiny-tailed Gecko)	3	3	1.9		
Ctenophorus reticulatus (Western Netted Dragon)	2	3	1.3		
# Diplodactylus vittatus (Eastern Stone Gecko)	2	2	1.3		
Lerista sp.	2	2	1.3		
Morethia sp.	2	2	1.3		
Pseudechis australis (Mulga Snake)	2	2	1.3	3	3
Simoselaps anomalus (Centralian Banded Snake)	2	2	1.3		
***# Varanus brevicauda* (Short-tailed Pygmy Goanna)**	2	3	1.3		
***Ctenophorus salinarum* (Claypan Dragon)**	1	3	0.6	1	1
Ctenotus leae (Centralian Coppertail)	1	1	0.6		
# Demansia reticulata (Desert Whipsnake)	1	1	0.6		
Diplodactylus granariensis (Western Stone Gecko)	1	1	0.6		
***Diplodactylus pulcher* (Patchwork Gecko)**	1	1	0.6		
Diplodactylus sp.	1	1	0.6		
# Diporiphora reginae (Plain-back Two-lined Dragon)	1	2	0.6		
Morethia obscura (Mallee Snake-eye)	1	1	0.6		
Nephrurus sp.	1	1	0.6		
***Proablepharus reginae* (Silvereye Skink)**	1	2	0.6		
Pseudonaja nuchalis (Western Brown Snake)	1	1	0.6	1	1
Ramphotyphlops bicolor (Southern Blind Snake)	1	1	0.6		
Ramphotyphlops bituberculatus (Rough-nosed Blind Snake)	1	1	0.6		
Simoselaps bimaculatus (Western Black-naped Snake)	1	1	0.6		
Strophurus intermedius (Southern Spiny-tailed Gecko)	1	1	0.6		
Suta monachus (Hooded Snake)	1	1	0.6		
# Tympanocryptis lineata (Five-lined Earless Dragon)	1	1	0.6		
Christinus marmoratus (Marbled Gecko)				1	1
Pogona nullarbor (Nullarbor Bearded Dragon)				2	2
# Pogona vitticeps (Central Bearded Dragon)				1	1

Table 25: Vegetation mapping codes used in the text and the detailed description of the community.

Mapping Code	Description
GVD_1 Woodland	*Acacia aneura* complex over *Eremophila latrobei* ssp. *glabra* +/- *A. tetragonophylla* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus* spp., *Eragrostis eriopoda, Aristida contorta, Monachather paradoxa* Low Open Woodland
GVD_2	*Acacia aneura* complex over *Maireana sedifolia, Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. *petiolaris, Ptilotus obovatus* var. *obovatus, Aristida contorta* Low Open Woodland
GAW_11	*Acacia aneura* complex over *Maireana sedifolia* +/- *Ptilotus obovatus* var. *obovatus* +/- *Eremophila latrobei* ssp. *glabra* +/- *Senna artemisioides* ssp. +/- *Aristida contorta* Very Low Open Woodland
GVD_3	*Acacia ramulosa* var., *A. aneura* complex over, *Senna artemisioides* ssp. *petiolaris* +/- *Dodonaea viscosa* ssp. *angustissima* +/- *Ptilotus* spp, *Aristida holathera* var. *holathera, Eragrostis eriopoda* Low Open Woodland
GAW_10	*Acacia aneura* complex over *Aristida contorta* +/- *Eragrostis eriopoda* +/- *Maireana georgei* +/- *Ptilotus obovatus* var. *obovatus* +/- *Monachather paradoxa* Very Low Open Woodland
GVD_4	+/- *Alectryon oleifolius* ssp. *canescens* +/- *Myoporum platycarpum* ssp. *platycarpum* +/- *Casuarina pauper* +/- *E. concinna* +/- *E. oleosa* ssp. +/- *E. socialis* over +/- *Acacia ramulosa, Senna artemisioides* ssp., *Maireana sedifolia, Austrostipa nitida* Low Open Woodland
GVD_5	*Casuarina pauper* and/or *Acacia papyrocarpa* over *Maireana sedifolia* or *Cratystylis conocephala, Senna cardiosperma* ssp. *gawlerensis* +/- *Senna artemisioides* ssp. *petiolaris, Atriplex vesicaria* ssp. Low Open Woodland
GAW_6	*Casuarina pauper* +/- *Acacia papyrocarpa* +/- *A. aneura* complex +/- *Alectryon oleifolius* ssp. *canescens* +/- *Santalum acuminatum* over *Maireana sedifolia, Atriplex vesicaria* ssp. +/- *Enchylaena tomentosa* var. *tomentosa* Low Open Woodland
NUL_3	*Casuarina pauper, Acacia aneura* complex over *Senna artemisioides ssp.* Low Woodland
GVD_6	*Casuarina pauper* +/- *Alectryon oleifolius* ssp. *canescens* +/- *Acacia aneura* complex over *Senna cardiosperma* ssp. *gawlerensis, Ptilotus obovatus* var. *obovatus* Low Open Woodland
GVD_7	*Eucalyptus gongylocarpa, E. youngiana* +/- *E. concinna* +/- *E. glomerosa* over *Acacia ligulata* +/- *Acacia ramulosa, Ptilotus polystachyus* var. *polystachyus, Triodia basedowii, Aristida holathera* var. *holathera* Low Open Woodland
GVD_400	*Callitris gracilis* or *C. glaucophylla* or *C. verrucosa* over *Dodonaea viscosa* ssp. *angustissima, Rhagodia preissii* ssp. *preissii* Low Woodland
GVD_9 Mallee	*Eucalyptus concinna* +/- *E. canescens* ssp. *canescens* +/- *E. socialis* ssp. +/- *E. eremicola* +/- *Acacia aneura* complex over *Senna artemisioides* ssp. *petiolaris* +/- *Eremophila paisleyi* ssp. *paisleyi, Ptilotus obovatus* var. *obovatus, Triodia scariosa* Open Mallee
NUL_5	*Eucalyptus concinna* and/or *E. socialis or E. yumburrana* ssp. *yumburrana* over *Triodia scariosa* or *T. lanata* and/or *T. irritans* Open Mallee
GVD_10	*Eucalyptus concinna* +/- *E. socialis* ssp. over *Dodonaea viscosa* ssp. *angustissima, Senna artemisioides* ssp. *petiolaris, Acacia colletioides* +/- *A. ligulata* +/- *Bossiaea walkeri, Aristida contorta* +/- *Triodia* spp. +/- *Lomandra leucocephala* ssp. *robusta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* Open Mallee
GVD_11	*Eucalyptus oleos*a ssp. +/- *Eucalyptus brachycalyx* or *E. concinna* over *Acacia nyssophylla, Atriplex vesicaria* ssp., *Maireana radiata, M. pentatropis* +/- *Cratystylis conocephala* Open Mallee
GVD_12	+/- *Eucalyptus yumbarrana* ssp. *yumbarrana* +/- *E. brachycalyx* or *E. concinna* +/- *E. gracilis* over *Melaleuca eleuterostachya* +/- *Hakea francisiana* +/- *Westringia rigida* +/- *Eremophila scoparia, Triodia* spp. Open Mallee
GVD_14 Shrubland	*Acacia aneura* complex over *Eremophila latrobei* ssp. *glabra, Eriachne mucronata, Eragrostis eriopoda* +/- *Monachather paradoxa* Tall Open Shrubland
GVD_15	*Acacia ligulata, A. ramulosa* var., *Dodonaea viscosa* ssp. *angustissima* over *Aristida holathera* var. *holathera* +/- *Aristida contorta* Tall Open Shrubland
NUL_9	*Acacia ligulata* or *A. ramulosa* or *A. clelandii* or *Acacia aneura* complex over *Dodonaea viscosa ssp. angustissima* Tall Open Shrubland
GVD_16	*Atriplex vesicaria* ssp. over *Hemichroa diandra* +/- *Tecticornia* spp. +/- emergent *Melaleuca nanophylla* Low Open Shrubland
GVD_17	+/- *Dodonaea viscosa* ssp. *angustissima* +/- *Acacia oswaldii* over *Atriplex vesicaria, Austrostipa nitida* +/- *Aristida contorta* +/- emergent *Myoporum platycarpum* ssp. *platycarpum* and/or *Alectryon oleifolius* ssp. *canescens* Shrubland
GVD_18	*Tecticornia* spp., *Atriplex vesicaria* over +/- *Hemichroa diandra* +/- *Maireana oppositifolia* Low Open Shrubland
GVD_19	*Salsola tragus, Eriochiton sclerolaenoides, Sclerolaena obliquicuspis, S. diacantha, Austrostipa nitida, Enneapogon avenaceus* +/- emergents *Acacia tetragonophylla* or *Alectryon oleifolius* ssp. *canescens* or *Pittosporum angustifolium* Low Open Shrubland / (Tussock) Grassland
GVD_20	*Sclerolaena diacantha, Enneapogon avenaceus, Salsola tragus* with emergent senescent *Acacia aneura* complex Low Shrubland
GVD_21	*Senna artemisioides* ssp. *petiolaris* +/- *S. artemisioides* ssp. *coriacea* over *Atriplex vesicaria* ssp., emergent *Acacia oswaldii* +/- emergent *Pittosporum angustifolium* Tall Open Shrubland

Table 26: Two-way table showing proportion of captures of each reptile species within each vegetation mapping group/vegetation community (key to colours: >33%, 20-32%, 10-19%, <10% +). Species with less than 10 records for each vegetation mapping group shown as +, and blank if absent. Species are sorted alphabetically by scientific name.

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Amphibolurus longirostris (Long-nosed Dragon)									+								+							
Cryptoblepharus australis (Desert Wall skink)			+		+		+																	
Ctenophorus clayi (Black-collared Dragon)	+		+				+																+	
Ctenophorus cristatus (Crested Dragon)	+	+	+	+			+	+			+		+			+		+			+			
Ctenophorus fordi (Mallee Dragon)									+								+							
Ctenophorus isolepis (Military Dragon)	+	+	+		+	+	+				+		+	+	+	+	+	+						+
Ctenophorus nuchalis (Central Netted Dragon)	+		+		+		+	+	+	+		+				+	+	+			+	+		
Ctenophorus pictus (Painted Dragon)					+			+	+															
Ctenophorus reticulatus (Western Netted Dragon)		+									+													
Ctenophorus salinarum (Claypan Dragon)																				+				
Ctenotus atlas (Southern Spinifex Ctenotus)		+					+		+				+				+							+
Ctenotus brooksi (Sandhill Ctenotus)	+		+		+																			
Ctenotus calurus (Blue-tailed Skink)									+	+														
Ctenotus dux (Narrow-lined Ctenotus)			+																					
Ctenotus leae (Centralian Coppertail)									+															
Ctenotus leonhardii (Common Desert Ctenotus)					+																			
Ctenotus pantherinus (Leopard Skink)			+		+		+										+							+
Ctenotus quattuordecimlineatus (Many-lined Ctenotus)	+		+				+			+			+										+	
Ctenotus regius (Eastern Desert Ctenotus)							+				+	+		+		+	+	+	+		+	+		
Ctenotus saxatilis (Centralian Striped Skink)							+																	
Ctenotus schomburgkii (Sandplain Ctenotus)	+		+	+		+	+		+		+		+	+	+	+	+	+	+		+	+		+
Cyclodomorphus melanops (Spinifex Slender Bluetongue)									+	+			+											+
Delma australis (Barred Snake-lizard)																							+	
Delma butleri (Spinifex Snake-lizard)			+			+			+	+							+							
Demansia reticulata (Desert Whipsnake)										+														
Diplodactylus conspicillatus (Fat-tailed Gecko)	+	+	+		+		+	+				+				+					+	+	+	
Diplodactylus granariensis (Western Stone Gecko)										+														
Diplodactylus pulcher (Patchwork Gecko)											+													
Diplodactylus vittatus (Eastern Stone Gecko)									+															
Diporiphora reginae (Plain-back Two-lined Dragon)						+																		

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Egernia inornata (Desert Skink)	+		+	+	+	+	+				+		+		+		+					+	+	+
Eremiascincus richardsonii (Broad-banded Sandswimmer)														+										
Eremiascincus richardsonii (Narrow-banded Sandswimmer)											+													
Gehyra purpurascens (Purple Dtella)		+						+	+		+		+											+
Gehyra variegata (Tree Dtella)	+	+				+				+						+	+				+			
Heteronotia binoei (Bynoe's Gecko)	+	+	+								+	+												
Lerista bipes (Western Two-toed Slider)			+						+								+							
Lerista desertorum (Great Desert Slider)	+		+			+	+		+			+	+			+		+				+	+	+
Lerista labialis (Eastern Two-toed Slider)	+	+		+				+	+	+		+	+			+	+	+						
Lerista muelleri (Dwarf Three-toed Slider)					+	+	+				+													
Lerista taeniata (Ribbon Slider)			+						+															
Lialis burtonis (Burton's Legless Lizard)	+								+	+														
Lucaseum damaeum (Beaded Gecko)	+			+		+	+			+	+		+		+	+		+						
Lucaseum stenodactylum (Sandplain Gecko)	+	+	+		+		+	+	+	+	+		+			+	+	+		+	+			
Menetia greyii (Dwarf Skink)							+		+	+							+				+			
Moloch horridus (Thorny Devil)	+	+		+	+	+	+	+			+					+	+				+		+	+
Morethia adelaidensis (Adelaide Snake-eye)	+																	+						
Morethia boulengeri (Common Snake-eye)	+				+					+						+						+		
Morethia butleri (Butler's Snake-eye)	+	+							+															
Morethia obscura (Mallee Snake-eye)										+														
Neobatrachus centralis (Trilling Frog)							+																	
Nephrurus laevissimus (Pale Knob-tailed Gecko)	+				+		+				+		+	+						+			+	
Nephrurus levis (Smooth Knob-tailed Gecko)		+			+	+	+	+	+			+				+	+	+			+		+	
Pogona minor (Dwarf Bearded Dragon)	+				+	+	+		+				+	+			+							+
Proablepharus reginae (Silvereye Skink)									+															
Pseudechis australis (Mulga Snake)	+										+													
Pseudonaja modesta (Five-ringed Snake)			+		+											+			+					
Pseudonaja nuchalis (Western Brown Snake)									+															
Pygopus nigriceps (Black-headed Scaly-foot)	+									+											+			
Ramphotyphlops bicolor (Southern Blind Snake)																				+				
Ramphotyphlops bituberculatus (Rough-nosed Blind Snake)							+																	

Species	GVD_1	GVD_2	GVD_3	NUL_3	GVD_5	NUL_5	GVD_6	GAW_6	GVD_7	GVD_9	NUL_9	GAW_10	GVD_11	GAW_11	GVD_12	GVD_14	GVD_15	GVD_16	GVD_17	GVD_18	GVD_19	GVD_20	GVD_99	GVD_999
Ramphotyphlops endoterus (Centralian Blind Snake)											+											+	+	
Rhynchoedura ornata (Beaked Gecko)	+	+	+		+			+	+	+	+	+	+			+	+	+	+		+			
Simoselaps anomalus (Centralian Banded Snake)	+								+															
Simoselaps bertholdi (Desert Banded Snake)			+	+				+									+							
Simoselaps bimaculatus (Western Black-naped Snake)							+																	
Simoselaps semifasciatus (Half-girdled Snake)							+		+		+													
Strophurus ciliaris (Northern Spiny-tailed Gecko)	+		+											+										
Strophurus elderi (Jewelled Gecko)									+	+														
Strophurus intermedius (Southern Spiny-tailed Gecko)							+																	
Suta monachus (Hooded Snake)			+																					
Tiliqua occipitalis (Western Bluetongue)				+	+					+						+	+							
Tympanocryptis lineata (Five-lined Earless Dragon)																		+						
Varanus brevicauda (Short-tailed Pygmy Goanna)			+						+															
Varanus eremius (Desert Pygmy Goanna)	+												+											
Varanus gilleni (Pygmy Mulga Goanna)	+	+			+		+					+		+										
Varanus gouldii (Sand Goanna)	+		+	+	+		+		+		+		+	+		+		+						

NOMENCLATURE AND ECOLOGICAL KNOWLEDGE

Published accounts

Only three studies have documented Anangu names for reptiles, Goddard (1992), Baker *et al*. (1993) and Robinson *et al*. (2003). It is suggested that the latter be read in conjunction with this report. Obtaining further Traditional Aboriginal Knowledge on fauna was not within the scope of this survey.

SIGNIFICANT SPECIES

The selected species summaries are for taxa that are new to the region, have a conservation status rating or are species warranting further attention due to their restricted distribution or low occurrence.

Dragon Lizards

***Ctenophorus salinarum* (Claypan Dragon) R**

The capture of this species during the survey represents the first records for the region since 1979. This species appears restricted to a single location in the MT Lands in close proximity to Serpentine Lakes (SER cluster) in vegetation community GVD_17. This species is probably more widespread in the MT Lands around salt lakes and claypans, however physical access and cultural reasons prevent access to these areas.

***Diporiphora reginae* (Plain-back Two-lined Dragon) (Figure 81)**

Two individuals were collected from a single quadrat on the Tjuntjuntjara Track (TJU 1), where they were found in a mallee *Triodia* association (GVD_7). They represent the first records of this species for South Australia, the nearest location being in spinifex-heath associations in the arid southern interior of WA (Wilson & Swan 2004).

Figure 81: The first captures of the Plain-backed Two-lined Dragon (*Diporiphora reginae*) for South Australia were made on this survey. (Photo: M. Hutchinson).

***Pogona vitticeps* (Central Bearded Dragon)**

A single individual was observed on a post on the Dog Fence on the eastern boundary of the MT Lands. This was the first record of this species for the MT Lands and reflects the western extent of its range in South Australia.

***Tympanocryptis lineata* (Five-lined Earless Dragon) (Figure 82)**

A single specimen was recorded from one quadrat in the Igy Corner cluster of sites (IGY). This was the first record of this species for the MT Lands and reflects the western extent of its range in South Australia. Elsewhere in eastern Australia it is widespread in arid open mallee, chenopod and sandhill habitats. Armstrong (1986) recorded the Five-lined Earless Dragon in the southern MT Lands on typical Nullarbor habitats.

Figure 82: A single specimen of the Five-lined Earless Dragon (*Tympanocryptis lineata*) was collected on the eastern side of the MT Lands. (Photo: P. Canty).

Geckoes

***Diplodactylus pulcher* (Patchwork Gecko) R**

A single capture of the Patchwork Gecko was made on this survey (TJU 1 cluster), within NUL_9 mapping group (Table 25, 26) only six other records known for this species known from the MT Lands from 1987. This species occupies shrubland habitats on heavy and harder soils, more typical of the Nullarbor Plain. The records in the MT Lands represent the eastern limit of its distribution.

***Diplodactylus vittatus* (Eastern Stone Gecko)(Figure 83)**

Two individuals were caught at single quadrat in the VOK 2 and SER cluster (GVD_7). These records represent the first records for the MT Lands but also a large north-westerly range extension (>500km). Throughout its range it is found in a range of habitats from arid shrublands to wet sclerophyll forests.

Figure 83: The Eastern Stone Gecko *Diplodactylus vittatus* was captured for the first time in the MT Lands near Serpentine Lakes. (Photo: P. Canty).

***Strophurus ciliaris* (Northern Spiny-tailed Gecko)**
Three captures of this species (Figure 84) represent the first records for the MT Lands, from single quadrats in the EMU, TAL and DIN clusters in the eastern half of the MT Lands. The three locations are all in different vegetation communities (GVD_1, GVD_3 and GAW_11 (Table 25)). This species is widespread through arid shrublands and *Triodia* associations, however because it is largely arboreal it is rarely caught using conventional trapping methods.

Figure 84: The Northern Spiny-tailed Gecko (*Strophurus ciliaris*) was recorded from three locations in the eastern half of the MT Lands. (Photo: A. Robinson).

Skinks
***Ctenotus calurus* (Blue-tailed Skink)** Figure 85
This brightly coloured skink was recorded from MT Lands for the first time during the survey with 8 records from 3 quadrats (1 in the SER cluster and 2 in the VOK1 cluster). Its preferred habitat appears to be leaf litter associated with *Triodia* hummocks (mapping groups GVD_7 & GVD_9). It shelters in complex, deep vertical burrows and forages in the open spaces between hummocks (Horner 1991). It appears confined in SA to the MT and AP Lands but occurs more widely in adjacent areas of WA and the NT.

Figure 85: The spectacular Blue-tailed Skink (*Ctenotus calurus*) was recorded for the first time in the Maralinga Tjarutja Lands on this survey. (Photo: P. Canty).

***Ctenotus dux* (Mutinka, Narrow-lined Ctenotus)**
During this survey, seventeen records from eight quadrats (5%) were made (4 quadrats in the VOK2 cluster and two quadrats in the VOK1 and SER clusters) on the Anne Beadell Highway. It was recorded from four vegetation communities (Table 26), however the majority of captures were made in GVD_7 (Table 25). These records appear to represent the southerly extent of their distribution in the MT Lands. The Narrow-lined Ctenotus is an animal of the soft sand of dune slopes and crests, being confined in SA to the MT and AP Lands. Prior to this survey it was known from two locations adjacent the WA border in Mamungari CP. It is widely distributed in adjacent areas of the NT and WA, but also through NE South Australia, New South Wales and Queensland.

***Ctenotus leonhardii* (Common Desert Ctenotus) (Figure 86)**
The first records of this species for the MT Lands were made on this survey. It appears to prefer heavier soils associated with acacia woodlands and shrublands, however, it is also recorded in sandy *Triodia* dominated habitats. On this survey it was recorded from three communities, however the majority were recorded from GAW_11 (Table 25, 26). Twenty-five individuals were recorded form six quadrats (4%) in the north and east of the MT Lands (2 each in SER, VOK1 and DIN clusters).

Figure 86: The Common Desert Ctenotus (*Ctenotus leonhardii*) is one of thirteen species of *Ctenotus* now known from the MT Lands. (Photo: P. Canty).

Twenty five records from 6 quadrats represent the first records of this species from the MT Lands (2 sites in DIN cluster, 1 in SER, 2 in VOK 1 and 1 in DEY. At these sites, its preferred habitat appears to be plant associations on heavier soils in swales such as mulga and chenopod shrublands.

***Lerista bipes* (Kuyi, Western Two-toed Slider)**
Previously only known from the AP Lands from three specimens collected in 1985 at Mt Crombie, the present survey collected 6 specimens from six quadrats in three vegetation communities (GVD_3, GVD_7 and GVD_17, Table 26).

This species appears to be widespread and common in sandy areas across the AP Lands. Elsewhere in SA it appears confined to sandy substrates in the western part of the State also occurring widely across the deserts of the NT and WA.

***Lerista taeniata* (Ribbon Slider) R**
The Ribbon Slider was recorded from 5 quadrats (4 in the VOK 2 cluster and 1 from SER in vegetation communities GVD_3 and GVD_7 (Table 25). Again this represents the first records of a skink species for the MT Lands. It appears to be very uncommon and is found in association with *Triodia* hummock grasses and litter on sandplain. This tiny skink appears to have disjunct populations in SA and the NT. Only one individual was captured in the AP Lands survey (Robinson *et al.* (2000). It is considered Rare in South Australia.

***Proablepharus reginae* (Silvereye Skink) R**
Two specimens were collected on the survey from a single site in the MT Lands (VOK2 cluster, GVD_7) and otherwise known in South Australia from the AP Lands from a single specimen collected from Mt Davies in 1961.

It is small and inconspicuous and more searching is required to understand its distribution and status in SA where it is currently classified as Rare.

Goannas

***Varanus brevicauda* (Short-tailed Pygmy Goanna) (Figure 87) R**
This attractive ground-dwelling goanna is found across the *Triodia* dominated sandy deserts of the NT and WA. It was previously considered that the AP Lands encompassed the SE limits of its distribution (Robinson *et al.* 2000), however this survey extends their distribution further to the south, with captures at single quadrats in the SER and VOK2 clusters in open mallee and open shrubland communities with a dense *Triodia* understorey (GVD_3 & GVD_9 (Table 25, 26)). This species is relatively sedentary, living in the *Triodia* hummocks and foraging close to shelter, and the lack of sightings and specimens is almost certainly related to its secretive behaviour (James 1996). It is currently classified as Rare in SA.

Figure 87: The Short-tailed Pygmy Goanna (*Varanus brevicauda)* is one of five species of goanna from the MT Lands. (Photo: P. Canty).

***Varanus tristis* (Black-headed Goanna)**
There is a single undated SA Museum specimen of this species from the MT Lands. It is more likely to be common in suitable rocky habitats which are not widespread in the MT Lands, but more extensive in the ranges of the APY Lands. It is likely to be only an occasional vagrant in the MT Lands.

Pythons

***Antaresia stimsoni* (Nantalpa, Stimson's Python)**
This species was not seen during the survey. There is a single SA Museum specimen for the MT Lands collected by Frank Badman in the vicinity of Maralinga in 1995. This species is probably more widespread across the range country in the AP Lands where suitable caves and broken rock outcrops are found. Survey for this species was difficult due to its preference for ranges and nocturnal behaviour. The AP Lands are a significant part of the species widespread but patchy distribution across the northern arid and semi-arid parts of SA, but breakaways surrounding salt lakes may be important habitat for it in the MT Lands.

Fanged Snakes

***Acanthophis pyrrhus* (Panakura, Desert Death Adder) V**
This species was not seen during the survey. There is a single SA Museum specimen for the MT Lands collected by Anthony Bolam in the vicinity of Ooldea,

however the date is not certain (probably 1930's). Little is known of these nocturnal, highly venomous and secretive snakes, other than that they shelter during the day buried in litter or soil under trees and shrubs. Extensive raking of litter searching for reptiles on this survey revealed no sign of this species. It is currently classified as Vulnerable in SA.

***Simoselaps* (*Neelaps*) *bimaculatus* (Western Black-naped Snake) R (Figure 88)**

This survey recorded only the second record for this species for the MT Lands, with the previous record from around 1950. It was captured at a MAU quadrat when raking through leaf litter. The closest record is that of a single individual from Kingoonya (date unknown), however other populations are known from south west Western Australia. More searching is required to understand its distribution and status in SA where it is currently classified as Rare.

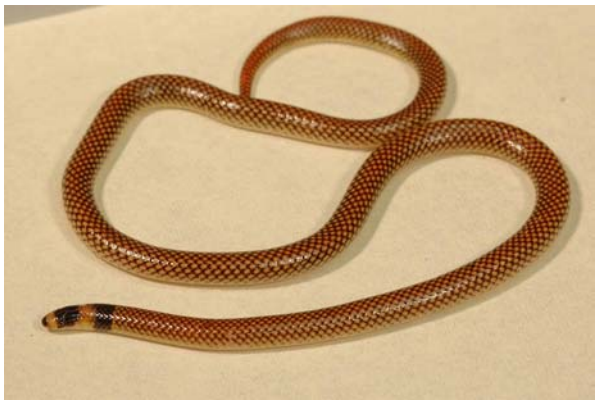

Figure 88: The beautifully marked Western Black-naped Snake (*Neelaps bimaculatus*) was recorded for the second time in the MT Lands on this survey. (Photo: M. Hutchinson).

Frogs

***Neobatrachus centralis* (Trilling Frog)**

(Figure 89)

The Trilling Frog is a robust burrowing frog and is adapted to desert conditions and can spend years without having to surface, buried deep underground. It emerges following heavy rains and breeds in claypans, waterholes and puddles (including road ruts). Captures of the Trilling Fog on this survey were the first recorded for the MT Lands. Many were captured in roadside puddles, however a number were captured in pitfall traps on dune crests. It is likely that this species is widespread through out the MT Lands, despite being captured in only five vegetation communities (Table 26). A higher proportion of captures were made in GVD_1 and GVD_3.

Figure 89: Captures of the Trilling Frog (*Neobatrachus centralis*) on this survey were the first for the Maralinga Tjarutja Lands. (Photo: P. Lang).

CONCLUSIONS AND RECOMMENDATIONS

J. N. Foulkes[1]

INTRODUCTION

The Maralinga Tjarutja Lands (MT Lands) cover a significant proportion (c 21%) of the Great Victoria Desert Bioregion and smaller portions of the Gawler (0.2%) and Nullarbor (8.3%) Bioregions in South Australia. The Great Victoria Desert in particular supports vegetation communities and a suite of plant and animal species that are only found in SA from the MT and APY Lands, but which also occur in adjacent areas of Western Australia. Any conservation management across the bioregions should be carried out in cooperation with the stakeholders bordering the MT Lands, some of which are Aboriginal communities; some are government agencies, NRM Boards, and pastoral lands. There are now significant administrative differences across the area and these must be taken into account when developing conservation management across the region.

In common with the rest of arid Australia, the flora and fauna have undergone a significant decline since from the 1920's onwards with the arrival of fox and rabbit populations coupled with extended drought periods. The mammal fauna has been impacted most with at least 17 species becoming extinct. Other species such as the Sandhill Dunnart appear to continue to fluctuate or be very restricted in their distribution. A variety of birds also appear to have been lost from the MT Lands over the last 50 years including the Grey Currawong (*Strepera versicolor*), while the Malleefowl (*Leipoa ocellata*) is still thought to be under threat and requires monitoring to determine management requirements to ensure its continued survival on the MT Lands. The reptile fauna appears resilient however due to poor historical records; it is difficult to ascertain if particular groups such as larger goannas and pythons have declined.

SUMMARY OF RESULTS

Vascular plants

Overall the survey produced 6,398 plant records and 2000+ herbarium voucher specimens. A total of 916 vascular plant species (or taxa of lower rank) were recorded within the MT Lands from 59 families. Of these, 8 were species not previously recorded in South Australia, and several appear to represent the discovery of new undescribed species. Another 174 represent new plant records for the MT Lands.

The fifty most frequent perennial species are ranked in Table 9. The most frequently recorded perennial species in MT Lands quadrats was *Acacia aneura* complex (Mulgas) being present at 141 (81.5%) of the 173 quadrats sampled. The third most frequent species, *Enchylaena tomentosa* (Ruby Saltbush), occur widely but at low densities in most vegetation types across the MT Lands.

Tussock grasses are well represented among the most common perennial species with *Aristida contorta* (Curly Wire-grass) occurring at 73 quadrats (42.2%) and *Aristida holathera* var. *holathera* at 63 quadrats (36.4%), *Enneapogon polyphyllus* (Leafy Bottle-washers) at 59 quadrats (34.1%), *Enneapogon avenaceus* (57 quadrats, 32.9%) and *Monochather paradoxa* (55 quadrats, 31.8%) Some of these grasses are short-lived perennial and may either die back completely in very dry years, or persist in a dormant state until more favourable conditions return.

Hummock grasses occur much less widely, with the most common species being *Triodia basedowii* (Hard Spinifex) at 29 quadrats (16.8%), *Triodia scariosa* (17 quadrats, 9.8%), *T. irritans* (Grey Spinifex) with 9 quadrats (5.2%) and *T. lanata* (5 quadrats, 2.9%). However, where they do occur, hummock grasses usually dominate their communities, forming relatively dense and uniform layers (in contrast to the tussock grasses which are more widespread, but less abundant overall). Hence, two *Triodia* species (*T. basedowii* and *T. scariosa*) fall among the top five species in terms of overall abundance based on canopy cover

The MT Lands are remarkable for the low incidence of weeds, with only 8 introduced species recorded on survey quadrats or as opportunistic sightings. This number is 0.8 % of the total flora, and reflects the relatively intact vegetation in the MT Lands compared to most other regions of the State. Nevertheless, a few of the alien species found in the MT Lands are of

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concern and Buffel Grass (*Cenchrus ciliaris*) in particular is considered to be a serious management issue.

Twenty-three vegetation mapping communities comprised of woodlands, mallee, shrublands and grasslands have been identified in the MT Lands. Seventeen of which are Great Victoria Desert Bioregion communities, three are Nullarbor Bioregion communities and three are Gawler Bioregion Communities.

A total of 174 new species (and sub-species) from 34 families for the MT Lands were recorded on the survey. There are at least eight species which are new to South Australia collected on the survey;

Eremophila hygrophana
Sida sp. B
Sida sp. Rabbit Flat
Sida sp. Watarrka
Sida sp. golden calyces
Pityrodia loricata
Goodenia larapinta
Nicotiana ingulba

There are no vegetation communities of national or state significance, however there are particular communities containing species such as the Ooldea Range Mallee and Beadell's Mallee which occur only occur in the MT Lands.

Mammals
In common with the rest of the Australian arid zone, a significant proportion of the mammal fauna has become extinct since European settlement. This wave of extinctions began in the 1930's, however many species did not become extinct till the 1960's. Approximately to 44 native and 9 introduced mammal species were known to inhabit the region. This survey, and other recent observations, has recorded 27 native mammal species still remaining across the MT Lands. At least 17 species must now be presumed extinct. Nine species collected or recorded on this survey, represent additions to the previously known mammal fauna;

Short-beaked Echidna

Southern Marsupial Mole

Euro

Western Pygmy-possum

Inland Freetail-bat

White-striped Freetail-bat

Forrest's Mouse

Spinifex Hopping-mouse

Desert Mouse

The most frequently recorded species, using all methods was Gould's Wattled Bat constituting 34.6% of records on survey quadrats but recorded at only 36% of these quadrats. Gould's Wattled Bat was the species most widely recorded opportunistically.

The two most frequently trapped species however, were the two small rodents, the Sandy Inland Mouse (112 quadrats, 73.2%) and the introduced House Mouse (92, 60.1%) with the Wongai Ningaui (34, 22.2%) which was also encountered frequently. Other common and widespread native species include the Lesser Long-eared Bat (55, 36.6%) and the Ooldea Dunnart (45, 29.4%). Other common and widespread introduced species include the One-humped Camel (77, 50.3%), Rabbit (44, 28.8%) and the Feral Cat (24, 15.7%).

Birds
The survey and previous observations have recorded 134 species of birds across the MT Lands. The northern form of the Grey Currawong (*Strepera versicolor plumbea*) appear to have become extinct since European settlement. The survey added five species to the known bird fauna.

Australian Wood Duck

Brown Songlark

Black Falcon

Brown-headed Honeyeater

Masked Lapwing

During the systematic site-based surveys 134 bird species were identified. Forty (30%) of these species were recorded at more than 15 of the 154 bird survey quadrats (i.e. > 10% of quadrats surveyed) and fifty-four (42%) were detected at more than 8 quadrats sampled in the region (i.e. at > 5% of sample quadrats). Interestingly, all of these species are native. A further 18 species were recorded at 'opportunistic' sites only.
The most widespread species (i.e. recorded at most survey quadrats, was the Crested Bellbird that was recorded on 117 quadrat surveys (or at 76% of quadrats). The ten most commonly recorded species ware listed below

Crested Bellbird (117 quadrats, 76% of total)

Spiny-cheeked Honeyeater (114, 74%)

Yellow-throated Miner (112, 73%)

Chestnut-rumped Thornbill (94, 61%)

White-browed Babbler (94, 61%)

Grey Shrike-thrush (90, 58%)

Grey Butcherbird (86, 56%)

White-fronted Honeyeater (81, 53%)

Mulga Parrot (81, 52%)

Singing Honeyeater (80, 52%)

Reptiles and frogs
There are now 96 species of reptiles and a single species of frog known for the MT Lands. The survey

added 7 new reptile species and one new frog to the previous known fauna. New reptile records included one new reptile taxa for South Australia, the Plain-back Two-lined Dragon *Diporiphora reginae.*

Central Bearded Dragon

Five-lined Earless Dragon

Eastern Stone Gecko

Northern Spiny-tailed Gecko

Blue-tailed Skink

Common Desert Ctenotus

Ribbon Slider

Short-tailed Pygmy Goanna

Desert Whipsnake

Trilling Frog

The most widely recorded species on survey quadrats were;

Sandplain Ctenotus (83 quadrats, 54%)

Eastern Desert Ctenotus (53 quadrats, 34%)

Thorny Devil (53 quadrats, 34%)

Great Desert Slider (50 quadrats, 33%)

Military Dragon (49 quadrats, 32%)

Beaked Gecko (49 quadrats, 32%)

CONSERVATION SIGNIFICANCE / SPECIES WITH CONSERVATION RATINGS

Many of the plant and animal species now known from the MT Lands are at their western, southern or south eastern limits in South Australia and have a much more extensive distribution in adjacent areas of Western Australia, APY Lands and eastern pastoral lands. As such it is still very important to manage the South Australian populations of these species at the limits of their natural distribution. Many of the species with a State conservation rating below fall into this category. There is however another suite of species still found on the MT Lands, which have been recognised as being threatened across their whole range in Australia. These species are listed below with a National conservation rating. For mammals, only species that still have current populations somewhere in Australia are listed. Species presumed to be extinct from the MT Lands are discussed in the mammal and bird chapters of this report.

Plants

National conservation rating

Austrostipa nullanulla (Club Spear-grass)
Hibbertia crispula (Ooldea Guinea-flower)

State conservation rating

Sarcozona bicarinata (Ridged Noon-flower)
Lobelia heterophylla (Wing-seeded Lobelia)
Maireana melanocarpa (Black-fruit Bluebush)
Sclerolaena blackiana (Black's Bindyi)
Sclerolaena symoniana (Symon's Bindyi)
Atriplex morrisii
Sclerolaena fusiformis
Gratwickia monochaeta
Podolepis jaceoides (Showy Copper-wire Daisy)
Brachyscome ciliaris var. *subintegrifolia*
Olearia arida (Desert Daisy-Bush)
Phlegmatospermum eremaeum (Spreading Cress)
Hibbertia crispula (Ooldea Guinea-flower)
Frankenia cinerea
Dampiera lanceolata var. *intermedia* (Aldinga Dampiera)
Goodenia glandulosa
Austrostipa nullanulla (Club Spear-grass)
Austrostipa tenuifolia
Teucrium grandiusculum ssp. *pilosum*
Acacia rhodophloia (Minni Ritchi)
Acacia helmsiana (Helm's Wattle)
Acacia jennerae (Coonavittra Wattle)
Swainsona kingii
Swainsona dictyocarpa
Corynotheca licrota (Sand Lily)
Alyogyne pinoniana var. *microandra*
Eremophila hillii (Hill's Emubush)
Eremophila parvifolia (Small-leaf Emubush)
Eucalyptus canescens ssp. *beadellii* (Beadell's Mallee)
Eucalyptus wyolensis (Wyola Mallee)
Eucalyptus kingsmillii ssp. *alatissima* (Kingsmill's Mallee)
Melaleuca nanophylla (Dwarf-leaf Honey-myrtle)
Choretrum glomeratum var. *chrysanthum*
Santalum spicatum (Sandalwood)
Gilesia biniflora (Western Tar-vine)

Mammals

National conservation rating

Myrmecobius fasciatus (Numbat)
Dasycercus blythi (Mulgara)
Dasyurus geoffroii (Western Quoll)
Isoodon auratus (Golden Bandicoot)
Macrotis lagotis (Greater Bilby)
Perameles bougainville Western Barred Bandicoot)
Notoryctes typhlops (Southern Marsupial Mole)
Trichosurus vulpecula (Common Brushtail Possum)
Bettongia lesueur (Burrowing Bettong)
Lagorchestes hirsutus (Rufous hare Wallaby)

State conservation rating

Myrmecobius fasciatus (Numbat)
Dasycercus blythi (Mulgara)
Macrotis lagotis (Greater Bilby)
Perameles bougainville (Western Barred Bandicoot)
Notoryctes typhlops (Southern Marsupial Mole)
Bettongia lesueur (Burrowing Bettong)
Bettongia penicillata (Brush-tailed Bettong)
Sminthopsis hirtipes (Hairy-footed Dunnart)
Sminthopsis psammophila (Sandhill Dunnart)

Birds
National conservation rating
Leipoa ocellata (Malleefowl)
Polytelis alexandrae (Princess Parrot)

State conservation rating
Leipoa ocellata (Malleefowl)
Ardeotis australis (Australian Bustrad)
Cacatua leadbeateri (Major Mitchell's Cockatoo)
Amytornis striatus (Striated Grasswren)
Calamanthus cautus (Shy Heathwren)
Climacteris affinis (White-browed Treecreeper)
Falco perigrinus (Peregrine Falcon)
Gerygone fusca (Western Gerygone)
Myiagra inequieta (Restless Flycatcher)
Neophema splendida (Scarlet-chested Parrot)
Pachycephala inornata (Gilbert's Whistler)
Polytelis alexandrae (Princess Parrot)
Tringa glareola (Wood Sandpiper)
Tyto novaehollandiae (Masked Owl)

Reptiles
State conservation rating
Ctenophorus salinarium (Claypan Dragon)
Diplodactylus pulcher (Patchwork Gecko)
Probablepharus reginae (Silvereye Skink)
Varanus brevicauda (Short-tailed Pygmy Goanna)
Acanthopis pyrrhus (Desert Death Adder)

BIOGEOGRAPHIC SIGNIFICANCE

The Great Victoria Desert Bioregion of which the MT Lands is a part extends into WA and north onto the APY Lands is of great biogeographic significance. Approximately 50% of the Great Victoria Desert Bioregion occurs in and SA, almost half of this is in the MT Lands.

The other significant biogeographic region in the MT Lands is the Nullarbor Bioregion. The South Australian portion of the bioregion comprises about 58% conservation reserves (including regional reserves), whereas only about 17% of the Western Australian portion of the bioregion is conservation reserve. (Woinarski *et. al*. 2001.) The flora and fauna associated with these two major bioregions are therefore almost restricted to the Aboriginal lands of the MT Lands and southern parts of the Alinytjara Wilurara NRM region. A proportion of these species that are habitat generalists are however distributed more widely across the Australian arid zone.

THREATENING PROCESSES

The life cycles of all plants and animals resident on the MT Lands are driven by rainfall, fire and the availability of water for maintenance of their life processes. Rainfall/water is limited, temporally and spatially during extended droughts and in the longer term, it will become more limiting with the impacts of climate change/global warming.

The life cycles of many plants have become disrupted even further through:

- the grazing and browsing effects of introduced herbivores – in particular, by the European Rabbit, but also by feral camels
- the less selective, and often very extensive, impacts of larger and more frequent wildfires than used to be the pattern prior to the 1930's-1940's.

These impacts remove vast quantities of potential food and shelter resources for many animals, as well as limiting breeding sites. As a result, they reduce the relative carrying capacities of the land for a wide range of native species. In addition, wildfires severely fragment plant and animal populations and lead to localized population extinctions.

Soil disturbance and removal of vegetation cover by fire and introduced herbivores can lead to displacement of native plant species by introduced weed species. In the MT Lands the range of such weedy species is still very small; however, Buffel Grass is probably the most notable of these species. It can form dense monocultures which can carry wildfires and will re-shoot quickly following fire, competing with and overcrowding most native species. It is still only sparsely distributed across the MT Lands; however it has the capacity to spread rapidly, principally along main roads and into flood-out areas.

Anangu traditional management practices included regular cleaning and maintenance of all rockholes. Programs undertake regular maintenance has been running, through MT Land Management, for a number of years but efforts are affected by the impacts of introduced species, particularly camels.

Some bird and mammal populations that are dependant upon the availability of surface water (e.g. kangaroos, emus, parrots and pigeons) may become even more limited in their abundance and distribution, due to reduction in water available from waterholes. This may be because of increasing rates of silt accumulation due to lack of Anangu maintenance, fouling and consumption of water by feral camels.

For some species, the effects of some or all of the above threats to their ecology and hence rates of survivorship are compounded by predation by introduced mammals and in particular the fox.

Examples of these threats and threatening processes are indicated in previous chapters. Particular management and research needs are presented below.

CONSERVATION AND LAND MANAGEMENT

Threats

Fire

Wildfires are typically random in the areas that they affect and can have devastating consequences for populations and communities. Many species, and especially those that occur in *Triodia* hummock grasslands, are well-adapted to recover following fire. However, recovery can be limited when the fires cover huge areas and/or when fire frequencies are too frequent and/or follow-up rains don't occur. Poor recovery and recruitment of seedlings can also be attributed to grazing of seedlings by rabbits and camels but this is considered a minor problem in the MT Lands.

There is strong evidence to support the notion that for thousands of years Anangu maintained mosaics of vegetation of different age-since-fire over much of arid Australia. The size of mosaic patches were varied from tens of hectares to a thousand hectares. However, when Anangu were moved into missions, traditional 'patch-burning' practices became less frequent. As a consequence, the average age of the vegetation since last fires gradually increased until there were relatively few, recent fire patterns left. The patchy mosaic pattern disappeared and was replaced, on average, with a more even-aged and older range of plant communities that were able to carry wildfires over increasingly large areas. The *Triodia* grasslands are very important food source areas for Anangu and a food and shelter for a wide variety of mammals, birds, reptiles and insects. Mature *Triodia* grasslands have few bush-foods and low species diversity. Fire increases herbaceous species diversity, and more importantly increases populations of edible plants and fauna species also respond to these changes.

Mulga woodlands in particular, are also an important resource for Anangu. The woodlands provide various foods, timber for tools and crafts, medicinal resources and fuel for heating and cooking. Mulga is also highly sensitive to fire. Mulga communities that have an annual grass understorey tend not to burn except after exceptional rainfall events. Mulga that has a *Triodia* understorey is much more fire-prone. When Mulga is burnt in a hot fire it generally dies, however trees burnt in less severe fires can recover following rain, but are susceptible if burnt again too soon.

Some of the wildfires in recent years have been in the order of hundreds of thousands of hectares or, in some cases, thousands of square kilometres. A potentially serious consequence of such large fires is that they severely diminish the total area of relatively dense Mulga shrubland and woodland habitats that are critical to the survival of Malleefowl and other species which compound the problems further by fragmenting the remnant populations.

Recommended Actions:

- Prepare an fire management strategy for the MT Lands with the main objectives of:
- Identifying areas of cultural significance requiring fire protection measures.
    - identifying fire-breaks and fire control advantages – roads, water sources, salt lakes, and recent burns.
    - protecting known populations of significant plant and animal species and significant plant communities/habitats.
    - improving habitat quality and age since fire for threatened species' populations' e.g: Sandhill Dunnart and Malleefowl.
    - limiting the extent of future wildfires.
- Prepare ecological fire management strategies for significant species populations/habitats based around:
    - identifying the significant species.
    - identifying and mapping known and suspected occupied habitats of these species.
    - prioritising works on the basis of relative risk, importance and need.
- Map and determine age of existing fire patterns across the MT Lands using satellite imagery. This will provide a useful framework for:
    - determining where contemporary burnt fire-breaks might be put in place along existing roads and tracks to limit the extent of future extensive wildfires, and
    - operational planning in preparation for large wildfires in the future.
- Using traditional and contemporary knowledge to undertake fire management activities particularly patch burning
- Prepare an appropriate education and training program for implementation of fire management by Anangu.

Introduced herbivores

Rabbits occur across the whole MT Lands, but are most prevalent in the north-eastern portion of the lands. There is little that can be done to control them at a landscape scale, but there could be local-scale management through the erection of rabbit-exclusion fencing or site-specific warren fumigation and ripping and/or blasting. This would only be justified if a particularly threatened plant population was known to be at risk through rabbit grazing and an associated lack of recruitment, or if rabbit grazing was considered to be causing potentially serious competition for a threatened native herbivore. See Gillen *et al.* (2000) for more detailed case studies on the control of introduced fauna in relation to reintroductions of native fauna on Aboriginal Lands.

Recommended Actions:

- Contract suitably experienced land managers to assist in designing an effective rabbit control program in identified priority areas.

- Map all treated warrens and re-visit 1-2 months later to determine efficacy of fumigation. Re-treat as necessary.
- Prepare an appropriate education and training program for implementation of rabbit management by Anangu.

Feral camels occur across the entire MT Lands. They are well-adapted to life in the desert and can move long distances in a relatively short time. Camels are most evident in the western and central sand plain and sand dune desert areas, though they will move into the eastern and southern pastoral areas in larger numbers during droughts. Impacts of camels on native vegetation are usually less noticeable than from other introduced herbivores because camels are so mobile and are less-dependant upon surface water.

As a result their grazing/browsing affects are less obvious. However, some plant species appear to be favoured by camels. Most seriously affected among these are the Quandong, Plumbush and Desert Poplar.

Recommended Actions:
- Establish and maintain a database concerning water sources across the MT Lands and the relative impacts of camels at each.
- Prioritise water sources requiring protection works and particular camel management practices. Undertake aerial surveys of the camel population to determine population numbers and trends.
- Shoot camels at problem sites on a needs basis. Camel control strategies could incorporate the use of market-based instruments to remove camels in the most cost-effective way. Targeted on-site control such as ground shooting should also be considered.
- Map and monitor plant health/camel impacts at selected locations
- Prepare an appropriate education and training program for implementation of camel management by Anangu.

Weeds

There are few weed problems on the MT Lands and most result from disturbance. An issue with most weed problems is that they are not addressed soon enough after their arrival in an area. When the first sightings of a new weed species are made they are not usually seen as a problem, and the assessment of risk of spread and potential for establishment are not undertaken. It is usually only when the weed has spread more widely that the problem is acknowledged.

Buffel Grass is a weed that has the potential to spread rapidly in the MT Lands (see also vegetation chapter of this report). Where small populations are found, they should be treated as soon as possible (preferably with an appropriate herbicide) to remove the species from the area. It may also be possible to institute some control around communities and to shed tanks make some modifications to road grading practices to minimise the spread along roadsides. The increase of mineral exploration activity, such as seismic surveys off main tracks, increases the potential for weeds to be brought in on machinery, and also creating disturbance which allows a variety of weed species to establish during the rehabilitation phase.

Buffel Grass is already spread along the roadside verges of many arterial roads and is spreading inland in some areas aided by vehicle traffic. Its spread, if unchecked, could extend to all roads and tracks from which it may spread and threaten inland areas.

Recommended Actions:
- Establish a weeds distribution database to:
  - establish an early warning system, to ensure that something is done immediately once a new species is identified on the lands.
  - identify where significant weed species are known to occur (and, therefore, also where they are known or suspected to not occur).
- Undertake community awareness program to raise awareness about inappropriate species and possible native alternatives that could be used in amenity horticulture practises in communities– this could include poster display, information package for new community residents, reporting procedure for new weed species occurrences.
- Establish a list of significant weeds of neighbouring regions and undertake a risk assessment process as part of an early warning system develop a response plan for particular species should they be located on the MT Lands.
- Examine options for managing Buffel Grass at key biodiversity sites, to reduce fire hazard and improve habitat quality: Buffel Grass control along arterial roads to minimise spread into key biodiversity areas.
- Prepare an appropriate education and training program for implementation of weed management by Anangu.
- Establish weed hygiene protocols for mineral exploration and road maintenance vehicles to minimise spread of invasive weeds.

Water

Rockholes/wells are uncommon in the MT landscape; however they are both culturally and biologically very significant features of the MT Lands landscape.

Culturally, they are the focal points of many important Tjukurpa (creation stories) that 'map' the landscape for all Anangu. Without an intimate knowledge of the locations of the water sources in this desert environment Anangu would have perished. Thus, the Tjukurpa story-lines pass through these sites and people can locate water sources through reference to the sequences of story-lines for any area they find themselves in on the MT Lands and its surrounds.

Care for rockholes and wells, is therefore very significant work in a cultural context.

Biologically, rockholes and other water sources allow a wide range of species to survive in the desert environment. Species such as Red Kangaroo, Emu, Pink Cockatoo, Zebra Finch, Crested Pigeon, etc. all need water to survive.

Many water supplies at rockholes and waterholes are now severely compromised by the large volumes of water being consumed by an increasing feral camel population and by a decreasing capacity of many rock-holes to hold water due to ongoing siltation resulting from camel activity.

Recommended Actions:

- significant wells and soakages also need to be protected from camels. This may require a combination of selective fencing to exclude the feral animals, that allows access for Anangu, kangaroos and Emus, etc. and a broader control program for camels across the arid areas of Australia
- Prepare an appropriate education and training program for implementation of rock hole and water supply management by Anangu.

Introduced predators

The greatest loss of species across the MT Lands has been amongst the medium-sized mammals (ca 200 – 6000 g body weight) and appears to have been caused primarily through 'over-predation' by the Red Fox. Some local bird extinctions and serious declines (e.g. Bustard) appear to follow the same pattern, however because of their mobility' their changes in abundance are more lik. Feral cats have been present in the region for longer than foxes, and have undoubtedly contributed to the demise of some of these species but the evidence for their role in species decline and extinction is less compelling that that of foxes.

Predation by introduced predators is a recognised key threat to four nationally listed threatened species that still occur on the MT Lands. e.g. Malleefowl, Princess Parrot, Southern Marsupial Mole and Sandhill Dunnart.

Predation pressure increases with fragmentation of habitats. Predators follow vehicle tracks as they are comparatively easy to traverse compared to through natural vegetation where there may be obstacles and rough ground. The unregulated driving of vehicles off established tracks and activities such as the establishment of seismic lines or exploration tracks, effectively allows easier access to areas they would not readily enter, thereby putting previously relatively isolated populations under threats from predators.

Before considering undertaking baiting around threatened species sites, it needs to be established that feral animal predation is having a significant impact on the population (rather than just assumed). Any baiting undertaken needs to be at an appropriate scale, regular and monitored. If the project cannot achieve this over a number of years the baiting is extremely unlikely to be successful and may do more harm than good.

Recommended Actions:

- Predator meat baits should be placed at an appropriate scale and frequency at active Malleefowl nest mounds during the nesting season.
- Baiting in Malleefowl habitats should not be undertaken, if too great a risk of increases in Cat activities in these areas if foxes and dingoes are removed.
- Predator activity should be monitored in all baiting zones, through tracking and data-logging by Anangu using the 'Cybertracker' facility on a hand-held GPS unit. Additionally, establishment of sandplot monitoring would be an effective method of monitoring changes in predator distribution.
- Prepare an appropriate education and training program for implementation of predator management by Anangu.

Hunting pressures

Anangu regularly hunt Red Kangaroo, Emu, and Bustard Sand Goanna and collect Malleefowl eggs. However, there is circumstantial evidence from Anangu observations that success has been decreasing, and hunting pressures, at least around Oak Valley is one of the possible reasons for poor hunting returns.

Recommended Actions:

- Establish "sanctuaries" within which predators are controlled, water is supplied, hunting is excluded, and populations of Red Kangaroos, Emu, Malleefowl and Bustard can increase. These species could then disperse into surrounding areas where hunting could be less restricted. Population and range estimates for each of these 'target' species should be determined at the beginning of the process as a baseline for measuring the effectiveness of the sanctuary concept in the longer term.
- Numbers of chicks produced by Emu and young produced by Red Kangaroos inside and outside of the sanctuaries should also be recorded as indicators.

Threatened species recovery

Threatened species are distributed across many parts of the MT Lands and some of the fauna species require very large areas of habitat to support viable populations. Their management cannot therefore just occur in one or two small and relatively confined areas. However, some significant areas of overlap in distributions of some species offer significant opportunities for recognition of economies of scale in implementing management activities.

Malleefowl occur in a wide range of areas across the MT Lands at very low population densities. Their habitat is highly susceptible to wildfire and has been substantially fragmented or not in some cases the continuity of unburnt vegetation leads to huge fires when the landscape does burn. Their eggs are preyed upon by foxes, and chicks and adults may be taken by foxes, cats, Dingoes and some native predators e.g. goannas. While the frequency of such predation may be relatively low it is a significant concern given the low numbers and densities of Malleefowl present and the high degree of habitat fragmentation.

Recommended Actions:

- All habitats known to be occupied by Malleefowl should be protected with external burnt firebreaks as a matter of urgency. All adjoining areas of potentially suitable habitat that are recovering from fire should also be protected with burnt firebreaks as a matter of priority.

Active Malleefowl nests should be protected from egg predation by foxes (where appropriate), through placement of 1080 meat baits at an appropriate scale and frequency.

- Further survey work should be undertaken to continue to document the distribution of Malleefowl across the MT Lands and to monitor the nesting activity and success at a selected range of known nest sites to determine management priorities (if any management is required).
- Prepare an appropriate education and training program for implementation of Malleefowl monitoring and management by Anangu.
- Establish a threatened and endemic species distribution database to:
    - establish an early warning system, to ensure that something is done immediately once a new species is identified on the lands.
    - identify where significant species are known to occur (and, therefore, also where they are known or suspected to not occur).
    - Use to identify potential for disturbance in the event of developments or activities
- Undertake community awareness program to raise awareness. This could include poster display, information package for new community residents, reporting procedure for new or unusual species occurrences.
- Establish a list of significant threatened species of neighbouring regions and undertake a risk assessment process as part of an early warning system develop a response plan for particular species should they be located on the MT Lands.
- Examine options for managing specific threatened plants/populations at key biodiversity sites, to reduce fire hazard and improve habitat quality:

Southern Marsupial-mole occurs across the MT Lands in sand plain and sand dune habitats, but little is known about its population ecology, its relative abundance or the threats to its survival. This is very difficult research because the animals appear to spend virtually all of their time underground.

Recommended Actions:

- Research on the distribution patterns and population ecology of marsupial-moles must continue;
- An assessment of threats to marsupial-moles should also be made to determine what measures need to be applied;

Australian Bustard has had a significant population decline across the southern half of its known former range that coincides with the documented range of the Red Fox. Hunting pressures by Anangu may also contribute to decreased recruitment rates of chicks hatched within the region.

Recommended Actions:

- Location and date records should be kept of all bustard sightings on the MT Lands and of all nests found and chicks/juvenile birds seen.

Monitoring and reporting

To ensure that land management and biodiversity conservation outcomes are achieved in the most effective way, some important indicators should be 'measured' and reported on, preferably annually. This will require some secure base funding and an investment in basic training to ensure that it occurs. However, the results would provide essential information around which planning and investment can be based on a more logical footing than is possible at present.

The actions below are indicative of the types of monitoring that could be undertaken.

Fire

- Access to appropriate satellite imagery and collated data on patch-burning and firebreak installation work would enable annual maps and total areas of natural fires and management fires to be produced. The area of Malleefowl habitat protected and the area of such habitat lost to fire should be reported each year.

Introduced Herbivores

- Camel population estimates should be obtained through aerial surveys every 5 years or so (in association with surrounding lands) to monitor and report on population trends.
- Camel off-take through mustering/shooting should also be recorded and reported on (by location) annually.
- Observations of RCD outbreaks in the local rabbit population should be recorded and reported on annually.

Weeds

- Record, map and report on localised occurrences of significant environmental weeds and the efficacy of any control actions taken.
- Map major occurrences of environmental weeds (e.g. Buffel Grass) to enable spread to be monitored and action taken as one of the highest priorities,

Water

- Record and map all waterholes and other water sources identified by Anangu and document cleaning and protection measures (e.g. fencing) taken each year.
- Note and report on water sources where camels are causing problems.
- Record drying frequency or longevity or reliability of each water source.

Introduced Predators

- Establish and maintain a simple database record of all predator baiting undertaken (date, location, area, no. of baits) so that this can be reported on annually. This can help determine if, and where, baiting regimes may need to be altered.
- Monitoring of predator activities within baited areas should be undertaken by Anangu using hand-held Cyber-tracker units. Priority should be given to areas around Malleefowl nests.

Threatened Species

- Distribution of known active Malleefowl nests should be mapped and reported on annually.
- Egg hatching success rates should be reported on for a sample of active Malleefowl nests each year.
- Distribution of recent Princess Parrots should be documented and sites revisited to determine/predict habitat preferences more widely across the MT Lands.
- Numbers of marsupial-moles 'recorded/search
- Distribution of threatened plants monitored, particularly after significant rainfall events but also after fires.
- Effort' in all these activities should be reported annually

Training and education

Significant training opportunities would present themselves through development of a range of the management actions recommended above. These could include:

- Patch-burning and burnt fire-break installation to protect critical habitats and threatened species.
- Controlling camels.
- Weed control.
- Rock-hole restoration and protection works, including construction of selective fences (to exclude camels, etc.).
- Predator baiting and predator monitoring using tracking (with recording on a palm-top using Cyber-tracker) and monitoring predators with a network of sandplots.
- Survey and monitoring for, Malleefowl, Southern Marsupial Mole, Sandhill Dunnart , Australian Bustard and threatened or endemic plant populations such as Beadell's Mallee or Ooldea Guinea-flower.
- Maintenance of weed and threatened species database.
- Information from the Biological Survey should, where appropriate, be incorporated into education programmes on the MT Lands to allow students to relate to and value both the traditional ecological knowledge and basic survey results from the area.

FURTHER SURVEY AND RESEARCH

The Biological Survey of the Maralinga Tjarutja Lands was not exhaustive. Ideally, a comprehensive survey would provide a more proportional representation of habitats across their distributional range and with better sampling in good seasons. Given the remoteness of many areas, the cultural sensitivity of others and the fact that the MT Lands cover nearly 11% of South Australia, such an ideal sampling regime was not achieved.

Several parts of the study area were poorly sampled and a few were not sampled at all. In particular, the large expanse on the western side of the MT Lands between the Anne Beadell Highway and the Tjuntjuntjara Track, particularly the palaeodrainage system which continues southwards from Serpentine Lakes. Another location requiring further work is the Mount Davies track which heads northwest from Anne's Corner into the APY Lands

In addition there are other locations south east of Emu that warrant further examination or survey work. Access was also limited to many interesting sand plain, sand dune, limestone plain and outcropping hill areas towards and along the Western Australian border and in the central and southern MT Lands. These should be sampled in a systematic way whenever opportunities arise.

To gain an even better understanding of the plants and animals that contribute to the biological diversity of the MT Lands, more intensive or longer term, repeat sampling is required at selected sites. These sites should preferably be easy to access and should include some sites within recently burnt areas, and others within predator baiting areas, may help in gaining an understanding of the impacts of climate change, fire and introduced predators.

Specific projects should be conducted on the various species highlighted as being of regional conservation significance, and especially those that are considered endangered or vulnerable on the MT Lands. Priority for research and management effort needs to focus on Malleefowl, Princess Parrot, Sandhill Dunnart and

Southern Marsupial Mole. Research projects to clarify distribution anomalies or information gaps should also be considered as opportunities arise. In addition, a sensitivity analysis should be undertaken to identify which taxa and communities are most at risk from climate change, following the methods defined by Westoby and Burgmann (2006).

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Appendix I: List of plant species recorded from the Maralinga Tjarutja Lands, ordered alphabetically by family and species.

FAMILY	***SPECIES***	**COMMON NAME**
ADIANTACEAE	*Cheilanthes lasiophylla*	Woolly Cloak-fern
AIZOACEAE	*Carpobrotus rossii* (NC)	Native Pigface
AIZOACEAE	*Carpobrotus* sp.	Pigface
AIZOACEAE	*Disphyma crassifolium* ssp. *clavellatum*	Round-leaf Pigface
AIZOACEAE	*Galenia pubescens* var. *pubescens*	Coastal Galenia
AIZOACEAE	*Gunniopsis calcarea*	
AIZOACEAE	*Gunniopsis quadrifida*	Sturt's Pigface
AIZOACEAE	*Gunniopsis septifraga*	Green Pigface
AIZOACEAE	*Mesembryanthemum aitonis*	Angled Iceplant
AIZOACEAE	*Mesembryanthemum crystallinum*	Common Iceplant
AIZOACEAE	*Mesembryanthemum nodiflorum*	Slender Iceplant
AIZOACEAE	*Mollugo cerviana*	Wire-stem Chickweed
AIZOACEAE	*Sarcozona bicarinata*	Ridged Noon-flower
AIZOACEAE	*Sarcozona praecox*	Sarcozona
AIZOACEAE	*Tetragonia eremaea*	Desert Spinach
AIZOACEAE	*Tetragonia* sp.	False Spinach
AIZOACEAE	*Trianthema triquetra*	Red Spinach
AMARANTHACEAE	*Amaranthus* sp.	Amaranth
AMARANTHACEAE	*Hemichroa diandra*	Mallee Hemichroa
AMARANTHACEAE	*Hemichroa* sp.	Hemichroa
AMARANTHACEAE	*Ptilotus exaltatus* var.	Pink Mulla Mulla
AMARANTHACEAE	*Ptilotus exaltatus* var. *exaltatus*	Pink Mulla Mulla
AMARANTHACEAE	*Ptilotus gaudichaudii* var.	Paper Fox-tail
AMARANTHACEAE	*Ptilotus gaudichaudii* var. *gaudichaudi*	Paper Fox-tail
AMARANTHACEAE	*Ptilotus helipteroides* var.	Hairy Mulla Mulla
AMARANTHACEAE	*Ptilotus nobilis* var. *nobilis*	Yellow-tails
AMARANTHACEAE	*Ptilotus obovatus* (NC)	
AMARANTHACEAE	*Ptilotus obovatus* var.	Silver Mulla Mulla
AMARANTHACEAE	*Ptilotus obovatus* var. *griseus*	Silver Mulla Mulla
AMARANTHACEAE	*Ptilotus obovatus* var. *obovatus*	Silver Mulla Mulla
AMARANTHACEAE	*Ptilotus polystachyus* var. (NC)	Long-tails
AMARANTHACEAE	*Ptilotus polystachyus* var. *polystachyus*	Long-tails
AMARANTHACEAE	*Ptilotus sessilifolius* var. *sessilifolius*	Crimson-tails
AMARANTHACEAE	*Ptilotus* sp.	Mulla Mulla
ANACARDIACEAE	*Schinus molle*	Pepper-tree
APOCYNACEAE	*Alyxia buxifolia*	Sea Box
APOCYNACEAE	*Nerium oleander*	Oleander
ASCLEPIADACEAE	*Cynanchum floribundum*	Desert Cynanchum
ASCLEPIADACEAE	*Marsdenia australis*	Native Pear
ASCLEPIADACEAE	*Rhyncharrhena linearis*	Bush Bean
ASCLEPIADACEAE	*Sarcostemma viminale* ssp. *australe*	Caustic Bush
BORAGINACEAE	*Echium plantagineum*	Salvation Jane
BORAGINACEAE	*Halgania cyanea*	Rough Blue-flower
BORAGINACEAE	*Heliotropium europaeum*	Common Heliotrope
BORAGINACEAE	*Omphalolappula concava*	Burr Stickseed
BORAGINACEAE	*Plagiobothrys plurisepaleus*	White Rochelia
BORAGINACEAE	*Trichodesma zeylanicum*	Camel Bush
CAMPANULACEAE	*Lobelia heterophylla*	
CAMPANULACEAE	*Lobelia* sp.	Lobelia
CAMPANULACEAE	*Wahlenbergia tumidifructa*	Swollen-fruit Bluebell

CASUARINACEAE	*Allocasuarina helmsii*	Helm's Oak-bush
CASUARINACEAE	*Allocasuarina* sp.	Sheoak/Oak-bush
CASUARINACEAE	*Casuarina pauper*	Black Oak
CHENOPODIACEAE	*Atriplex acutibractea* ssp.	Pointed Saltbush
CHENOPODIACEAE	*Atriplex acutibractea* ssp. *acutibracte*	Pointed Saltbush
CHENOPODIACEAE	*Atriplex acutibractea* ssp. *karoniensis*	Pointed Saltbush
CHENOPODIACEAE	*Atriplex cinerea*	Coast Saltbush
CHENOPODIACEAE	*Atriplex cryptocarpa*	
CHENOPODIACEAE	*Atriplex eardleyae*	Eardley's Saltbush
CHENOPODIACEAE	*Atriplex holocarpa*	Pop Saltbush
CHENOPODIACEAE	*Atriplex leptocarpa*	Slender-fruit Saltbush
CHENOPODIACEAE	*Atriplex morrisii*	
CHENOPODIACEAE	*Atriplex paludosa* ssp. *cordata*	Marsh Saltbush
CHENOPODIACEAE	*Atriplex pumilio*	Mat Saltbush
CHENOPODIACEAE	*Atriplex* sp.	Saltbush
CHENOPODIACEAE	*Atriplex spongiosa*	Pop Saltbush
CHENOPODIACEAE	*Atriplex stipitata*	Bitter Saltbush
CHENOPODIACEAE	*Atriplex velutinella*	Sandhill Saltbush
CHENOPODIACEAE	*Atriplex vesicaria* (NC)	
CHENOPODIACEAE	*Atriplex vesicaria* ssp.	Bladder Saltbush
CHENOPODIACEAE	*Chenopodiaceae* sp.	Goosefoot Family
CHENOPODIACEAE	*Chenopodium cristatum*	Crested Goosefoot
CHENOPODIACEAE	*Chenopodium curvispicatum*	Cottony Goosefoot
CHENOPODIACEAE	*Chenopodium desertorum* ssp.	Desert Goosefoot
CHENOPODIACEAE	*Chenopodium desertorum* ssp. *desertorum*	Frosted Goosefoot
CHENOPODIACEAE	*Chenopodium desertorum* ssp. *microphyll*	Small-leaf Goosefoot
CHENOPODIACEAE	*Chenopodium desertorum* ssp. *rectum*	Erect Goosefoot
CHENOPODIACEAE	*Chenopodium gaudichaudianum*	Scrambling Goosefoot
CHENOPODIACEAE	*Chenopodium melanocarpum f.*	Black-fruit Goosefoot
CHENOPODIACEAE	*Chenopodium melanocarpum f. melanocarpum*	Black-fruit Goosefoot
CHENOPODIACEAE	*Chenopodium murale*	Nettle-leaf Goosefoot
CHENOPODIACEAE	*Chenopodium nitrariaceum*	Nitre Goosefoot
CHENOPODIACEAE	*Chenopodium* sp.	Goosefoot
CHENOPODIACEAE	*Chenopodium truncatum*	
CHENOPODIACEAE	*Dissocarpus paradoxus*	Ball Bindyi
CHENOPODIACEAE	*Dysphania kalpari*	Rats' Tails
CHENOPODIACEAE	*Dysphania plantaginella*	Plantain Crumbweed
CHENOPODIACEAE	*Dysphania platycarpa*	Flat-fruit Crumbweed
CHENOPODIACEAE	*Dysphania simulans*	Erect Crumbweed
CHENOPODIACEAE	*Einadia nutans* ssp.	Climbing Saltbush
CHENOPODIACEAE	*Einadia nutans* ssp. *eremaea*	Dryland Climbing Saltbus
CHENOPODIACEAE	*Einadia nutans* ssp. *nutans*	Climbing Saltbush
CHENOPODIACEAE	*Enchylaena tomentosa* var.	Ruby Saltbush
CHENOPODIACEAE	*Enchylaena tomentosa* var. *tomentosa*	Ruby Saltbush
CHENOPODIACEAE	*Eremophea spinosa*	
CHENOPODIACEAE	*Eriochiton sclerolaenoides*	Woolly-fruit Bluebush
CHENOPODIACEAE	*Maireana appressa*	Pale-fruit Bluebush
CHENOPODIACEAE	*Maireana astrotricha*	Low Bluebush
CHENOPODIACEAE	*Maireana brevifolia*	Short-leaf Bluebush
CHENOPODIACEAE	*Maireana campanulata*	Bell-fruit Bluebush
CHENOPODIACEAE	*Maireana erioclada*	Rosy Bluebush
CHENOPODIACEAE	*Maireana georgei*	Satiny Bluebush
CHENOPODIACEAE	*Maireana georgei/turbinata*	Satiny Bluebush
CHENOPODIACEAE	*Maireana integra*	Entire-wing Bluebush

CHENOPODIACEAE	*Maireana lobiflora*	Lobed Bluebush
CHENOPODIACEAE	*Maireana melanocarpa*	Black-fruit Bluebush
CHENOPODIACEAE	*Maireana oppositifolia*	Salt Bluebush
CHENOPODIACEAE	*Maireana ovata*	
CHENOPODIACEAE	*Maireana pentatropis*	Erect Mallee Bluebush
CHENOPODIACEAE	*Maireana planifolia*	Flat-leaf Bluebush
CHENOPODIACEAE	*Maireana pyramidata*	Black Bluebush
CHENOPODIACEAE	*Maireana radiata*	Radiate Bluebush
CHENOPODIACEAE	*Maireana scleroptera*	Hard-wing Bluebush
CHENOPODIACEAE	*Maireana sedifolia*	Bluebush
CHENOPODIACEAE	*Maireana* sp.	Bluebush/Fissure-plant
CHENOPODIACEAE	*Maireana spongiocarpa*	Spongy-fruit Bluebush
CHENOPODIACEAE	*Maireana tomentosa* ssp. *urceolata*	
CHENOPODIACEAE	*Maireana trichoptera*	Hairy-fruit Bluebush
CHENOPODIACEAE	*Maireana triptera*	Three-wing Bluebush
CHENOPODIACEAE	*Maireana turbinata*	Top-fruit Bluebush
CHENOPODIACEAE	*Maireana villosa*	Silky Bluebush
CHENOPODIACEAE	*Osteocarpum acropterum* var. *acropterum*	Tuberculate Bonefruit
CHENOPODIACEAE	*Osteocarpum salsuginosum*	Inland Bonefruit
CHENOPODIACEAE	*Osteocarpum* sp.	Bonefruit
CHENOPODIACEAE	*Rhagodia candolleana* ssp. *argentea*	Silver Sea-berry Saltbus
CHENOPODIACEAE	*Rhagodia crassifolia*	Fleshy Saltbush
CHENOPODIACEAE	*Rhagodia drummondii*	Drummond's Saltbush
CHENOPODIACEAE	*Rhagodia eremaea*	Desert Saltbush
CHENOPODIACEAE	*Rhagodia parabolica*	Mealy Saltbush
CHENOPODIACEAE	*Rhagodia preissii* ssp. *preissii*	Mallee Saltbush
CHENOPODIACEAE	*Rhagodia* sp.	Saltbush
CHENOPODIACEAE	*Rhagodia spinescens*	Spiny Saltbush
CHENOPODIACEAE	*Rhagodia ulicina*	Intricate Saltbush
CHENOPODIACEAE	*Salsola tragus*	Buckbush
CHENOPODIACEAE	*Sclerolaena blackiana*	Black's Bindyi
CHENOPODIACEAE	*Sclerolaena brachyptera*	Short-wing Bindyi
CHENOPODIACEAE	*Sclerolaena brevifolia*	Small-leaf Bindyi
CHENOPODIACEAE	*Sclerolaena clelandii*	Cleland's Bindyi
CHENOPODIACEAE	*Sclerolaena convexula*	Tall Bindyi
CHENOPODIACEAE	*Sclerolaena costata*	Ribbed Bindyi
CHENOPODIACEAE	*Sclerolaena decurrens*	Green Bindyi
CHENOPODIACEAE	*Sclerolaena deserticola*	Desert Bindyi
CHENOPODIACEAE	*Sclerolaena diacantha*	Grey Bindyi
CHENOPODIACEAE	*Sclerolaena divaricata*	Tangled Bindyi
CHENOPODIACEAE	*Sclerolaena eriacantha*	Silky Bindyi
CHENOPODIACEAE	*Sclerolaena fusiformis*	
CHENOPODIACEAE	*Sclerolaena holtiana*	Holt's Bindyi
CHENOPODIACEAE	*Sclerolaena johnsonii*	Johnson's Bindyi
CHENOPODIACEAE	*Sclerolaena limbata*	Pearl Bindyi
CHENOPODIACEAE	*Sclerolaena muricata* var. *muricata*	Five-spine Bindyi
CHENOPODIACEAE	*Sclerolaena obliquicuspis*	Oblique-spined Bindyi
CHENOPODIACEAE	*Sclerolaena parallelicuspis*	Western Bindyi
CHENOPODIACEAE	*Sclerolaena parviflora*	Small-flower Bindyi
CHENOPODIACEAE	*Sclerolaena patenticuspis*	Spear-fruit Bindyi
CHENOPODIACEAE	*Sclerolaena* sp.	Bindyi
CHENOPODIACEAE	*Sclerolaena symoniana*	Symon's Bindyi
CHENOPODIACEAE	*Sclerolaena uniflora*	Small-spine Bindyi
CHENOPODIACEAE	*Tecticornia arbuscula*	Shrubby Samphire

CHENOPODIACEAE	*Tecticornia disarticulata*	
CHENOPODIACEAE	*Tecticornia halocnemoides* ssp.	Grey Samphire
CHENOPODIACEAE	*Tecticornia halocnemoides* ssp. *halocnememoides*	Grey Samphire
CHENOPODIACEAE	*Tecticornia halocnemoides* ssp. *tenuis*	
CHENOPODIACEAE	*Tecticornia indica* ssp. *bidens*	Brown-head Samphire
CHENOPODIACEAE	*Tecticornia indica* ssp. *leiostachya*	Brown-head Samphire
CHENOPODIACEAE	*Tecticornia lylei*	Wiry Samphire
CHENOPODIACEAE	*Tecticornia pergranulata* ssp. *pergranulata*	Black-seed Samphire
CHENOPODIACEAE	*Tecticornia pruinosa*	Bluish Samphire
CHENOPODIACEAE	*Tecticornia* sp.	Samphire
CHENOPODIACEAE	*Tecticornia tenuis*	Slender Samphire
CHLOANTHACEAE	*Dicrastylis beveridgei* var.	Sand-sage
CHLOANTHACEAE	*Dicrastylis beveridgei* var. *beveridgei*	Sand-sage
CHLOANTHACEAE	*Dicrastylis beveridgei* var. *lanata*	Woolly Sand-sage
CHLOANTHACEAE	*Dicrastylis lewellinii*	Purple Sand-sage
CHLOANTHACEAE	*Newcastelia bracteosa*	
CHLOANTHACEAE	*Newcastelia spodiotricha*	
CHLOANTHACEAE	*Spartothamnella teucriiflora*	Bead Bush
COMPOSITAE	*Actinobole uliginosum*	Flannel Cudweed
COMPOSITAE	*Anemocarpa podolepidium*	Rock Everlasting
COMPOSITAE	*Anemocarpa saxatilis*	Hill Sunray
COMPOSITAE	*Angianthus brachypappus*	Spreading Angianthus
COMPOSITAE	*Angianthus conocephalus*	
COMPOSITAE	*Brachyscome ciliaris* var.	Variable Daisy
COMPOSITAE	*Brachyscome ciliaris* var. *ciliaris*	Variable Daisy
COMPOSITAE	*Brachyscome ciliaris* var. *lanuginosa*	Woolly Variable Daisy
COMPOSITAE	*Brachyscome ciliaris* var. *subintegrifolia*	
COMPOSITAE	*Brachyscome iberidifolia*	Swan River Daisy
COMPOSITAE	*Brachyscome trachycarpa*	Smooth Daisy
COMPOSITAE	*Calotis breviradiata*	
COMPOSITAE	*Calotis cymbacantha*	Showy Burr-daisy
COMPOSITAE	*Calotis erinacea*	Tangled Burr-daisy
COMPOSITAE	*Calotis hispidula*	Hairy Burr-daisy
COMPOSITAE	*Calotis multicaulis*	Woolly-headed Burr-daisy
COMPOSITAE	*Calotis plumulifera*	Woolly-headed Burr-daisy
COMPOSITAE	*Centipeda thespidioides*	Desert Sneezeweed
COMPOSITAE	*Centipeda thespidioides* (NC)	Desert Sneezeweed
COMPOSITAE	*Cephalipterum drummondii*	Pompom Head
COMPOSITAE	*Chrysocephalum apiculatum*	Common Everlasting
COMPOSITAE	*Chrysocephalum eremaeum*	Sand Button-bush
COMPOSITAE	*Chrysocephalum pterochaetum*	Shrub Everlasting
COMPOSITAE	*Chrysocephalum semipapposum*	Clustered Everlasting
COMPOSITAE	*Chthonocephalus pseudevax*	Ground-heads
COMPOSITAE	*Compositae* sp.	Daisy Family
COMPOSITAE	*Craspedia* sp.	
COMPOSITAE	*Cratystylis conocephala*	Bluebush Daisy
COMPOSITAE	*Elachanthus pusillus*	Elachanth
COMPOSITAE	*Eriochlamys behrii*	Woolly Mantle
COMPOSITAE	*Erodiophyllum elderi*	Koonamore Daisy
COMPOSITAE	*Erymophyllum ramosum* ssp. *ramosum*	
COMPOSITAE	*Gnephosis arachnoidea*	Spidery Button-flower
COMPOSITAE	*Gnephosis eriocarpa*	Native Camomile
COMPOSITAE	*Gnephosis tenuissima*	Dwarf Golden-tip
COMPOSITAE	*Gratwickia monochaeta*	

COMPOSITAE	*Hedypnois rhagadioloides* (NC)	Cretan Weed
COMPOSITAE	*Isoetopsis graminifolia*	Grass Cushion
COMPOSITAE	*Ixiochlamys filicifolia*	
COMPOSITAE	*Ixiochlamys nana*	Small Fuzzweed
COMPOSITAE	*Kippistia suaedifolia*	Fleshy Kippistia
COMPOSITAE	*Lactuca serriola* (NC)	Prickly Lettuce
COMPOSITAE	*Lawrencella davenportii*	Davenport Daisy
COMPOSITAE	*Leiocarpa semicalva* ssp. *semicalva*	Scented Button-bush
COMPOSITAE	*Leiocarpa tomentosa*	Woolly Plover-daisy
COMPOSITAE	*Lemooria burkittii*	Wires-and-wool
COMPOSITAE	*Leptorhynchos baileyi*	Bailey's Buttons
COMPOSITAE	*Leucochrysum fitzgibbonii*	Fitzgibbon's Daisy
COMPOSITAE	*Leucochrysum stipitatum*	Salt-spoon Daisy
COMPOSITAE	*Millotia greevesii* ssp. *helmsii*	
COMPOSITAE	*Millotia incurva*	
COMPOSITAE	*Millotia muelleri*	Common Bow-flower
COMPOSITAE	*Millotia perpusilla*	Tiny Bow-flower
COMPOSITAE	*Minuria annua*	Annual Minuria
COMPOSITAE	*Minuria cunninghamii*	Bush Minuria
COMPOSITAE	*Minuria denticulata*	Woolly Minuria
COMPOSITAE	*Minuria integerrima*	Smooth Minuria
COMPOSITAE	*Minuria leptophylla*	Minnie Daisy
COMPOSITAE	*Minuria multiseta*	
COMPOSITAE	*Minuria* sp.	Minuria
COMPOSITAE	*Olearia arida*	Desert Daisy-bush
COMPOSITAE	*Olearia exiguifolia*	Lobed-leaf Daisy-bush
COMPOSITAE	*Olearia muelleri*	Mueller's Daisy-bush
COMPOSITAE	*Olearia pannosa* ssp. *pannosa*	Silver Daisy-bush
COMPOSITAE	*Olearia pimeleoides* ssp. *incana*	Showy Daisy-bush
COMPOSITAE	*Olearia ramulosa*	Twiggy Daisy-bush
COMPOSITAE	*Olearia* sp.	Daisy-bush
COMPOSITAE	*Olearia subspicata*	Spiked Daisy-bush
COMPOSITAE	*Oligocarpus calendulaceus*	
COMPOSITAE	*Podolepis canescens*	Grey Copper-wire Daisy
COMPOSITAE	*Podolepis capillaris*	Wiry Podolepis
COMPOSITAE	*Podolepis jaceoides*	Showy Copper-wire Daisy
COMPOSITAE	*Podolepis longipedata*	Tall Copper-wire Daisy
COMPOSITAE	*Podolepis rugata* var. *rugata*	Pleated Copper-wire Daisy
COMPOSITAE	*Podotheca angustifolia*	Sticky Long-heads
COMPOSITAE	*Polycalymma stuartii*	Poached-egg Daisy
COMPOSITAE	*Pycnosorus pleiocephalus*	Soft Billy-buttons
COMPOSITAE	*Rhodanthe chlorocephala* ssp. *rosea*	Western Sunray
COMPOSITAE	*Rhodanthe citrina*	Pale Immortelle
COMPOSITAE	*Rhodanthe corymbiflora*	Paper Everlasting
COMPOSITAE	*Rhodanthe floribunda*	White Everlasting
COMPOSITAE	*Rhodanthe haigii*	Haig's Everlasting
COMPOSITAE	*Rhodanthe moschata*	Musk Daisy
COMPOSITAE	*Rhodanthe pygmaea*	Pigmy Daisy
COMPOSITAE	*Rhodanthe* sp.	Everlasting
COMPOSITAE	*Rhodanthe stricta*	Slender Everlasting
COMPOSITAE	*Rhodanthe tietkensii*	Tietken's Daisy
COMPOSITAE	*Rutidosis helichrysoides* ssp. *helichrysoides*	Grey Wrinklewort
COMPOSITAE	*Schoenia ayersii*	Ayer's Button-daisy
COMPOSITAE	*Schoenia cassiniana*	Pink Everlasting

COMPOSITAE	*Senecio glossanthus*	Annual Groundsel
COMPOSITAE	*Senecio glossanthus* (NC)	Annual Groundsel
COMPOSITAE	*Senecio gregorii*	Fleshy Groundsel
COMPOSITAE	*Senecio pinnatifolius*	Variable Groundsel
COMPOSITAE	*Senecio* sp.	Groundsel
COMPOSITAE	*Sonchus oleraceus*	Common Sow-thistle
COMPOSITAE	*Sonchus oleraceus* (NC)	Common Sow-thistle
COMPOSITAE	*Sonchus* sp.	Sow-thistle
COMPOSITAE	*Streptoglossa liatroides*	Wertaloona Daisy
COMPOSITAE	*Trichanthodium skirrophorum*	Woolly Yellow-heads
COMPOSITAE	*Tripteris clandestina*	Tripteris
COMPOSITAE	*Triptilodiscus pygmaeus*	Small Yellow-heads
COMPOSITAE	*Vittadinia arida*	
COMPOSITAE	*Vittadinia australasica* var. *australasica*	Sticky New Holland Daisy
COMPOSITAE	*Vittadinia cervicularis* var. *cervicularis*	Waisted New Holland Dais
COMPOSITAE	*Vittadinia dissecta* var. *hirta*	Dissected New Holland Da
COMPOSITAE	*Vittadinia eremaea*	Desert New Holland Daisy
COMPOSITAE	*Vittadinia gracilis*	Woolly New Holland Daisy
COMPOSITAE	*Vittadinia nullarborensis*	Nullarbor New Holland Da
COMPOSITAE	*Vittadinia pustulata*	Ridged New Holland Daisy
COMPOSITAE	*Vittadinia* sp.	New Holland Daisy
COMPOSITAE	*Vittadinia sulcata*	Furrowed New Holland Dai
COMPOSITAE	*Waitzia acuminata* var. *acuminata*	Orange Immortelle
COMPOSITAE	*Xerochrysum bracteatum*	Golden Everlasting
CONVOLVULACEAE	*Convolvulus clementii*	
CONVOLVULACEAE	*Convolvulus erubescens* (NC)	Australian Bindweed
CONVOLVULACEAE	*Convolvulus remotus*	Grassy Bindweed
CONVOLVULACEAE	*Convolvulus* sp.	Bindweed
CRASSULACEAE	*Crassula colorata* var. *acuminata*	Dense Crassula
CRASSULACEAE	*Crassula colorata* var. *colorata*	Dense Crassula
CRUCIFERAE	*Arabidella filifolia*	Thread-leaf Cress
CRUCIFERAE	*Arabidella glaucescens*	
CRUCIFERAE	*Arabidella trisecta*	Shrubby Cress
CRUCIFERAE	*Blennodia canescens*	Native Stock
CRUCIFERAE	*Blennodia pterosperma*	Wild Stock
CRUCIFERAE	*Brassica tournefortii*	Wild Turnip
CRUCIFERAE	*Carrichtera annua*	Ward's Weed
CRUCIFERAE	*Harmsiodoxa blennodioides*	Hairy-pod Cress
CRUCIFERAE	*Harmsiodoxa brevipes* var. *brevipes*	Short Cress
CRUCIFERAE	*Lepidium africanum*	Common Peppercress
CRUCIFERAE	*Lepidium draba* (NC)	Hoary Cress
CRUCIFERAE	*Lepidium fasciculatum*	Bundled Peppercress
CRUCIFERAE	*Lepidium muelleri-ferdinandii*	Mueller's Peppercress
CRUCIFERAE	*Lepidium oxytrichum*	Green Peppercress
CRUCIFERAE	*Lepidium phlebopetalum*	Veined Peppercress
CRUCIFERAE	*Lepidium rotundum*	Veined Peppercress
CRUCIFERAE	*Lepidium sagittulatum*	Fine-leaf Peppercress
CRUCIFERAE	*Lepidium* sp.	Peppercress
CRUCIFERAE	*Menkea australis*	Fairy Spectacles
CRUCIFERAE	*Menkea crassa*	Fat Spectacles
CRUCIFERAE	*Menkea sphaerocarpa*	
CRUCIFERAE	*Phlegmatospermum cochlearinum*	Downy Cress
CRUCIFERAE	*Phlegmatospermum eremaeum*	Spreading Cress
CRUCIFERAE	*Sisymbrium erysimoides*	Smooth Mustard

CRUCIFERAE	*Sisymbrium irio*	London Mustard
CRUCIFERAE	*Sisymbrium orientale*	Indian Hedge Mustard
CRUCIFERAE	*Stenopetalum anfractum*	Inland Thread-petal
CRUCIFERAE	*Stenopetalum lineare*	Narrow Thread-petal
CRUCIFERAE	*Stenopetalum nutans*	Nodding Thread-petal
CRUCIFERAE	*Stenopetalum sphaerocarpum*	Round-fruit Thread-petal
CRUCIFERAE	*Stenopetalum velutinum*	Velvet Thread-petal
CUCURBITACEAE	*Citrullus colocynthis*	Colocynth
CUCURBITACEAE	*Cucumis myriocarpus*	Paddy Melon
CUPRESSACEAE	*Callitris glaucophylla*	White Cypress-pine
CUPRESSACEAE	*Callitris* sp.	Native Pine
CUPRESSACEAE	*Callitris verrucosa*	Scrub Cypress Pine
CYPERACEAE	*Cyperus rigidellus*	Dwarf Flat-sedge
CYPERACEAE	*Fimbristylis dichotoma*	Common Fringe-rush
DILLENIACEAE	*Hibbertia crispula*	Ooldea Guinea-flower
EUPHORBIACEAE	*Adriana urticoides* var. *hookeri*	Mallee Bitter-bush
EUPHORBIACEAE	*Beyeria opaca*	Dark Turpentine Bush
EUPHORBIACEAE	*Chamaesyce drummondii*	
EUPHORBIACEAE	*Chamaesyce drummondii* (NC)	Caustic Weed
EUPHORBIACEAE	*Chamaesyce inappendiculata*	
EUPHORBIACEAE	*Chamaesyce wheeleri*	Wheeler's Spurge
EUPHORBIACEAE	*Euphorbia* sp.	Spurge
EUPHORBIACEAE	*Euphorbia tannensis* ssp. *eremophila*	Desert Spurge
EUPHORBIACEAE	*Phyllanthus lacunarius* (NC)	Lagoon Spurge
EUPHORBIACEAE	*Poranthera microphylla* (NC)	Small Poranthera
FRANKENIACEAE	*Frankenia cinerea*	
FRANKENIACEAE	*Frankenia cordata*	
FRANKENIACEAE	*Frankenia foliosa*	Leafy Sea-heath
FRANKENIACEAE	*Frankenia pauciflora* var.	Southern Sea-heath
FRANKENIACEAE	*Frankenia serpyllifolia*	Thyme Sea-heath
FRANKENIACEAE	*Frankenia* sp.	Sea-heath
GERANIACEAE	*Erodium angustilobum* (NC)	
GERANIACEAE	*Erodium aureum*	
GERANIACEAE	*Erodium carolinianum*	Clammy Heron's-bill
GERANIACEAE	*Erodium crinitum*	Blue Heron's-bill
GERANIACEAE	*Erodium cygnorum*	Blue Heron's-bill
GERANIACEAE	*Erodium cygnorum* ssp. (NC)	Blue Heron's-bill
GERANIACEAE	*Erodium cygnorum* ssp. *cygnorum* (NC)	Blue Heron's-bill
GERANIACEAE	*Erodium cygnorum* ssp. *glandulosum* (NC)	Clammy Heron's-bill
GERANIACEAE	*Erodium* sp.	Heron's-bill/Crowfoot
GOODENIACEAE	*Brunonia australis*	Blue Pincushion
GOODENIACEAE	*Coopernookia strophiolata*	Sticky Coopernookia
GOODENIACEAE	*Dampiera lanceolata* var. *intermedia*	Aldinga Dampiera
GOODENIACEAE	*Dampiera lanceolata* var. *lanceolata*	Grooved Dampiera
GOODENIACEAE	*Dampiera ramosa*	
GOODENIACEAE	*Goodenia berardiana*	Split-end Goodenia
GOODENIACEAE	*Goodenia blackiana*	Native Primrose
GOODENIACEAE	*Goodenia centralis*	
GOODENIACEAE	*Goodenia cycloptera*	Serrated Goodenia
GOODENIACEAE	*Goodenia fascicularis*	Silky Goodenia
GOODENIACEAE	*Goodenia geniculata*	Bent Goodenia
GOODENIACEAE	*Goodenia glabra*	Smooth Goodenia
GOODENIACEAE	*Goodenia glandulosa*	
GOODENIACEAE	*Goodenia gypsicola*	

GOODENIACEAE	*Goodenia havilandii*	Hill Goodenia
GOODENIACEAE	*Goodenia hirsuta*	
GOODENIACEAE	*Goodenia larapinta*	
GOODENIACEAE	*Goodenia occidentalis*	
GOODENIACEAE	*Goodenia pinnatifida*	Cut-leaf Goodenia
GOODENIACEAE	*Goodenia pusilliflora*	Small-flower Goodenia
GOODENIACEAE	*Goodenia* sp.	Goodenia
GOODENIACEAE	*Goodenia xanthosperma*	Yellow-seed Goodenia
GOODENIACEAE	*Lechenaultia divaricata*	Tangled Lechenaultia
GOODENIACEAE	*Lechenaultia striata*	Striate Lechenaultia
GOODENIACEAE	*Scaevola amblyanthera* var. *centralis*	
GOODENIACEAE	*Scaevola basedowii*	Leafless Fanflower
GOODENIACEAE	*Scaevola collaris*	
GOODENIACEAE	*Scaevola collina*	Hill Fanflower
GOODENIACEAE	*Scaevola depauperata*	Skeleton Fanflower
GOODENIACEAE	*Scaevola humilis*	Inland Fanflower
GOODENIACEAE	*Scaevola parvibarbata*	Small-beard Fanflower
GOODENIACEAE	*Scaevola parvifolia* ssp. *parvifolia*	Camel Weed
GOODENIACEAE	*Scaevola* sp.	Fanflower
GOODENIACEAE	*Scaevola spinescens*	Spiny Fanflower
GOODENIACEAE	*Velleia arguta*	Toothed Velleia
GOODENIACEAE	*Velleia connata*	Cup Velleia
GOODENIACEAE	*Velleia glabrata*	Smooth Velleia
GRAMINEAE	*Amphipogon caricinus* var. *caricinus*	Long Grey-beard Grass
GRAMINEAE	*Aristida contorta*	Curly Wire-grass
GRAMINEAE	*Aristida holathera* var. *holathera*	Tall Kerosene Grass
GRAMINEAE	*Aristida* sp.	Three-awn/Wire-grass
GRAMINEAE	*Astrebla pectinata*	Barley Mitchell-grass
GRAMINEAE	*Austrodanthonia auriculata*	Lobed Wallaby-grass
GRAMINEAE	*Austrodanthonia caespitosa*	Common Wallaby-grass
GRAMINEAE	*Austrodanthonia setacea*	Small-flower Wallaby-gra
GRAMINEAE	*Austrodanthonia* sp.	
GRAMINEAE	*Austrostipa dongicola*	
GRAMINEAE	*Austrostipa elegantissima*	Feather Spear-grass
GRAMINEAE	*Austrostipa nitida*	Balcarra Spear-grass
GRAMINEAE	*Austrostipa nullanulla*	Club Spear-grass
GRAMINEAE	*Austrostipa platychaeta*	Flat-awn Spear-grass
GRAMINEAE	*Austrostipa puberula*	Fine-hairy Spear-grass
GRAMINEAE	*Austrostipa scabra* ssp.	Rough Spear-grass
GRAMINEAE	*Austrostipa scabra* ssp. *falcata*	Slender Spear-grass
GRAMINEAE	*Austrostipa scabra* ssp. *scabra*	Rough Spear-grass
GRAMINEAE	*Austrostipa* sp.	Spear-grass
GRAMINEAE	*Austrostipa tenuifolia*	
GRAMINEAE	*Avena barbata*	Bearded Oat
GRAMINEAE	*Avena fatua*	Wild Oat
GRAMINEAE	*Avena sativa*	Cultivated Oat
GRAMINEAE	*Brachyachne ciliaris*	Hairy Native Couch
GRAMINEAE	*Bromus rubens*	Red Brome
GRAMINEAE	*Cenchrus ciliaris*	Buffel Grass
GRAMINEAE	*Cynodon dactylon* (NC)	Couch
GRAMINEAE	*Dactyloctenium radulans*	Button-grass
GRAMINEAE	*Danthonia* sp. (NC)	Wallaby-grass
GRAMINEAE	*Digitaria ammophila*	Spider Grass
GRAMINEAE	*Digitaria brownii*	Cotton Panic-grass

GRAMINEAE	*Digitaria coenicola*	Spider Grass
GRAMINEAE	*Enneapogon avenaceus*	Common Bottle-washers
GRAMINEAE	*Enneapogon caerulescens* var. *caerulescens*	Blue Bottle-washers
GRAMINEAE	*Enneapogon cylindricus*	Jointed Bottle-washers
GRAMINEAE	*Enneapogon intermedius*	Tall Bottle-washers
GRAMINEAE	*Enneapogon nigricans*	Black-head Grass
GRAMINEAE	*Enneapogon polyphyllus*	Leafy Bottle-washers
GRAMINEAE	*Enneapogon robustissimus*	Cleland's Nineawn
GRAMINEAE	*Enneapogon* sp.	Bottle-washers/Nineawn
GRAMINEAE	*Enteropogon ramosus*	Umbrella Grass
GRAMINEAE	*Eragrostis australasica*	Cane-grass
GRAMINEAE	*Eragrostis dielsii* var. *dielsii*	Mulka
GRAMINEAE	*Eragrostis eriopoda*	Woollybutt
GRAMINEAE	*Eragrostis falcata*	Sickle Love-grass
GRAMINEAE	*Eragrostis laniflora*	Hairy-flower Woollybutt
GRAMINEAE	*Eragrostis lanipes*	Woollybutt
GRAMINEAE	*Eragrostis leptocarpa*	Drooping Love-grass
GRAMINEAE	*Eragrostis pergracilis*	Small Love-grass
GRAMINEAE	*Eragrostis setifolia*	Bristly Love-grass
GRAMINEAE	*Eragrostis* sp.	Love-grass
GRAMINEAE	*Eragrostis xerophila*	Knotty-butt Neverfail
GRAMINEAE	*Eriachne helmsii*	Woollybutt Wanderrie
GRAMINEAE	*Eriachne mucronata*	Mountain Wanderrie
GRAMINEAE	*Eriachne pulchella* ssp. *pulchella*	Pretty Wanderrie Grass
GRAMINEAE	*Eriachne* sp.	Wanderrie Grass
GRAMINEAE	*Gramineae* sp.	Grass Family
GRAMINEAE	*Hordeum glaucum*	Blue Barley-grass
GRAMINEAE	*Hordeum hystrix*	Mediterranean Barley-gra
GRAMINEAE	*Hordeum leporinum*	Wall Barley-grass
GRAMINEAE	*Lolium rigidum*	Wimmera Ryegrass
GRAMINEAE	*Monachather paradoxus*	Bandicoot Grass
GRAMINEAE	*Neurachne munroi*	Window Mulga-grass
GRAMINEAE	*Neurachne* sp.	Mulga-grass
GRAMINEAE	*Panicum effusum* var. *effusum*	Hairy Panic
GRAMINEAE	*Paractaenum novae-hollandiae* ssp. *reversum*	Barbed-wire Grass
GRAMINEAE	*Paractaenum refractum*	Bristle-brush Grass
GRAMINEAE	*Paspalidium* sp.	Summer-grass
GRAMINEAE	*Rostraria pumila*	Tiny Bristle-grass
GRAMINEAE	*Schismus arabicus*	Arabian Grass
GRAMINEAE	*Schismus barbatus*	Arabian Grass
GRAMINEAE	*Setaria basiclada*	
GRAMINEAE	*Setaria clementii*	Clement's Paspalidium
GRAMINEAE	*Setaria constricta*	Knotty-butt Paspalidium
GRAMINEAE	*Setaria parviflora*	Slender Pigeon-grass
GRAMINEAE	*Setaria reflexa*	
GRAMINEAE	*Setaria* sp.	Pigeon-grass
GRAMINEAE	*Sorghum bicolor*	Grain Sorghum
GRAMINEAE	*Thyridolepis mitchelliana*	Window Mulga-grass
GRAMINEAE	*Thyridolepis multiculmis*	
GRAMINEAE	*Thyridolepis* sp.	
GRAMINEAE	*Thyridolepis xerophila*	
GRAMINEAE	*Tragus australianus*	Small Burr-grass
GRAMINEAE	*Triodia basedowii*	Hard Spinifex
GRAMINEAE	*Triodia helmsii*	Helm's Spinifex

GRAMINEAE	*Triodia irritans*	Spinifex
GRAMINEAE	*Triodia lanata*	Woolly Spinifex
GRAMINEAE	*Triodia lanigera*	Spinifex
GRAMINEAE	*Triodia melvillei*	Melville's Spinifex
GRAMINEAE	*Triodia scariosa*	Spinifex
GRAMINEAE	*Triodia* sp.	
GRAMINEAE	*Triodia* sp. (NC)	Spinifex
GRAMINEAE	*Triodia truncata*	Spinifex
GRAMINEAE	*Tripogon loliiformis*	Five-minute Grass
GRAMINEAE	*Triraphis mollis*	Purple Plume Grass
GYROSTEMONACEAE	*Codonocarpus cotinifolius*	Desert Poplar
GYROSTEMONACEAE	*Gyrostemon ramulosus*	Bushy Wheel-fruit
HALORAGACEAE	*Glischrocaryon aureum* var. *angustifolium*	Golden Pennants
HALORAGACEAE	*Gonocarpus* sp.	Raspwort
HALORAGACEAE	*Haloragis gossei*	Gosse's Raspwort
HALORAGACEAE	*Haloragis odontocarpa f.*	Mulga Nettle
HALORAGACEAE	*Haloragis odontocarpa f. pterocarpa*	Mulga Nettle
HALORAGACEAE	*Haloragis odontocarpa f. rugosa*	Mulga Nettle
HALORAGACEAE	*Haloragis* sp.	Raspwort
JUNCAGINACEAE	*Triglochin centrocarpum* (NC)	Dwarf Arrowgrass
LABIATAE	*Lycopus australis*	Australian Gipsywort
LABIATAE	*Marrubium vulgare*	Horehound
LABIATAE	*Prostanthera althoferi* ssp. *longifolia*	
LABIATAE	*Prostanthera sericea*	Silky Mintbush
LABIATAE	*Prostanthera* sp.	Mintbush
LABIATAE	*Prostanthera striatiflora*	Striated Mintbush
LABIATAE	*Prostanthera wilkieana*	
LABIATAE	*Teucrium grandiusculum* ssp. *pilosum*	
LABIATAE	*Teucrium racemosum*	Grey Germander
LABIATAE	*Westringia rigida*	Stiff Westringia
LAURACEAE	*Cassytha melantha*	Coarse Dodder-laurel
LEGUMINOSAE	*Acacia aneura* (NC)	Mulga
LEGUMINOSAE	*Acacia aneura* var.	
LEGUMINOSAE	*Acacia aneura* var. (NC)	Mulga
LEGUMINOSAE	*Acacia aneura* var. *aneura*	Mulga
LEGUMINOSAE	*Acacia aneura* var. *aneura* (NC)	Mulga
LEGUMINOSAE	*Acacia aneura* var. *conifera*	Christmas-tree Mulga
LEGUMINOSAE	*Acacia aneura* var. *intermedia*	Broad-leaf Mulga
LEGUMINOSAE	*Acacia aneura* var. *macrocarpa*	Weeping Mulga
LEGUMINOSAE	*Acacia aneura* var. *major*	
LEGUMINOSAE	*Acacia aneura* var. *microcarpa*	
LEGUMINOSAE	*Acacia aneura* var. *'silver falcate'* (NC)	
LEGUMINOSAE	*Acacia aneura* var. *tenuis*	Mulga
LEGUMINOSAE	*Acacia ayersiana*	Blue Mulga
LEGUMINOSAE	*Acacia ayersiana* var. (NC)	Broad-leaf Mulga
LEGUMINOSAE	*Acacia ayersiana* var. *latifolia* (NC)	Broad-leaf Mulga
LEGUMINOSAE	*Acacia brachybotrya*	Grey Mulga-bush
LEGUMINOSAE	*Acacia brachystachya*	Turpentine Mulga
LEGUMINOSAE	*Acacia burkittii*	Pin-bush Wattle
LEGUMINOSAE	*Acacia calcicola*	Northern Myall
LEGUMINOSAE	*Acacia cibaria* (NC)	Turpentine Mulga
LEGUMINOSAE	*Acacia colletioides*	Veined Wait-a-while
LEGUMINOSAE	*Acacia continua*	Thorn Wattle
LEGUMINOSAE	*Acacia dictyophleba* (NC)	Net-veined Wattle

LEGUMINOSAE	*Acacia gilesiana*	Giles' Wattle
LEGUMINOSAE	*Acacia helmsiana*	Helm's Wattle
LEGUMINOSAE	*Acacia jennerae*	Coonavittra Wattle
LEGUMINOSAE	*Acacia kempeana*	Witchetty Bush
LEGUMINOSAE	*Acacia ligulata* (NC)	Umbrella Bush
LEGUMINOSAE	*Acacia ligulata*	Umbrella Bush
LEGUMINOSAE	*Acacia maitlandii*	Maitland's Wattle
LEGUMINOSAE	*Acacia melleodora*	Net-veined Wattle
LEGUMINOSAE	*Acacia minyura*	Desert Mulga
LEGUMINOSAE	*Acacia murrayana*	Colony Wattle
LEGUMINOSAE	*Acacia nyssophylla*	Spine Bush
LEGUMINOSAE	*Acacia oswaldii*	Umbrella Wattle
LEGUMINOSAE	*Acacia papyrocarpa*	Western Myall
LEGUMINOSAE	*Acacia paraneura* (NC)	Weeping Mulga
LEGUMINOSAE	*Acacia prainii*	Prain's Wattle
LEGUMINOSAE	*Acacia ramulosa* (NC)	Horse Mulga
LEGUMINOSAE	*Acacia ramulosa* var.	
LEGUMINOSAE	*Acacia ramulosa* var. *linophylla*	Horse Mulga
LEGUMINOSAE	*Acacia ramulosa* var. *ramulosa*	Horse Mulga
LEGUMINOSAE	*Acacia rhodophloia*	Minni Ritchi
LEGUMINOSAE	*Acacia rigens*	Nealie
LEGUMINOSAE	*Acacia sibirica*	Bastard Mulga
LEGUMINOSAE	*Acacia* sp.	Wattle
LEGUMINOSAE	*Acacia stenophylla*	River Cooba
LEGUMINOSAE	*Acacia tetragonophylla*	Dead Finish
LEGUMINOSAE	*Acacia victoriae* ssp. *victoriae*	Elegant Wattle
LEGUMINOSAE	*Bossiaea walkeri*	Cactus Pea
LEGUMINOSAE	*Cassia sturtii* (NC)	Grey Cassia
LEGUMINOSAE	*Crotalaria eremaea* ssp. *strehlowii*	Smooth Loose-flowered Ra
LEGUMINOSAE	*Crotalaria* sp.	Rattle-pod/Bird-flower
LEGUMINOSAE	*Cullen cinereum*	Annual Scurf-pea
LEGUMINOSAE	*Cullen discolor*	Prostrate Scurf-pea
LEGUMINOSAE	*Cullen pallidum*	White Scurf-pea
LEGUMINOSAE	*Cullen patens*	Spreading Scurf-pea
LEGUMINOSAE	*Daviesia benthamii* ssp.	Spiny Bitter-pea
LEGUMINOSAE	*Daviesia benthamii* ssp. *acanthoclona*	Dryland Bitter-pea
LEGUMINOSAE	*Daviesia ulicifolia* ssp. *aridicola*	Gorse Bitter-pea
LEGUMINOSAE	*Indigofera georgei*	George's Indigo
LEGUMINOSAE	*Indigofera psammophila*	Sand Indigo
LEGUMINOSAE	*Kennedia prorepens*	Kal#pil-kal#pilpa
LEGUMINOSAE	*Lotus cruentus*	Red-flower Lotus
LEGUMINOSAE	*Medicago polymorpha* var. *polymorpha*	Burr-medic
LEGUMINOSAE	*Medicago truncatula*	Barrel Medic
LEGUMINOSAE	*Melilotus indicus*	King Island Melilot
LEGUMINOSAE	*Muelleranthus stipularis*	Sand Pea
LEGUMINOSAE	*Psoralea patens* (NC)	Spreading Scurf-pea
LEGUMINOSAE	*Senna artemisioides* ssp.	Desert Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *artemisioides*	Desert Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *filifolia*	Fine-leaf Desert Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *helmsii*	Blunt-leaf Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *petiolaris*	
LEGUMINOSAE	*Senna artemisioides* ssp. *petiolaris* (NC)	Flat-stalk Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *quadrifolia*	Four-leaf Desert Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *X artemisioides*	Silver Senna

LEGUMINOSAE	*Senna artemisioides* ssp. *X coriacea*	Broad-leaf Desert Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *X sturtii*	Grey Senna
LEGUMINOSAE	*Senna artemisioides* ssp. *zygophylla*	Twin-leaf Desert Senna
LEGUMINOSAE	*Senna cardiosperma* ssp. *gawlerensis*	Gawler Ranges Senna
LEGUMINOSAE	*Senna cardiosperma* ssp. *microphylla*	Curved-leaf Senna
LEGUMINOSAE	*Senna phyllodinea*	
LEGUMINOSAE	*Senna pleurocarpa* var. *pleurocarpa*	Stripe-pod Senna
LEGUMINOSAE	*Senna* sp.	Senna
LEGUMINOSAE	*Sutherlandia frutescens*	Bladder Senna
LEGUMINOSAE	*Swainsona acuticarinata*	Burke's Swainson-pea
LEGUMINOSAE	*Swainsona campestris*	
LEGUMINOSAE	*Swainsona campylantha*	
LEGUMINOSAE	*Swainsona canescens*	Grey Swainson-pea
LEGUMINOSAE	*Swainsona dictyocarpa*	
LEGUMINOSAE	*Swainsona flavicarinata*	Yellow-keel Swainson-pea
LEGUMINOSAE	*Swainsona formosa*	Sturt Pea
LEGUMINOSAE	*Swainsona kingii*	
LEGUMINOSAE	*Swainsona microphylla*	Small-leaf Swainson-pea
LEGUMINOSAE	*Swainsona oliveri*	
LEGUMINOSAE	*Swainsona oroboides*	Variable Swainson-pea
LEGUMINOSAE	*Swainsona oroboides* complex	Variable Swainson-pea
LEGUMINOSAE	*Swainsona phacoides*	Dwarf Swainson-pea
LEGUMINOSAE	*Swainsona purpurea*	Purple Swainson-pea
LEGUMINOSAE	*Swainsona* sp.	Swainson-pea
LEGUMINOSAE	*Swainsona stipularis*	Orange Swainson-pea
LEGUMINOSAE	*Swainsona tenuis*	
LEGUMINOSAE	*Swainsona tephrotricha*	Ashy-haired Swainson-pea
LEGUMINOSAE	*Swainsona unifoliolata*	
LEGUMINOSAE	*Swainsona villosa*	Villous Swainson-pea
LEGUMINOSAE	*Templetonia egena*	Broombush Templetonia
LEGUMINOSAE	*Templetonia sulcata*	Flat Mallee-pea
LEGUMINOSAE	*Trigonella suavissima*	Sweet Fenugreek
LILIACEAE	*Corynotheca licrota*	Sand Lily
LILIACEAE	*Corynotheca micrantha* var. *divaricata*	Small-flower Sand Lily
LILIACEAE	*Dianella revoluta* var. *divaricata*	Broad-leaf Flax-lily
LILIACEAE	*Lomandra leucocephala* ssp. *robusta*	Woolly Mat-rush
LILIACEAE	*Murchisonia volubilis*	
LILIACEAE	*Thysanotus baueri*	Mallee Fringe-lily
LILIACEAE	*Thysanotus exiliflorus*	Inland Fringe-lily
LILIACEAE	*Thysanotus patersonii*	Twining Fringe-lily
LOGANIACEAE	*Logania nuda*	Leafless Logania
LOGANIACEAE	*Logania ovata*	Oval-leaf Logania
LORANTHACEAE	*Amyema fitzgeraldii*	Pincushion Mistletoe
LORANTHACEAE	*Amyema gibberula* var. *gibberula*	Twin-flower Mistletoe
LORANTHACEAE	*Amyema linophylla* ssp. *orientale*	Casuarina Mistletoe
LORANTHACEAE	*Amyema maidenii* ssp. *maidenii*	Pale-leaf Mistletoe
LORANTHACEAE	*Amyema miquelii*	Box Mistletoe
LORANTHACEAE	*Amyema miraculosa* ssp. *boormanii*	Fleshy Mistletoe
LORANTHACEAE	*Amyema preissii*	Wire-leaf Mistletoe
LORANTHACEAE	*Amyema quandang* var. *quandang*	Grey Mistletoe
LORANTHACEAE	*Amyema* sp.	Mistletoe
LORANTHACEAE	*Lysiana exocarpi* ssp. *exocarpi*	Harlequin Mistletoe
LORANTHACEAE	*Lysiana murrayi*	Mulga Mistletoe
LORANTHACEAE	*Lysiana* sp.	Mistletoe

MALVACEAE	*Abutilon cryptopetalum* (NC)	Hill Lantern-bush
MALVACEAE	*Abutilon cryptopetalum* ssp.	
MALVACEAE	*Abutilon halophilum*	Plains Lantern-bush
MALVACEAE	*Abutilon leucopetalum*	Desert Lantern-bush
MALVACEAE	*Abutilon malvaefolium*	Scrambling Lantern-bush
MALVACEAE	*Abutilon otocarpum*	Desert Lantern-bush
MALVACEAE	*Abutilon* sp.	Lantern-bush
MALVACEAE	*Alyogyne huegelii*	Native Hibiscus
MALVACEAE	*Alyogyne pinoniana* var.	
MALVACEAE	*Alyogyne pinoniana* var. *microandra*	
MALVACEAE	*Alyogyne pinoniana* var. *pinoniana*	Sand Hibiscus
MALVACEAE	*Alyogyne* sp.	
MALVACEAE	*Hibiscus krichauffianus*	Velvet-leaf Hibiscus
MALVACEAE	*Hibiscus solanifolius*	Solanum-leaf Hibiscus
MALVACEAE	*Hibiscus sturtii* var.	Sturt's Hibiscus
MALVACEAE	*Lawrencia glomerata*	Clustered Lawrencia
MALVACEAE	*Lawrencia squamata*	Thorny Lawrencia
MALVACEAE	*Malva parviflora*	Small-flower Marshmallow
MALVACEAE	*Malva preissiana*	Australian Hollyhock
MALVACEAE	*Malvastrum americanum* var. *americanum*	Malvastrum
MALVACEAE	*Sida ammophila* (NC)	Sand Sida
MALVACEAE	*Sida ammophila*	Sand Sida
MALVACEAE	*Sida calyxhymenia*	Tall Sida
MALVACEAE	*Sida corrugata* var.	Corrugated Sida
MALVACEAE	*Sida corrugata* var. *corrugata*	Corrugated Sida
MALVACEAE	*Sida fibulifera*	Pin Sida
MALVACEAE	*Sida filiformis*	Fine Sida
MALVACEAE	*Sida intricata*	Twiggy Sida
MALVACEAE	*Sida petrophila*	Rock Sida
MALVACEAE	*Sida phaeotricha*	Hill Sida
MALVACEAE	*Sida* sp.	Sida
MALVACEAE	*Sida* sp. *B (C.Dunlop 1739)*	
MALVACEAE	*Sida* sp. *golden calyces (H.N.Foote 32)*	
MALVACEAE	*Sida* sp. *L (A.M.Ashby 4202)*	
MALVACEAE	*Sida* sp. *R (P.Copley 1390)*	
MALVACEAE	*Sida* sp. *Rabbit Flat (R.B.Major 158)*	
MALVACEAE	*Sida* sp. *Watarrka (D.E.Albrecht 8672)*	
MALVACEAE	*Sida spodochroma -- Sida* sp.	
MALVACEAE	*Sida spodochroma*	
MALVACEAE	*Sida trichopoda*	High Sida
MYOPORACEAE	*Eremophila alternifolia*	Narrow-leaf Emubush
MYOPORACEAE	*Eremophila arachnoides* ssp. *tenera*	Spider Emubush
MYOPORACEAE	*Eremophila arenaria*	
MYOPORACEAE	*Eremophila battii*	
MYOPORACEAE	*Eremophila behriana*	Rough Emubush
MYOPORACEAE	*Eremophila bowmanii* ssp. *latifolia*	Velvet Emubush
MYOPORACEAE	*Eremophila clarkei*	Turpentine Bush
MYOPORACEAE	*Eremophila decipiens* var. *decipiens*	Long-stalk Tar-bush
MYOPORACEAE	*Eremophila delisseri*	Nullarbor Emubush
MYOPORACEAE	*Eremophila deserti*	Turkey-bush
MYOPORACEAE	*Eremophila duttonii*	Harlequin Emubush
MYOPORACEAE	*Eremophila freelingii*	Rock Emubush
MYOPORACEAE	*Eremophila gibsonii*	Gibson's Emubush
MYOPORACEAE	*Eremophila gilesii*	Hairy-fruit Emubush

MYOPORACEAE	*Eremophila glabra* (NC)	Tar Bush
MYOPORACEAE	*Eremophila glabra* ssp.	Tar Bush
MYOPORACEAE	*Eremophila glabra* ssp. *glabra*	Tar Bush
MYOPORACEAE	*Eremophila hillii*	Hill's Emubush
MYOPORACEAE	*Eremophila latrobei* ssp.	Crimson Emubush
MYOPORACEAE	*Eremophila latrobei* ssp. *glabra*	Crimson Emubush
MYOPORACEAE	*Eremophila latrobei* ssp. *latrobei*	Grey-leaf Crimson Emubus
MYOPORACEAE	*Eremophila longifolia*	Weeping Emubush
MYOPORACEAE	*Eremophila macdonnellii*	Macdonnell's Emubush
MYOPORACEAE	*Eremophila maculata* ssp.	Spotted Emubush
MYOPORACEAE	*Eremophila maculata* ssp. *brevifolia*	Short-leaf Spotted Emubu
MYOPORACEAE	*Eremophila maculata* ssp. *maculata*	Spotted Emubush
MYOPORACEAE	*Eremophila oppositifolia* ssp.	Opposite-leaved Emubush
MYOPORACEAE	*Eremophila paisleyi* (NC)	Paisley's Emubush
MYOPORACEAE	*Eremophila paisleyi* ssp. *paisleyi*	
MYOPORACEAE	*Eremophila parvifolia*	Small-leaf Emubush
MYOPORACEAE	*Eremophila platythamnos* ssp.	Munyun#pa
MYOPORACEAE	*Eremophila platythamnos* ssp. *exotrachys*	Munyun#pa
MYOPORACEAE	*Eremophila platythamnos* ssp. *platytham*	
MYOPORACEAE	*Eremophila platythamnos* ssp. *Villous*	
MYOPORACEAE	*Eremophila scoparia*	Broom Emubush
MYOPORACEAE	*Eremophila serrulata*	Green Emubush
MYOPORACEAE	*Eremophila* sp.	Emubush/Turkey-bush
MYOPORACEAE	*Eremophila* sp. *Decussate (R.J.Chinnock*	
MYOPORACEAE	*Eremophila* sp. *Dendritica (W.S.Reid AD*	
MYOPORACEAE	*Eremophila* sp. *Fallax (D.E.Symon 12311*	
MYOPORACEAE	*Eremophila* sp. *Hygrophana (P.J.Lang B8*	
MYOPORACEAE	*Eremophila sturtii*	Turpentine Bush
MYOPORACEAE	*Eremophila verrucosa* ssp. *brevistellat*	Warty Emubush
MYOPORACEAE	*Eremophila verrucosa* ssp. *verrucosa*	Warty Emubush
MYOPORACEAE	*Eremophila willsii* (NC)	Wills' Emubush
MYOPORACEAE	*Eremophila willsii* var.	
MYOPORACEAE	*Eremophila willsii* var. *integrifolia*	Will's Emubush
MYOPORACEAE	*Myoporum montanum*	Native Myrtle
MYOPORACEAE	*Myoporum platycarpum* ssp.	False Sandalwood
MYOPORACEAE	*Myoporum platycarpum* ssp. *platycarpum*	False Sandalwood
MYOPORACEAE	*Myoporum* sp.	
MYRTACEAE	*Aluta maisonneuvei* ssp. *auriculata*	Desert Thryptomene
MYRTACEAE	*Babingtonia behrii*	Silver Broombush
MYRTACEAE	*Baeckea tuberculata*	
MYRTACEAE	*Calytrix gypsophila*	Gypsum Fringe-myrtle
MYRTACEAE	*Calytrix* sp.	Fringe-myrtle
MYRTACEAE	*Darwinia micropetala* (NC)	Small Darwinia
MYRTACEAE	*Darwinia salina*	Salt Darwinia
MYRTACEAE	*Eucalyptus brachycalyx*	Gilja
MYRTACEAE	*Eucalyptus calcareana*	Nundroo Mallee
MYRTACEAE	*Eucalyptus canescens* ssp.	
MYRTACEAE	*Eucalyptus canescens* ssp. *beadellii*	Beadell's Mallee
MYRTACEAE	*Eucalyptus canescens* ssp. *canescens*	Ooldea Range Mallee
MYRTACEAE	*Eucalyptus concinna*	Victoria Desert Mallee
MYRTACEAE	*Eucalyptus eremicola*	Vokes Hill Mallee
MYRTACEAE	*Eucalyptus eucentrica*	
MYRTACEAE	*Eucalyptus eucentrica* (NC)	
MYRTACEAE	*Eucalyptus foecunda* (NC)	Narrow-leaved Mallee

MYRTACEAE	*Eucalyptus gillii*	Curly Mallee
MYRTACEAE	*Eucalyptus glomerosa*	Jinjulu
MYRTACEAE	*Eucalyptus gongylocarpa*	Marble Gum
MYRTACEAE	*Eucalyptus gracilis*	Yorrell
MYRTACEAE	*Eucalyptus gypsophila*	Kopi Mallee
MYRTACEAE	*Eucalyptus kingsmillii* ssp. *alatissima*	Kingsmill's Mallee
MYRTACEAE	*Eucalyptus leptophylla*	Narrow-leaf Red Mallee
MYRTACEAE	*Eucalyptus mannensis* ssp. *mannensis*	Mann Ranges Mallee
MYRTACEAE	*Eucalyptus oleosa* (NC)	Red Mallee
MYRTACEAE	*Eucalyptus oleosa* ssp.	
MYRTACEAE	*Eucalyptus oleosa* ssp. *ampliata*	Red Mallee
MYRTACEAE	*Eucalyptus oleosa* ssp. *oleosa*	Red Mallee
MYRTACEAE	*Eucalyptus oxymitra*	Sharp-cap Mallee
MYRTACEAE	*Eucalyptus peeneri*	Peeneri Mallee
MYRTACEAE	*Eucalyptus pimpiniana*	Pimpin Mallee
MYRTACEAE	*Eucalyptus socialis* (NC)	Beaked Red Mallee
MYRTACEAE	*Eucalyptus socialis* ssp.	
MYRTACEAE	*Eucalyptus socialis* ssp. *South Great Victoria Desert*	
MYRTACEAE	*Eucalyptus* sp.	
MYRTACEAE	*Eucalyptus striaticalyx* (NC)	Kopi Mallee
MYRTACEAE	*Eucalyptus trivalvis*	Three-valve Mallee
MYRTACEAE	*Eucalyptus vokesensis*	Vokes Hill Mallee
MYRTACEAE	*Eucalyptus wyolensis*	Wyola Mallee
MYRTACEAE	*Eucalyptus yalatensis*	Yalata Mallee
MYRTACEAE	*Eucalyptus youngiana*	Ooldea Mallee
MYRTACEAE	*Eucalyptus yumbarrana* ssp.	Yumbarra Mallee
MYRTACEAE	*Eucalyptus yumbarrana* ssp. *yumbarrana*	Yumbarra Mallee
MYRTACEAE	*Leptospermum coriaceum*	Dune Tea-tree
MYRTACEAE	*Leptospermum fastigiatum*	
MYRTACEAE	*Melaleuca interioris*	Broombush
MYRTACEAE	*Melaleuca lanceolata* ssp. *lanceolata*	Dryland Tea-tree
MYRTACEAE	*Melaleuca nanophylla*	Dwarf-leaf Honey-myrtle
MYRTACEAE	*Melaleuca uncinata* (NC)	Broombush
MYRTACEAE	*Melaleuca xerophila*	Boree
MYRTACEAE	*Micromyrtus fimbrisepala*	
MYRTACEAE	*Micromyrtus flaviflora*	Yellow Heath-myrtle
MYRTACEAE	*Micromyrtus* sp.	Heath-myrtle
MYRTACEAE	*Thryptomene biseriata*	
MYRTACEAE	*Thryptomene elliottii*	
MYRTACEAE	*Thryptomene longifolia*	
MYRTACEAE	*Thryptomene maisonneuvei* (NC)	Desert Thryptomene
MYRTACEAE	*Thryptomene* sp.	Thryptomene
MYRTACEAE	*Thryptomene urceolaris*	
NYCTAGINACEAE	*Boerhavia dominii*	Tar-vine
NYCTAGINACEAE	*Boerhavia* sp.	Tar-vine
OLEACEAE	*Jasminum didymum* ssp. *lineare*	Native Jasmine
ORCHIDACEAE	*Caladenia* sp.	Spider-orchid
OXALIDACEAE	*Oxalis perennans* (NC)	Native Sorrel
PITTOSPORACEAE	*Pittosporum angustifolium*	Native Apricot
PLANTAGINACEAE	*Plantago drummondii*	Dark Plantain
POLYGALACEAE	*Comesperma volubile*	Love Creeper
POLYGONACEAE	*Acetosa vesicaria*	Rosy Dock
POLYGONACEAE	*Emex australis*	Three-corner Jack
POLYGONACEAE	*Muehlenbeckia florulenta*	Lignum

POLYGONACEAE	*Rumex tenax*	Shiny Dock
PORTULACACEAE	*Calandrinia corrigioloides*	Strap Purslane
PORTULACACEAE	*Calandrinia disperma*	Two-seed Purslane
PORTULACACEAE	*Calandrinia eremaea*	Dryland Purslane
PORTULACACEAE	*Calandrinia polyandra* var. *polyandra*	Parakeelya
PORTULACACEAE	*Calandrinia pumila*	Tiny Purslane
PORTULACACEAE	*Calandrinia remota*	Round-leaf Parakeelya
PORTULACACEAE	*Calandrinia reticulata*	
PORTULACACEAE	*Calandrinia* sp.	Purslane/Parakeelya
PORTULACACEAE	*Portulaca oleracea*	Common Purslane
PRIMULACEAE	*Anagallis arvensis*	Pimpernel
PROTEACEAE	*Grevillea albiflora*	White Grevillea
PROTEACEAE	*Grevillea huegelii*	Comb Grevillea
PROTEACEAE	*Grevillea juncifolia* ssp. *juncifolia*	Honeysuckle Grevillea
PROTEACEAE	*Grevillea nematophylla* ssp. *nematophylla*	Water Bush
PROTEACEAE	*Grevillea pterosperma*	Dune Grevillea
PROTEACEAE	*Grevillea stenobotrya*	Rattle-pod Grevillea
PROTEACEAE	*Hakea francisiana*	Bottlebrush Hakea
PROTEACEAE	*Hakea leucoptera* ssp. *leucoptera*	Silver Needlewood
PROTEACEAE	*Hakea lorea* ssp. *lorea*	Long-leaf Corkwood
RESTIONACEAE	*Lepyrodia muelleri*	Erect Scale-rush
RHAMNACEAE	*Cryptandra propinqua*	Silky Cryptandra
RUBIACEAE	*Pomax umbellata*	Pomax
RUBIACEAE	*Psydrax suaveolens*	Narrow-leaf Native Curra
RUTACEAE	*Boronia coerulescens* ssp. *coerulescens*	Blue Boronia
RUTACEAE	*Geijera linearifolia*	Sheep Bush
SANTALACEAE	*Choretrum glomeratum* var. *chrysanthum*	Yellow-flower Sour-bush
SANTALACEAE	*Choretrum glomeratum* var. *glomeratum*	White Sour-bush
SANTALACEAE	*Exocarpos sparteus*	Slender Cherry
SANTALACEAE	*Santalum acuminatum*	Quandong
SANTALACEAE	*Santalum lanceolatum*	Plumbush
SANTALACEAE	*Santalum* sp.	
SANTALACEAE	*Santalum spicatum*	Sandalwood
SAPINDACEAE	*Alectryon oleifolius* ssp. *canescens*	Bullock Bush
SAPINDACEAE	*Dodonaea lobulata*	Lobed-leaf Hop-bush
SAPINDACEAE	*Dodonaea microzyga* var. *microzyga*	Brilliant Hop-bush
SAPINDACEAE	*Dodonaea stenozyga*	Desert Hop-bush
SAPINDACEAE	*Dodonaea viscosa* ssp.	Sticky Hop-bush
SAPINDACEAE	*Dodonaea viscosa* ssp. *angustissima*	Narrow-leaf Hop-bush
SCROPHULARIACEAE	*Limosella curdieana* var. *curdieana*	Large Mudwort
SOLANACEAE	*Duboisia hopwoodii*	Pituri
SOLANACEAE	*Grammosolen truncatus*	Shrubby Ray-flower
SOLANACEAE	*Lycium australe*	Australian Boxthorn
SOLANACEAE	*Nicotiana glauca*	Tree Tobacco
SOLANACEAE	*Nicotiana goodspeedii*	Small-flower Tobacco
SOLANACEAE	*Nicotiana occidentalis* ssp. *obliqua*	Western Tobacco
SOLANACEAE	*Nicotiana rosulata* ssp.	
SOLANACEAE	*Nicotiana rosulata* ssp. *rosulata*	
SOLANACEAE	*Nicotiana simulans*	Native Tobacco
SOLANACEAE	*Nicotiana* sp.	Tobacco
SOLANACEAE	*Nicotiana velutina*	Velvet Tobacco
SOLANACEAE	*Solanum aff. centrale*	
SOLANACEAE	*Solanum centrale*	Desert Raisin
SOLANACEAE	*Solanum cleistogamum*	Shy Nightshade

SOLANACEAE	*Solanum coactiliferum*	Tomato-bush
SOLANACEAE	*Solanum ellipticum*	Velvet Potato-bush
SOLANACEAE	*Solanum ferocissimum*	Spiny Potato-bush
SOLANACEAE	*Solanum hystrix*	Afghan Thistle
SOLANACEAE	*Solanum lasiophyllum*	Flannel Bush
SOLANACEAE	*Solanum nigrum*	Black Nightshade
SOLANACEAE	*Solanum orbiculatum* ssp.	
SOLANACEAE	*Solanum orbiculatum* ssp. *orbiculatum*	Round-leaf Nightshade
SOLANACEAE	*Solanum quadriloculatum*	Plains Nightshade
SOLANACEAE	*Solanum* sp.	Nightshade/Potato-bush
SOLANACEAE	*Solanum sturtianum*	Sturt's Nightshade
STACKHOUSIACEAE	*Stackhousia clementii*	Limestone Candles
STACKHOUSIACEAE	*Stackhousia megaloptera*	Dune Candles
STACKHOUSIACEAE	*Stackhousia muricata* (NC)	Yellow Candles
STACKHOUSIACEAE	*Stackhousia muricata* ssp.	
STACKHOUSIACEAE	*Stackhousia muricata* ssp. *Annual (W.R.Barker 2172)*	Yellow Candles
STERCULIACEAE	*Brachychiton gregorii*	Desert Kurrajong
STERCULIACEAE	*Gilesia biniflora*	Western Tar-vine
STERCULIACEAE	*Keraudrenia nephrosperma*	
STERCULIACEAE	*Keraudrenia* sp. *North West (J.Z.Weber 6475)*	Common Firebush
STERCULIACEAE	*Rulingia loxophylla*	
STERCULIACEAE	*Rulingia magniflora*	
THYMELAEACEAE	*Pimelea microcephala* ssp.	Shrubby Riceflower
THYMELAEACEAE	*Pimelea microcephala* ssp. *microcephala*	Shrubby Riceflower
THYMELAEACEAE	*Pimelea simplex* ssp. *simplex*	Desert Riceflower
THYMELAEACEAE	*Pimelea trichostachya*	Spiked Riceflower
UMBELLIFERAE	*Daucus glochidiatus*	Native Carrot
UMBELLIFERAE	*Trachymene ceratocarpa*	Creeping Carrot
UMBELLIFERAE	*Trachymene cyanopetala*	Purple Trachymene
UMBELLIFERAE	*Trachymene glaucifolia*	Blue Parsnip
UMBELLIFERAE	*Trachymene glaucifolia* (NC)	Blue Parsnip
URTICACEAE	*Parietaria debilis* (NC)	Smooth-nettle
VERBENACEAE	*Pityrodia loricata*	
ZYGOPHYLLACEAE	*Tribulus eichlerianus*	Eichler's Caltrop
ZYGOPHYLLACEAE	*Tribulus terrestris*	Caltrop
ZYGOPHYLLACEAE	*Zygophyllum ammophilum* (NC)	Sand Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum ammophilum*	Sand Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum apiculatum*	Pointed Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum aurantiacum* (NC)	Shrubby Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum aurantiacum* ssp.	
ZYGOPHYLLACEAE	*Zygophyllum aurantiacum* ssp. *aurantiacum*	Shrubby Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum aurantiacum* ssp. *cuneatum*	
ZYGOPHYLLACEAE	*Zygophyllum aurantiacum* ssp. *simplicifolium*	
ZYGOPHYLLACEAE	*Zygophyllum compressum*	Rabbit-ears Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum eremaeum*	
ZYGOPHYLLACEAE	*Zygophyllum eremaeum* (NC)	Pale-flower Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum glaucum*	Pale Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum iodocarpum* (NC)	Violet Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum iodocarpum*	Violet Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum ovatum*	Dwarf Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum prismatothecum* (NC)	Square-fruit Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum simile*	White Twinleaf
ZYGOPHYLLACEAE	*Zygophyllum* sp.	Twinleaf