Conserving Adelaide's

BIODIVERSITY

RESOURCES

Conserving Adelaide's Biodiversity: Resources

DEPARTMENT FOR environment and heritage

S.A URBAN FOREST BIODIVERSITY PROGRAM

Natural Heritage Trust

Planning SA

SOUTH AUSTRALIA

Government of South Australia

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Cover Photographs (left to right)

Striated Pardalote (*Pardalotus striatus*)†
Native Lilac (*Hardenbergia violacea*) §
Banded Stilts (*Cladorhynchus leucocephalus*)†
Yabbie (*Cherax destructor*)†
Fat-tailed Dunnart (*Sminthopsis crassicaudata*)†
Pygmy Copperhead (*Austrelaps labialis*)†
Finger-flower (*Cheiranthera alternifolia*) §
Gum Moth (*Opodiphthera helena*)†
Purple-spotted Gudgeon (*Mogurnda adspersa*) †

† photograph by Nicholas Birks
§ photograph by Vicki Hagan

Overview

The South Australian Urban Forest Biodiversity Program (UFBP) was initiated in 1997 to provide a coordinated regional approach to biodiversity conservation across the Adelaide metropolitan area. The UFBP vision is to redress biodiversity loss in metropolitan Adelaide by protecting remaining native flora and fauna and increasing the biomass of locally indigenous species.

The UFBP is working to achieve this through a package of initiatives which aim to:

- identify priority areas and land linkages
- galvanise planning and action strategies of relevant authorities to achieve bio-regional goals
- support the collective effort being made to protect, conserve and restore biodiversity
- work with community groups to maximise the benefits of outcomes for effort
- influence organisational change and public knowledge through education, training and communication.

The program complements natural resource management actions of *inter alia* Local Agenda 21 and Catchment Water Management Plans. To date, the UFBP has implemented projects covering over 1000 hectares and significantly raised awareness of biodiversity issues across a wide range of community, professional and industry sectors through education and communication strategies.

Conserving Adelaide's Biodiversity is a series of publications developed by the UFBP to inform and encourage best practice in the management of our natural heritage. It builds on the many projects implemented to date and integrates with the Regional Biodiversity Planning series being undertaken by the Department for Environment and Heritage. The approach is systematic and transportable, having the potential for use as a model for adaptation to other urban centres. The package comprises:

- *Conserving Adelaide's Biodiversity: A planned approach* - this summary document is reaching a wide community audience and provides up-to-date information, guiding principles and specific actions for biodiversity conservation in the Adelaide region.
- Project Outlines - a series of project descriptions covering some high priority biodiversity issues and how to go about initiating and implementing a project to conserve biodiversity. Additional support, resources and technical information can be obtained by contacting UFBP Project Officers.
- Brochure Series - tailored to specific community, industry and professional sectors, these information sheets identify key issues and suggest actions we can take to assist in biodiversity conservation.
- *Conserving Adelaide's Biodiversity: Resources* - providing up-to-date technical information on Adelaide's biodiversity, including location maps of priority vegetation types and remnant bushland sites, and site descriptions, species lists and technical information on the region's flora and fauna.

The package complements the strategic and technical support provided by UFBP Project Officers, guides priorities for funding on-ground projects and builds on existing resources including:

- *The Urban Forest Biodiversity Program Strategy* (released April 1997)
- *Forests and Woodlands of the Adelaide Plains in 1836* poster (Planning SA)
- *Habitats of the Adelaide Region* (Planning SA)
- *Bio-What?* education kit for schools
- *Freshwater Fishes* poster (SA Native Fish Association)
- *Adelaide Biodiversity Bibliography*, a comprehensive set of biodiversity references
- Action Plans for regional priority projects
- Fact Sheets for community groups wishing to develop local projects.

The UFBP Committee hopes that through the use of these resources, with feedback, collaboration and incorporation of new information, further gains will be made in protecting and conserving our precious natural heritage.

Ross Oke
Executive Officer, UFBP Committee

Foreword

The need to better understand the significant environmental, cultural, social, educational and economic benefits of conserving biological diversity cannot be understated. The Commonwealth, through the Environment Protection and Biodiversity Conservation Act 1999, the Natural Heritage Trust and a range of national programs such as Bushcare has established a framework for effective partnerships to address biodiversity decline.

The Natural Heritage Trust promotes on-ground projects by communities, schools and local government to address the underlying causes of environmental and natural resource management problems. The size and distribution of our population is a major underlying cause of biodiversity decline and yet, for many of us, bushland reserves in urban areas may provide our only contact with the natural environment. Most importantly, bushland in and around our cities, often has threatened vegetation types and provides habitat for threatened species.

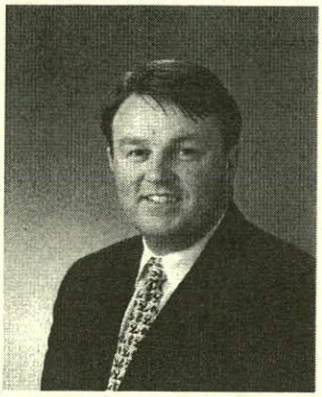
"Conserving Adelaide's Biodiversity- Resources" represents a major step in conserving biodiversity in South Australia. It completes the package of material that comprises the Biodiversity Plan for Adelaide and is the third of six regional biodiversity plans completed for South Australia, with funding from the Natural Heritage Trust and the State Government.

The Biodiversity Plan addresses conservation and biodiversity issues for metropolitan Adelaide and offers practical solutions to protect flora and fauna.

I congratulate the Urban Forest Biodiversity Program Management Committee on their first edition of the Biodiversity Plan for Metropolitan Adelaide.

Senator the Hon Robert Hill
Minister for the Environment and Heritage

Foreword



A planned approach to biodiversity conservation is critical: urban infrastructure is planned to accommodate a range of human activities and we must also plan for the protection and conservation of our biodiversity. Adelaide's natural biodiversity is unique, and includes species and habitats found nowhere else in the world. Recognising this, the SA Urban Forest Biodiversity Program (UFBP) was initiated in 1997 to implement a package of planning and action aimed at meeting the specific challenges of conserving biodiversity in a large urban environment.

The Department for Environment and Heritage is undertaking a systematic approach to regional biodiversity planning across South Australia. In the Metropolitan Adelaide Region, the UFBP has developed *Conserving Adelaide's Biodiversity* to guide priorities and actions for the conservation of our unique flora and fauna: their genetic diversity and the ecosystems which they inhabit.

Community, Industry and Government sectors need accurate, up-to-date information to ensure appropriate actions are promoted and taken to protect biodiversity. *Conserving Adelaide's Biodiversity - Resources* is the most comprehensive and up-to-date information available on the natural biodiversity of the Adelaide area. Together with local inventories, it is a vital reference and powerful tool for planners, land managers, educators, politicians, decision makers and community groups to assist in ensuring Adelaide's biodiversity is understood, valued and protected.

Through a planned approach to redressing biodiversity loss, consistent with the objectives and methodology promoted by ANZECC in the *National Framework for the Management and Monitoring of Australia's Native Vegetation* (1999), the UFBP draws on and integrates with other regional natural resource management initiatives including the Local Agenda 21 Framework, Catchment Water Management Plans, Parklands 21, Local Biodiversity Plans, Soil Conservation District Plans, the Planning Strategy for Metropolitan Adelaide and Local Development Plans.

The State Government recently enacted legislation to protect Adelaide's significant urban trees. In conjunction with provisions to protect native vegetation, improve water and air quality, and guide appropriate development, the framework is in place to ensure that biodiversity is conserved and restored. *Conserving Adelaide's Biodiversity* works with these provisions and other complementary strategies to address specific issues relating to protecting and conserving biodiversity both within public reserves and on private land.

Biodiversity planning in urban environments is relatively new and will challenge how our community approaches nature conservation and urban development. I look forward to the increased gains these resources will inevitably make to ensure that our natural heritage is secured for future generations.

Hon Iain Evans MP
SA Minister for Environment and Heritage

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1 Introduction

Biodiversity is declining at an alarming rate. The planet is currently in the midst of its sixth mass extinction. Scientists believe that it will take many millions of years for biodiversity to recover from the impacts of humans over the last 200 years (Kirchner & Weil 2000).

Biodiversity encompasses the variety of *all* life, the different plants, animals, micro-organisms, the genes they contain and the ecosystems which they inhabit (Biodiversity Unit 1993a; Meffe & Carroll 1994; Wilson 1992). The *Convention on Biological Diversity* (UN 2000), an international agreement signed by 120 nations, including Australia, has defined biodiversity as:

> ...the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species [genetic], between species and of ecosystems.

Biodiversity is commonly considered at three different levels: the gene, the species and the ecosystem. **Genetic diversity** refers to the natural variation within and variations between populations of species (Heywood & Baste 1995; Biodiversity Unit 1993a). It is measured in terms of variation between genes or between DNA and amino acid sequences (Heywood & Baste 1995). The importance of genetic diversity can not be under-estimated, as the ultimate aim of biodiversity conservation is to allow for evolutionary change, and it is genetic diversity that underpins the evolution of all biota (Meffe & Carroll 1994). The inclusion of genetic diversity as something to be conserved highlights the importance of conserving different populations of the same species. Consequently, species that may be locally rare but nationally abundant should also be conserved. **Species diversity** simply refers to the variety of organisms on earth (Biodiversity Unit 1993a). **Ecosystem diversity** refers to the variety of habitats, biotic communities, and ecological processes and the significant diversity found within ecosystems in terms of habitat differences and the variety of ecological processes (Biodiversity Unit 1993a).

1.1 How many species are there?

Biologists, and in particular taxonomists, have been describing species for many years. The number of described species on earth is approximately 1.4 million, although Wilson (1992) suggests the actual number of species is at least 10 times this amount. Most estimates of the total number of species range between 5 and 30 million (Campbell 1987). Other more controversial estimates conclude that arthropods alone (which include insects, crustaceans, and spiders) exceed 30 million (Erwin 1991) and that the total number is more than 110 million (Hawksworth & Kalin-Arroyo 1995). Wilson (1992) highlights the lack of knowledge about the Earth's biota by saying that we know the weight of an electron and the number of stars in the Milky Way and yet we do not know the number of living species with which we share the planet.

Vegetation assemblages are frequently viewed as a tangible surrogate for habitat for other terrestrial biota (Biodiversity Unit 1995; Brooks *et al.* 1996). Conserving vegetation assemblages will go a long way to conserving the plants and animals that live in those assemblages.

1.2 Values of biodiversity

There are many ways of valuing biodiversity. Values of biodiversity are commonly placed into three categories (Biodiversity Unit 1993a):

- ecosystem services (eg soil formation, nutrient storage and cycling, protection of water resources, pollution breakdown and absorption etc.)
- biological resources (eg food, medicinal resources and wood products) and
- social benefits (recreation, research, education and monitoring and cultural values etc.). Beattie (1995) draws the analogy that biodiversity is like a library- each species is a book full of genetic information that may be of use to humans now or in the future, only a small number of these have been read.

Meffe & Carroll (1994) recognise similar three categories but also suggest a fourth category of psycho-spiritual value (ie. aesthetic beauty, religious awe and scientific knowledge). Together these four

values of biodiversity are called ***instrumental values***; they are anthropocentric because they consider value only in what biodiversity can offer humans (Meffe & Carroll 1994; Hunter 1996). Other authors recognise different ways of categorising the economic value of biodiversity (see Buckley 1994; Turner *et al.* 1994). To consider only instrumental values of biodiversity is sufficient to substantiate conservation as a moral duty because today's humans have a moral obligation to future humans (Hampicke 1994).

Some authors also recognise an ***intrinsic value*** of biodiversity (Meffe & Carroll 1994; Turner *et al.* 1994). Intrinsic value purports that biodiversity is valuable in its own right, regardless of the human experience (Meffe & Carroll 1994; Primack 1993; Turner *et al.* 1994) or indeed without reference to anything else but its own existence (Hunter 1996). The fact that conservation biologists advocate that resources should go into the saving of those species most threatened (regardless of their instrumental value) is predisposed by the underlying belief that all species have intrinsic value (Hunter 1996). The importance of intrinsic value has been acknowledged in the global Convention on Biological Diversity (UNEP 1993).

When a species is threatened by human activities such as development, recognising only instrumental value places the burden of proof on conservationists. However, if one recognises the ***intrinsic value*** of species the burden of proof in the same situation is placed on the developers (Meffe & Carroll 1994).

Biodiversity conservation is somewhat different from traditional nature conservation. It requires a fundamental shift from a reactive stance to a more proactive stance so society can meet peoples' needs from biological resources while ensuring the long-term ecological sustainability of Earth's biotic wealth (Biodiversity Unit 1993a). Biodiversity Unit (1993a) concludes its argument on the value of biodiversity by claiming:

> There is possibly no single particular argument which [sic] on its own, provides sufficient grounds for attempting to maintain all existing biological diversity. A more general and pragmatic approach, however, recognises that different but equally valid arguments - resource values, precautionary values, ethics and aesthetics, and simple self-interest -apply in different cases, and between them provide an overwhelmingly powerful and convincing case for the conservation of biological diversity.

Gould (1993) views biodiversity at the geological timescale, he suggests that whatever damage humans inflict on the planet, will eventually be restored, albeit in many millions of years. Gould (1993) insists that it is humans who stand to lose the most from loss of biodiversity:

> I suggest that we execute...a pact with our planet. She holds all the cards, and has immense power over us- so such a compact, which we desperately need but she does not at her own timescale, would be a blessing for us and an indulgence for her. We had better sign the papers while she is willing to make a deal. If we treat her nicely, she will keep us going for a while. If we scratch her, she will bleed, kick us out, bandage up, and go about her business at her own scale.

1.3 Biodiversity planning

The single species approach to conservation has been less than successful. More and more decision makers are accepting what those in the conservation movement have advocated for many years- ***in order to conserve our biodiversity we need to conserve habitats***.

However, we cannot simply remain focused at the ecosystem level. Some species, in particular those that are threatened and/or endemic to a particular region, require specific attempts to prevent their extinction. There may be particular threats to these species that require amelioration in order to prevent the species from declining further. Furthermore, it is likely that these threats are affecting directly or indirectly, the populations of other species. Therefore, while the ecosystem approach underpins any biodiversity conservation measures, we cannot ignore possible causes behind the decline of rare, threatened, or endemic species. The presence of a rare, threatened or endemic species in a particular habitat underscores the importance of protecting that habitat.

Australia signed the Convention on Biological Diversity at the Earth Summit in Rio de Janeiro, Brazil on World Environment Day 1992. The Convention was ratified by the Council of Australian Governments the following year.

As a party to the Convention, Australia is committed to the conservation of biodiversity, the sustainable use and management of its components, and the equitable sharing of genetic resources.

The *National Strategy for the Conservation of Australia's Biological Diversity* (ANZECC 1995) is the main implementation measure for the Convention in Australia.

The Strategy is a joint initiative of the Commonwealth, State and Territory Governments, and supports other intergovernmental agreements, such as the National Strategy for Ecologically Sustainable Development, the National Greenhouse Strategy, the National Forest Policy Statement, the Decade of Landcare Plan, the Wetlands Policy of the Commonwealth Government of Australia, the Inter-Governmental Agreement on the Environment, the Natural Heritage Trust Partnership Agreements and the National Framework for the Management and Monitoring of Australia's Native Vegetation.

The National Strategy has clearly defined objectives for stopping further loss of biodiversity. A significant number of the objectives relating to the Adelaide Metropolitan Area will be met through the actions embodied in the UFBP (Oke *et al.* 1997).

The South Australian Government is facilitating the preparation of a series of Regional Biodiversity Plans to assist in the management and rehabilitation of natural habitats. This program is being assisted by the Commonwealth Government through the Natural Heritage Trust (Inns 1998).

Regional Biodiversity Plans cover the following regions of South Australia - South East, Northern Agricultural District, Eyre Peninsula, Murray Darling Basin (Murray Mallee), Kangaroo Island and Mount Lofty Ranges. The regions are based on the Natural Heritage Trust Regions for South Australia.

In recent years, lobbying for biodiversity planning has come from the Australian Conservation Foundation, the Nature Conservation Society of South Australia and the South Australian Farmers Federation, amongst others. The South Australian Government has embraced the concept of Regional Biodiversity Planning and the recent input of Natural Heritage Trust (NHT) funding has strengthened this commitment as the NHT favours projects with clear regional priorities (Possingham 1997).

Possingham (1996a) outlines four principles of conservation;

1. A comprehensive and representative network of natural areas. This principle dictates that those habitats which have been preferentially altered are the highest priority for conservation activities.
2. A focus on threatened species, with high priority for species of National, State and then Regional significance.
3. A coordinated approach to the management of threatening processes.
4. A strategic vision of subregions where diverse ecosystems can evolve and function in a relatively undisturbed fashion.

Regional Biodiversity Management Plans are an important reference for park management plans, heritage areas, council reserves, forest reserves, water catchment areas, farms, revegetation projects, etc. (Possingham 1996a). They enable regional priorities based on scientific principles to be considered by those involved in the management of particular habitats.

Regional Biodiversity Plans aim to:

- provide a regional context for long-term conservation of biodiversity;
- increase community understanding of biodiversity;
- guide management options that conserve biodiversity;
- provide a strategic approach to implementation and funding of projects, that will focus the regional community's limited resources in producing the best return on its investment;
- provide a regional framework for assessing proposals, including integration with other natural resource management plans;
- facilitate the integration of biodiversity objectives with other natural resource issues

as outlined in Croft *et al.* (1999).

1.4 This plan

Adelaide was a special place at the time of European settlement and possibly the most biodiverse region in the state (Possingham *pers. comm.*).

Biodiversity Planning for metropolitan Adelaide aims to provide a regional strategy for long-term biodiversity conservation and management.

This document highlights conservation needs in the Adelaide region; and outlines a path to follow so that priority outcomes are achieved.

Some background concepts on biodiversity, its importance and value are discussed along with an overview to Regional Biodiversity Planning in the introductory chapter.

Basic conservation biology issues are raised in chapter two. Issues such as the impacts of habitat fragmentation provide a context for biodiversity conservation measures.

A description of the metropolitan Adelaide study area, its boundaries, climate, land uses, significant biodiversity areas, plant communities, flora and fauna is critical information when providing a snapshot of the state of biodiversity. This information is provided and discussed in chapters three and four.

Chapter five provides a summary of threats to biodiversity and discusses their management, which is fundamental to halting biodiversity loss in any particular region.

Recommendations and methods of implementation are critical in achieving desired outcomes for biodiversity conservation. These issues along with information gaps are discussed in chapter six.

1.5 Integration With Other Plans

The Metropolitan Adelaide Biodiversity Plan will complement existing plans for conserving the natural biodiversity of the region. Planning actions, recommendations and strategies from this plan can be incorporated into local government policy and planning.

This regional biodiversity plan supports the biodiversity plans currently being prepared by the Department for Environment and Heritage for adjoining regions (Mount Lofty Ranges and Northern Agricultural Districts). It also supports the management plans for the water catchments of which the Adelaide Metropolitan Area forms a part. These plans have been prepared by the Northern Adelaide and Barossa Catchment Water Management Board (CWMB), Onkaparinga CWMB and the Patawalonga and Torrens CWMB.

Soil Conservation Board District Plans

The plan takes into account planning by the regional Soil Conservation Boards whose districts include parts of the Metropolitan Adelaide Region, namely the Southern Hills Soil Conservation District (SCD), Central Hills SCD and Northern Hills SCD (see Map 4 Soil Boards, p.160 and section "Administrative Boundaries," p.13).

As a part of the *Soil Conservation and Land Care Act 1999*, Soil Conservation Boards are required to prepare a district plan which identifies degraded areas, the causes of degradation and measures that should be taken to ameliorate that degradation.

Conservation and restoration of remnant vegetation are an important component of maintaining soil ecosystem health and alleviating degradation problems such as soil salinity and erosion.

Soil district plans include "...descriptions of the district's native vegetation, including preservation and rehabilitation of existing native vegetation" (Croft *et al.* 1999). This document will assist the Adelaide region's Soil Conservation Boards in identifying important areas for biodiversity and the threats and management associated with our local biodiversity.

Development Plans

Under the *Development Act 1993,* Development Plans have been prepared for all metropolitan councils.

A Development Plan should seek to promote the provisions of the Planning Strategy and may set out or include planning or development objectives or principles relating to-

(i) the natural or constructed environment and ecologically sustainable development;
(ii) social or socio-economic issues;
(iii) urban or regional planning;
(iv) the management or conservation of land, buildings, heritage places and heritage areas;
(v) management, conservation and use of natural and other resources;
(vi) economic issues.

(*Development Act 1993*)

When amending Development Plans, this document will assist local government and the state government in identifying important priority areas for biodiversity, as well as specific management actions that may be incorporated in Development Plans.

Revegetation Strategies

The *Revegetation Strategy for South Australia* has identified a need for regional revegetation strategies

that identify areas, options and priorities for revegetation (State Revegetation Committee 1996). To date two regional revegetation strategies have been produced, one for the South East of South Australia (USERRC 1998) and one for the Mount Lofty Ranges (MLR) (Ellis 2000).

This later revegetation strategy recommends high priority revegetation options and designs, including:

- protection and appropriate management of remnants, in particular large, high quality blocks, exhibiting high levels of original biodiversity;
- facilitated, natural regeneration through the fencing of degraded remnants; and
- multi-layered plantings representative of the original plant community.

The Mount Lofty Ranges Strategy overlaps partly with metropolitan Adelaide, primarily along the top of the MLR between Clarendon and Para Wirra. This overlap zone contains a considerable amount of metropolitan Adelaide's remnant vegetation.

In the area of overlap, this document complements the MLR Regional Revegetation Strategy by recommending that revegetation occurs in priority areas and plant communities, with seed collected from as near as possible to revegetation sites.

Other biodiversity initiatives

Recommendations from this document also support biodiversity initiatives by local government, under Local Agenda 21 and the Local Government Biodiversity Network, the Mount Lofty Ranges Catchment Program, Natural Heritage Trust Bushcare program and State government legislative initiatives.

Government responsibility for the conservation of biodiversity is through various international conventions, and Commonwealth or State Acts of Parliament. These include:

International conventions/agreements

- Draft Agreement on the Conservation of Albatrosses and Petrels of the Southern Hemisphere (2000)
- USSR Australia Migratory Bird Agreement (on hold)
- United Nations Framework Convention on Climate Change (1992) (inc. Kyoto protocol (1997))
- UN Convention on Biological Diversity (1992)
- The Convention for the Conservation of Southern Bluefin Tuna (1992)
- China Australia Migratory Bird Agreement (CAMBA) (1986)
- Basal Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (1986 and related protocols)
- Convention for the Protection of the Natural Resources and Environment of the South Pacific Region (SPREP) (1986 and related protocols)
- London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1985)
- Convention on the Conservation of Antarctic Marine Living Resources (1980)
- Bonn Convention on Conservation of Migratory Species of Wild Animals (1979)
- Convention on the Conservation of Nature in the South Pacific (Apia) (1976)
- Convention Concerning the Protection of World Cultural and Natural Heritage (1974)
- Japan Australia Migratory Bird Agreement (JAMBA) (1974)
- International Convention for the Prevention of Pollution from Ships (1973) and its 1978 protocol (MARPOL 73/78)
- Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973)
- Ramsar Convention (Wetlands of International Importance as Waterfowl Habitat) (1971)
- International Convention for the Regulation of Whaling (1946)

Federal legislation

- *Environment Protection and Biodiversity Conservation Act 1999*
  This Act recently built upon and replaces five pre-existing Acts:
  - *National Parks and Wildlife Conservation Act, 1975*
  - *Whale Protection Act, 1980*
  - *Environmental Protection (Impact of Proposals) Act, 1974*
  - *Endangered Species Protection Act, 1982*
  - *World Heritage Properties Conservation Act, 1983.*

State legislation

- *Aboriginal Heritage Act 1988*
- *Animal and Plant Control (Agricultural and Other Purposes) Act 1986*
- *Coast Protection Act 1972*

- *Country Fires Act 1989*
- *Crown Lands Act 1929*
- *Development Act 1993*
- *Environment Protection Act 1993*
- *Fisheries Act 1982*
- *Forestry Act 1950*
- *Heritage Act 1993*
- *Local Government Act 1999*
- *Marine Environment Protection Act 1990*
- *Metropolitan Drainage Act 1935*
- *Mining Act 1971*
- *National Parks and Wildlife Act 1972*
- *National Trust of South Australia Act 1955*
- *Native Vegetation Act 1991*
- *Pastoral Land Management and Conservation Act 1992*
- *Pollution of Waters by Oil and Noxious Substances Act 1987*
- *Soil Conservation and Land Care Act 1989*
- *Water Resources Act 1997*
- *Wilderness Protection Act 1992*

2 Conservation Issues for Metropolitan Adelaide

2.1 Habitat Loss/Fragmentation

In areas that have had much of the native vegetation cleared, the changes in distribution and abundance of particular plants or animals are not just a result of loss of habitat. Rather they are a result of habitat reduction, species invasion, fragmentation and changes in external processes affecting the dynamics of fragments (Hobbs *et al.* 1992, in Haila *et al.* 1993).

Vegetation decline in the Adelaide region was most rapid when many areas were cleared for agriculture and settlement. The rate of vegetation loss today is not as rapid as it was years ago. However, even now with only 12% of our native vegetation left and some of the strongest legislation in Australia prohibiting clearance of native vegetation, native habitats are still being lost. Areas of remnant vegetation are being whittled away at the edges: road widening exercises, clearing along fencelines, clearing for the erection of houses, collection of firewood and grazing by stock are just some of the 'legitimate' activities that result in the steady decline in the total area of remnant vegetation.

Extinction

Scientists agree that there are two types of extinction- driven and chance (Possingham 1996b). Driven extinctions occur when there are changes in processes that enable the persistence of a species. The death rate exceeds the birth rate throughout the range of the species (Possingham 1996b).

Chance extinctions occur when despite a positive population growth rate, a series of catastrophic events cause a species to become extinct. Typically, chance extinctions occur when the available habitat for a particular species has been severely reduced and fragmented (Possingham 1996b). For example, the habitat of a particular species may be fragmented into small remnant parcels, and a catastrophe such as a wildfire might destroy the whole population of one parcel. Conceivably, sequential catastrophes might destroy all existing populations.

Until only recently most extinctions in Australia have been ***driven extinctions***. That is, due to a combination of factors such as habitat loss, predation from introduced animals, disease, or many other threatening processes, the death rate has exceeded the birth rate. Chance extinctions are only just beginning to occur and will continue to occur for many centuries. Despite relatively strong vegetation clearance legislation that has drastically reduced the rate of clearance, we can still expect species to become extinct. Our past actions from habitat clearance have not yet been "paid-off," this debt has been called the "extinction debt" (Possingham 1996b).

What this means for biodiversity conservation is that each native vegetation remnant cannot be managed in isolation from one another. Long-term strategies are required that manage remaining habitat in a regional context, underscoring the need for Regional Biodiversity Plans.

There is no clear opinion on what size remnant areas need to be in order to be capable of having self sustaining populations of plants and animals. What is clear however, is that some particular types of fauna require large tracts of native vegetation for foraging and breeding. Larger remnants have less chance of experiencing extinction of species than smaller remnants.

Island Biogeography

Island biogeography theory as developed by MacArthur & Wilson (1967) explains why small remnants are at risk of losing species over time.

While the island biogeographic concept was developed to explain why smaller and more isolated offshore islands have fewer species than larger and closer islands, it has been applied to remnant vegetation in urban and rural settings also. Remnant vegetation in cities and on farms can be seen as islands of remnants in a sea of suburbia and/or agriculture. Island biogeography helps to explain why small, isolated remnants are more likely to lose species to extinction than larger less-isolated remnant patches.

The work by MacArthur & Wilson (1967) explains that the number of species on islands increases with the increasing size of the island. Since larger islands contain more habitats and probably more variety of habitat, they are likely to contain more rare species. If a species becomes too rare, it is more likely to become extinct because there are no habitats from

which to replenish numbers. The smaller the island, the more severe the effect.

MacArthur & Wilson (1967) also suggest that isolated islands have fewer species than islands of equal area that are not as isolated. This is because species have further to travel to colonise isolated islands.

The concept and application to terrestrial habitats of island biogeographic theory is limited by the fact that it considers the regions between the islands as being uniform. Therefore, the ability of particular species to move between islands is the same, regardless of the matrix between the islands. Urban areas are a particularly good example of this limitation. The "oceans" between the "islands" can be very different, ranging from parking lots and new residential areas at one extreme to open space areas such as parks with trees at the other.

Despite the above limitations, island biogeographic theory serves a useful purpose to underscore the fact that smaller, isolated patches of remnant vegetation generally have fewer species than larger, un-isolated patches.

Metapopulation Dynamics

A metapopulation is essentially a regional population that is comprised of several local populations- "a population of populations" (Hunter 1996). At the regional level, these sub-populations are separate from each other although movement of species between each population may still occur. Despite the balancing effect of immigration and emigration, sub-populations appear and disappear not unlike the winking on and off of small lights (Hunter 1996). Each appearance represents a colonisation event, such as the wind blowing in the seed of a particular species. Each disappearance represents a local extinction such as a sub-population being killed by wildfire (Hunter 1996).

Sub-populations that persist for relatively long periods are called "core populations." Sub-populations that are more likely to wink on and off are called "satellite populations." However, the difference between core and satellite populations is blurry. Indeed, one year a sub-population may be a core population and the next year it may be a satellite population (Hunter 1996).

In its application to conservation, the important concept to be gleaned from metapopulation dynamics is that while a particular patch of remnant vegetation may not contain a particular threatened species, it may contain it in the future.

Impacts on Biodiversity from Habitat Fragmentation

Two important issues are involved in habitat fragmentation. The first is reduction of habitat; the second is that remaining habitat is not one large patch but rather many often very small patches (Saunders 1993). It is important for managers to separate the effects of these two issues. The effects of habitat loss are fairly obvious, individual plants and animals are lost and the number of species able to inhabit an area declines. The effects of habitat fragmentation are not as obvious. Some of these effects of habitat fragmentation are discussed below.

Invasion by non-native species

Disturbed habitats are most susceptible to invasion because they are the areas that are likely to have under utilised resources (Fox & Adamson 1986).

Invasion of native vegetation by non-local species is a four-step process (Hobbs & Mooney 1993). First, propagules of a potential invader have to be available for dispersal. Invading species are introduced for a variety of reasons, primarily through human activities such as horticulture and agriculture. Second, if the propagules are available in an area they need to be dispersed into native vegetation. This may happen by wind or water dispersal or via human or animal activity.

Once a weed propagule has dispersed into a native vegetation site, the third required step for successful invasion is that it must germinate and establish successfully. Each species has different requirements for germination and establishment. Water and nutrient availability are important factors, as are presence of other species and the soil substrate on which the propagule is located. The fourth and final stage for successful invasion is for the established individual to grow to maturity and reproduce. Successful invaders often have particular biological attributes such as high fecundity, generalist habitat requirements and rapid growth rates (Fox & Adamson 1986). For example boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*) (see p.109) is able to produce 50,000 seeds per plant, is dispersed through a variety of means including wind, water, vehicle movements, animals such as foxes and birds, produces seed two

years following germination and is able to inhabit a variety of environments and ecological communities (Thomas 2000).

Disruption of ecosystem processes
Ecosystems are dependent on particular process for their long-term survival. Ecosystem processes might include fire regimes, pollination, seed dispersal, decomposition, water cycling and nutrient cycling. Fragmentation of habitats result in widespread changes to ecosystem processes.

Edge effects
One consequence of habitat fragmentation is an increase in the perimeter to area ratio. That is, as fragmentation makes patches of habitat smaller and smaller, the ratio of edge to interior increases disproportionately (Hunter 1996). This is important for two reasons. First, the physical environment near an edge is different to the interior environment. It is usually windier, drier, warmer in summer and cooler in the winter. The result is that some native species (especially plants) will not use this zone. Second, exotic species associated with disturbed habitat may penetrate the edge zone (eg weeds, cats, foxes, people).

2.2 Conservation Dilemmas

Removal of Weed Species

Within the context of biodiversity conservation, it is intended that the implementation of specific management actions will have specific desired outcomes. However, it is likely that any on-ground activities will have ***several*** outcomes, some of which are unforeseen and undesirable.

For example, blackberries (*Rubus fruticosis* L. agg.) are a weed of national significance, and one of the five most invasive weeds in the Adelaide region. They pose a significant threat to biodiversity through the smothering of native vegetation and inhibiting regeneration (section 5.2, p.106).

The control of blackberries is imperative for the long-term survival of Adelaide's biodiversity. However, blackberries provide habitat for fauna such as the vulnerable (state) **Southern Brown Bandicoot** (*Isoodon obesulus*) and smaller birds of dense understorey such as wrens. While a threat to biodiversity, blackberries provide habitat for other native animals, and must be removed slowly and accompanied by adequate regeneration or revegetation.

A further example serves to illustrate the importance of looking at all outcomes for specific on ground actions.

Yellow-tailed Black-Cockatoos (*Calyptorhynchus funereus*) are a vulnerable species at the state level. Their natural habitat includes the more moist areas of the Mount Lofty Ranges. The native foods for these birds include the seeds of *Banksia* spp. and *Allocasuarina* spp. The distribution and abundance of the native food resources of this bird have declined considerably. However, this large bird has found an alternative food in the seeds of introduced pines (*Pinus* spp.). Indeed through their feeding behaviour, Yellow-tailed Black-Cockatoos have been implicated in the spread of pines.

Like blackberries, pines are a threat to biodiversity as they invade native bushland. Their removal is imperative for long-term biodiversity conservation. Consequently, the widespread removal of large pines in areas where Yellow-tailed Black-Cockatoos are known to live and feed is likely to have a negative impact on the population of this bird.

Increaser Species

While many plants and animals have declined markedly following European settlement, some native plants and animals have increased in distribution and abundance in this time. The significant amount of habitat alteration following European settlement has favoured some species over others.

For example, the **Noisy Miner** (*Manorina melanocephala*) has benefited from clearing of dense vegetation and from fragmentation of remnant vegetation (Stothers *et al.* 1999).

Common Brushtail Possums (*Trichosurus vulpecula*) have suffered from vegetation clearance as their food (fruit, leaves etc.) and shelter (hollows) have been destroyed. However, these animals have benefited from the construction of dwellings and the planting of fruit trees (nesting and food requirements). The result is that in built-up areas possums numbers have probably increased following European settlement, but in agricultural regions where vegetation has undergone broadscale clearance, numbers are comparatively very low.

However, some native animals are more easily 'noticed' by humans than other native animals. In

particular animals that have a negative impact on humans are subject to scrutiny. For example, **Musk Lorikeets** (*Glossopsitta concinna*) are an attractive, medium sized bird that often includes the fruit from fruit trees in their diet. This sometimes results in significant losses to commercial fruit growers. The **Rainbow Lorikeet** (*Trichoglossus haematodus*) and **Adelaide Rosella** (*Platycercus elegans*) are also common visitors to local fruit orchards. The Common Brushtail Possums (*Trichosurus vulpecula*) and their nocturnal habits in suburban dwellings are also easily noticed by humans. The native animals mentioned here are often considered 'pests' to humans, as through their habits they negatively affect us and consequently are more likely to be noticed.

However, there are also native animals that can become locally abundant to the detriment of other native animals.

As discussed above, Noisy Miners (*Manorina melanocephala*) appear to be more common following European settlement. The success of this bird has been attributed to the fragmentation of vegetation and the clearing of dense understorey (Stothers *et al.* 1999). Their aggressive behaviour towards other nectarivorous/insectivorous birds excludes these more passive birds (Stothers *et al.* 1999). Indeed, studies have shown that in areas free of Noisy Miners, the abundance and diversity of other native bird species increases markedly (Stothers *et al.* 1999).

Furthermore, a Victorian study has shown that in native vegetation areas where Noisy Miners are common, eucalypts show signs of severe dieback caused by insect attack. This is due to the absence of small insectivorous birds in areas where Noisy Miners are common, allowing defoliating insects to increase unchecked (Stothers *et al.* 1999).

Clearly, the underlying cause of the problem is significant habitat alteration; the increase in abundance of this bird is simply an expression of this underlying cause.

Non-endemic Natives

A distinction needs to be made between plants and animals that are indigenous to the Adelaide region and those that have been translocated here or have colonised the region since European settlement. For example, Noisy Miners are indigenous to the Adelaide region (that is they were here at the time of European settlement) and have proliferated in number since then. However, the **Crested Pigeon** (*Ocyphaps lophotes*) was not present in the Adelaide region at the time of European settlement but has since colonised the Adelaide area.

Self-sustaining populations of the **Freshwater Catfish** (*Melanotaenia fluviatilis*) and **Koalas** (*Phascolarctos cinereus*) occur in the Adelaide region through translocation by humans from elsewhere in Australia.

3 Metropolitan Adelaide

3.1 Available Information

Mapping Data (GIS)

The State Government's Geographical Information System (GIS) and biological databases have been used to produce the maps and statistics presented in this report. This data has come from various State Government sources. All the datasets are referenced in Appendix 6 (p.169).

Vegetation Mapping

All vegetation mapping and site data, collected according to the standards of the Biological Survey of South Australia, are held in the Environmental Database of South Australia, (Planning SA/DEH). These data are the primary source of information about plant communities found within the region. This information was supplemented with information on plant communities provided in the published literature.

In addition, the Urban Forest Biodiversity Program is collating information from various published and unpublished community sources.

Native Vegetation Cover

As part of the vegetation survey process for the agricultural regions of SA (Heard & Channon 1997), native vegetation cover is mapped from 1:40,000 aerial photography. Areas five to 10 hectares or larger are mapped (Mount Lofty Region only), with the remaining areas mapped down to one hectare. This provides a spatial layer of information showing where native vegetation is and the size of remnants. This mapping is used to derive the broad area estimates provided in Table 1 (p.15). Following this mapping, the vegetation surveys and floristic mapping take place. Native vegetation cover mapping exists for the entire Adelaide Metropolitan Region. Native grasslands are difficult to map using this technique and are mostly unmapped in the region.

Native Vegetation Survey

Vegetation surveys are conducted in a systematic nature across the agricultural and pastoral regions of the State. Native vegetation survey sites are selected using aerial photography and other known information about an area. Sites are chosen to select the range of vegetation and landform types within a study area. Native vegetation surveys using the Biological Survey of SA methodology (Heard & Channon 1997) have been undertaken across the Southern Mount Lofty Ranges. Vegetation site data from these surveys are available from Planning SA and the Department for Environment and Heritage.

Floristic Mapping

Plant communities in the Southern Mount Lofty Ranges (Goodwins & Stubbs 1998) were mapped from 1:40,000 colour stereo pair aerial photography. As with the vegetation cover mapping areas one hectare or larger are mapped, with some areas only being mapped to five or 10 hectares.

The mapping is based on the site based vegetation survey data, which is analysed using a grouping technique (Belbin 1991) to determine species composition of sites based on both species presence and cover abundance. The plant communities are defined using the analysis groups as a base with further groups added to represent plant communities delineated from aerial photograph interpretation and field checking. Plant communities are mapped using dominant overstorey species (to represent the particular suite of species likely to be found within that community), along with overstorey species height and projective foliage cover to indicate structure.

Plant communities from the floristic mapping (Goodwins & Stubbs 1998), are described along with area estimates and the degree of formal protection of these groups in Table 2 (p.19). A description of the SA vegetation structural formation definitions is found in Appendix 7 (p.170).

Planning SA is currently re-mapping the remnant vegetation within the Adelaide region. It is expected that this exercise will consolidate the accuracy of previously collected information pertaining to remnant vegetation in the Adelaide region. A further assessment of vegetation condition for each discrete association would contribute immensely to a clearer picture of where we are now and what we need to do in the future.

Both regional and standard 1:50,000 tile based maps of the floristic mapping are readily available from Planning SA on request.

Floristic mapping for some of the larger NPWSA Reserves exists in GIS format.

In the Southern Mount Lofty Ranges region, much of the native grassland has not been included in this GIS floristic mapping.

Roadside Vegetation

Roadside vegetation has been difficult to map in a standard way due to the difficulty of using conventional aerial photography techniques for mapping narrow linear strips of vegetation. As a result, prior to the last two years, very little roadside vegetation mapping was available in GIS format for the Metropolitan Adelaide Region.

Lack of adequate mapping of native roadside vegetation and its condition has hampered efforts to regionally manage such vegetation effectively.

A methodology to rapidly assess and map roadside native vegetation has been developed by the State Government to survey vegetation on roads managed by Local Government and Transport SA (Stokes *et al.* 1998). The methodology provides for GIS mapping of roadside vegetation and assists in the development of appropriate management guidelines to be determined as a result. A number of roads in the Adelaide Metropolitan Region have been surveyed using the methodology (see Appendix 5, p.162). For details contact the Geographical Analysis and Research Unit or the Environmental Unit, Transport SA. Interim roadside vegetation survey manuals are available from Planning SA.

Pre-European Vegetation Mapping

Broad mapping (1:250,000) currently exists for the Adelaide Plains (Kraehenbuehl 1996). This mapping provides an indication of broad plant communities of the area and their distribution before clearance. This mapping provides a valuable tool for revegetation projects that aim to try and restore some of the original plants and plant communities of the region. This map is readily available from Planning SA and the Urban Forest Biodiversity Program.

The Pre-European settlement plant communities for the southern Adelaide region are currently being mapped. The use of Pre-European settlement vegetation maps within a biodiversity planning context is extremely useful. Extending this exercise into the Hills Face Zone and beyond would provide valuable information.

3.2 Study Area

The Adelaide region has been described as having probably the richest source of biodiversity in the state before European settlement (Possingham *pers. comm.*). This high biodiversity is a consequence of a high rainfall gradient between the Gulf and the Mount Lofty Ranges (see Map 1 Topography and Rainfall, p.157) and because the region has both coastal and interior elements. Such uniqueness and diversity is underscored by the fact that the Adelaide region supports several animal species at their northern and western limits of distribution (Tyler *et al.* 1976).

As a consequence of this habitat variety, the Adelaide region supported significant percentages of the State's terrestrial plants (30%), birds (58%), terrestrial mammals (32%), reptiles (20%) frogs (22%) and freshwater fishes (20%) in an area that is only 0.15% of the total land area of the State.

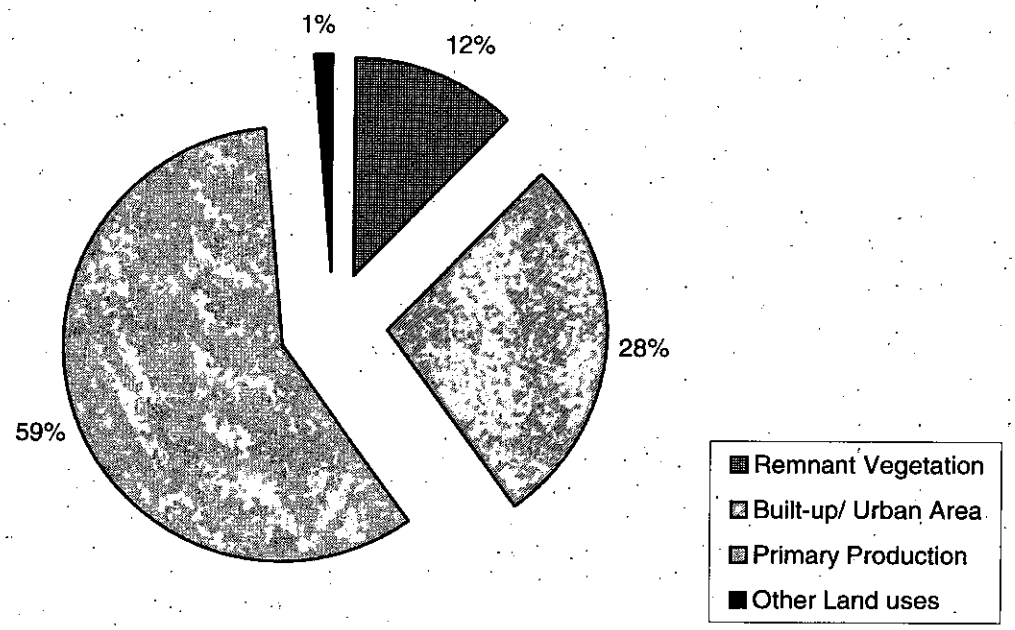
While it is unrealistic to aim at restoring all of the lost species, (indeed some are now totally extinct, not just in the Adelaide Metropolitan Area) we can aim to halt the current loss of habitat and therefore species, and to rehabilitate or even restore many areas.

The clearing of vegetation in the Adelaide region commenced with the arrival of the first European settlers. This was largely motivated by the desire to create suitable grasslands for the grazing of stock; to utilise timber for housing, fencing and firewood; and to clear areas for the construction of dwellings and infrastructure such as roads. The early settlers soon recognised the soil types and vegetation assemblages that provided the most productive areas for stock grazing. Consequently, many vegetation assemblages that were seen to be non-productive remained well conserved until only recent times. Kraehenbuehl (1996) indicates that the 'Black Forest' (*Eucalyptus microcarpa* Woodland) at Goodwood was recognised early in Adelaide's European history as prime grazing land, and therefore the Black Forest was almost totally cleared by 1880. Areas to the North and West of the city (reedbeds, samphire, and coastal dunes) remained largely uncleared until as late as 1950. These areas were rapidly urbanised following the boom period after World War II.

The estimated area of metropolitan Adelaide is about 185,000 hectares.

Figure 1 (p.13) shows that the metropolitan area comprises a variety of different landuses. Land owners are presented with unique challenges when faced with managing remnant vegetation surrounded by a variety of contrasting landuses.

Figure 1 Relative landcover estimates for Adelaide Metropolitan Area



Source: GIS Mapping (1985, 1987, 1991 – 1994 Colour aerial photography landcover mapping)

3.3 Boundaries

The boundaries of metropolitan Adelaide have been defined differently by different authors and organisations. This document has used the boundaries of the metropolitan area as defined in the Development Act 1993. (see Map 2 Metropolitan Open Space System (MOSS), Hills Face Zone and NPWSA Areas, p.158).

Administrative Boundaries

The Adelaide Metropolitan Area includes 20 Local Government Areas (see Map 3 Local Government Areas, p.159). It completely encompasses 18 of these and includes the western third of the Adelaide Hills Council. The Adelaide Metropolitan Area also includes a small portion (166ha) of the District Council of Kapunda Light, north of the Gawler River and east of Main North Road.

The Adelaide Metropolitan Area covers part of three Soil Conservation Board Districts and directly adjoins one other (see Map 4 Soil Boards p.160).

Biological boundaries

In the interests of planning for the National Reserves System, the Interim Biogeographic Regionalisation for Australia (IBRA) has recently divided Australia into 80 discrete biological regions (Thackway & Cresswell 1995). Metropolitan Adelaide falls into parts of two IBRA regions, The Mount Lofty Block and the Eyre/Yorke Block (see Map 5 , p.161). The Mount Lofty Block extends from the Quorn/Crystal Brook region in a narrow band along both sides of the ranges south to the tip of the Fleurieu Peninsula and includes Kangaroo Island. The Eyre/Yorke Block includes Eyre and Yorke Peninsula, but also extends down the northern Adelaide Plains in a south westerly direction from Gawler to the suburb of Cavan. All land south of this line is included in the Mount Lofty Block. The Eyre/Yorke Block should really extend further south on the Adelaide Plains to approximately Aldinga, as this region is biologically more like the Eyre/Yorke Block than the Mount Lofty Block. It is expected that this inaccuracy will be addressed following a comprehensive review of IBRA (Tim Bond *pers. comm.*).

While it is preferred that biodiversity plans be prepared and implemented according to biogeographic regions, it is considered that the metropolitan area has unique issues that require addressing at this social/administrative level.

3.4 Physical Description

Climate

Metropolitan Adelaide has a mediterranean climate, consisting of long hot summers and cool wet winters. Yet across the region, there is significant variation in both temperature and rainfall, with a general trend of increasing rainfall from west to east (see Map 1 Topography and Rainfall, p.157). This variation is largely a result of variation in topography. Areas adjacent to Mount Lofty receive the highest average annual rainfall, with Stirling receiving an average of 1189mm of rain per annum. Areas to the north and west receive the lowest average annual rainfall; Edinburgh on the northern Adelaide Plains receives, on average, 440mm of rain each year.

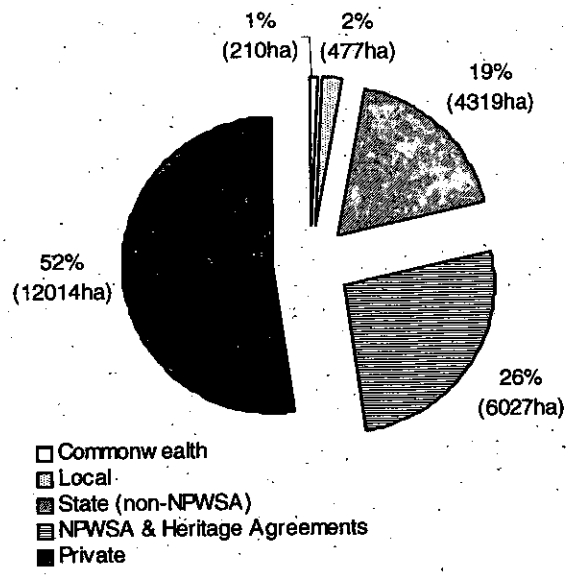
3.5 Native Vegetation Tenure

Since European settlement, approximately 88% of native vegetation has been cleared, originally for agriculture, but increasingly for residential development (see fold out map). The remaining 12% (23,047ha) is largely concentrated in the Hills Face Zone. Indeed, 33% (7699ha) of metropolitan Adelaide's remnant vegetation is found in the Hills Face Zone. The bulk of this is found in the central Hills Face Zone between Anstey Hill Conservation Park and Belair National Park. This region, representing 5% of the total metropolitan area, supports 25% of the total remnant vegetation. The southern and northern Hills Face Zone contains comparatively little remnant vegetation.

Outside of the Hills Face Zone, much of the remaining remnant vegetation is found in the coastal mangrove/samphire communities (2117ha).

Approximately 26% (6027ha) of Adelaide's remnant vegetation is found in NPWSA reserves or is afforded similar protection as a heritage agreement. With another 22% on land under government ownership, most of which is owned by the state government (primarily SA Water and Forestry SA). More than half of Adelaide's remaining native vegetation is held in private ownership (see Figure 2).

Figure 2 Land Tenure of Remnant Vegetation in Adelaide Metropolitan area



An analysis of the Adelaide Plains only, reveals even less remnant vegetation. Approximately 2.8% (2826ha) of the Adelaide Plains consists of remnant vegetation. The mangrove/samphire community along the coast makes up almost 75% of this amount (2117ha). Therefore, not including the mangroves and samphire communities, 0.7 percent of the Adelaide Plains is considered remnant vegetation.

Comparisons with other Planning Regions

Table 1 is a comparison of the area of native vegetation for different planning regions in the State.

As might be expected in an urban area, the Adelaide region is depauperate in remnant vegetation when compared with other nearby regions. As a percentage of the total region the Adelaide metropolitan area has only 12% native vegetation. Similar figures are obtained when comparing the total native vegetation reserved in NPWSA areas.

Table 1 *Area and Tenure of Native Vegetation for South Australian Biodiversity Planning Regions (source: Kahrimanis & Carruthers (2000))*

Biodiversity Planning Region	Total area of Native Vegetation '000 (ha)	Native Vegetation Cover as a % of Region	Total area of Native Vegetation '000 (ha) Formally Reserved	% of Native Vegetation Formally Reserved
Kangaroo Island	207	47%	132	64%
Eyre Peninsula	2188	43%	959	44%
Murray Darling Basin	4341	59%	1179	37%
South East	277	13%	108	39%
Mount Lofty Ranges	50	15%	14	28%
Northern Agricultural Districts	614	21%	50	8%
****Adelaide Metropolitan Region**	**23**	**12%**	**6**	**26%**

Note:
Hectares rounded to nearest 1000.
Metropolitan Region has some overlap with the Mount Lofty Ranges region - primarily in the Hills Face Zone and on the Northern Adelaide Plains

Source:
Kangaroo Island Native vegetation mapping (GIS), 1991 1:40,000 colour aerial photography, Planning SA.
Eyre Peninsula Native vegetation mapping (GIS), 1991,1995,1996 1:40,000 colour aerial photography, Planning SA and 1:250,000 Landsat Imagery, National Wilderness Inventory.
SA Murray Darling Basin Native vegetation mapping (GIS), 1985,1989,1991 1:40,000 colour aerial photography, Planning SA and 1:84,000 colour aerial photography, DEH.
South East Native vegetation mapping (GIS), 1987 1:40,000 colour aerial photography, Planning SA and Forestry Reserves, Forestry SA.
Mount Lofty Ranges Native vegetation mapping (GIS), 1985, 1987, 1991-1994 1:40,000 colour aerial photography, Planning SA.
Northern Agricultural Districts Native vegetation mapping (GIS) 1991-1994 1:40,000 colour aerial photography, Planning SA.
Adelaide Metropolitan Region Native vegetation mapping (GIS), 1985, 1987, 1991-1994 1:40,000 colour aerial photography, Planning SA and UFBP Native vegetation mapping (2000)
All Regions: NPWSA Reserves (GIS), Conservation Reserves (GIS), Heritage Agreements (GIS), Bookmark Biosphere Reserve (GIS), DEH, current to Jan 2000 for SAMDB, NAD, Eyre and current to Jan 1998 for KI, Mount Lofty and SE regions.

***Adelaide Metropolitan Region statistics generated by SA Urban Forest Biodiversity Program*

4 Biodiversity of Metropolitan Adelaide

As discussed earlier, the Adelaide region was possibly the most biodiverse region in the State. Today most of this biodiversity has disappeared. However, there remain some significant areas of remnant vegetation and associated biodiversity. Areas worthy of particular attention include:

- large remnant areas
- some council reserves
- some private property
- coastal areas
- linear remnants
- isolated trees

4.1 Significant Biodiversity Areas

Large Remnant Areas

Large portions of remnant vegetation are naturally significant biodiversity areas. Larger areas are likely to contain more species and be more viable in the long-term (section 2.1 "Island Biogeography").

The metropolitan area contains some reasonably large tracts of remnant vegetation, primarily in and to the east of the Hills Face Zone.

The central **Hills Face Zone**, barely 15 minutes drive from the city centre, contains a significant portion of metropolitan Adelaide's remnant vegetation. The region extending from Anstey Hill Recreation Park to Belair National Park and Sturt Gorge Recreation Park constitutes 5% of the metropolitan area (10,255ha), but contains 25% of Adelaide's remnant vegetation (5692ha). The NPWSA Reserves make up more than 3000ha of remnant vegetation and contain about 600 species of native plants. However, large tracts of remnant vegetation are also found on private property throughout this area.

It is no coincidence that almost one quarter of Adelaide's remnant vegetation is found in the Hills Face Zone. Restrictions on development in the Hills Face Zone have provided remnant vegetation in this zone some protection. However, already under threat from habitat fragmentation and weeds, the Hills Face Zone is also under significant pressure from some groups to 'free up' the Hills Face Zone for some types of development. If the Hills Face Zone is to continue to contribute as a fundamental component of Adelaide's overall biodiversity, pressures to develop this area must be resisted.

The region in and around **Para Wirra Recreation Park** is also a significant biodiversity area in the Adelaide region. 10,000ha of a variety of plant communities exist here. As the metropolitan boundary dissects this region, only 3000ha fall within the Adelaide Metropolitan Area.

The region around **Scott Creek Conservation Park** and **Mount Bold Reservoir** also contain significant, large tracts of vegetation. About 5000ha of remnant vegetation can be found in and immediately adjacent to Scott Creek and Mount Bold Reservoir. Scott Creek Conservation Park alone contains more species of native plants than any other NPWSA area in metropolitan Adelaide (See Table 3 Summary of NPWSA Parks, p.138).

The mangrove (*Avicennia marina* var *resinifera*) and saltmarsh communities (*Halosarcia* spp. *Sarcocornia* spp. Low Shrubland) in the **St Kilda/Barker Inlet** region total approximately 2200ha. These communities have a significant amount of their Pre-European settlement extent remaining. With approximately 1650ha of mangroves and 540ha of saltmarsh remaining in this region alone (smaller remnants of both of these plant communities can be found further north along and adjacent to the coast). This region contains the largest area of mangroves in the Gulf St Vincent and is considered one of South Australia's most important wetlands (Morelli & de Jong 1995).

The mangrove community while not containing a large number of plant species is very diverse in insect and bird life. It also plays an important role in water filtration and provides nursery habitat for native fishes and other marine species (many of, which are commercially important).

The saltmarsh community is diverse in both floral and faunal components. It also supports a nationally vulnerable bird species- the **Slender-billed Thornbill** (*Acanthiza iredalei*) (see p.103).

These four areas represent about 90% of the remnant vegetation in the Adelaide Metropolitan Area. Consequently, if Adelaide is to retain any of its remaining biodiversity, these areas must be protected

and managed with a clear focus on biodiversity conservation.

Council Reserves
Many council reserves also contain significant biodiversity areas. While some may have only overstorey eucalypts remaining, others have an intact structure and are species rich. Most of these reserves are in areas that have undergone extensive urban development relatively recently. Many council reserves in the Tea Tree Gully, Gawler, Blackwood and southern coastal areas are good examples of this (see Appendix 1 p.129).

Council reserves with significant conservation value are typically small (less than 10ha) surrounded on all sides by houses and are managed primarily for recreation purposes.

Private Property
In the Adelaide Metropolitan Area, some significant vegetation remains on private property. Indeed, 52% of the remnant vegetation in the Adelaide area is under private land tenure. These properties are under a variety of landuses some of which have been placed under heritage agreement (see A2 fold-out map "Metropolitan Adelaide"). Some highly significant remnant vegetation remains outside of public ownership. For example, the golf courses to the west of Adelaide house many rare or threatened plants and regionally significant plant associations.

Coastal Areas
There are a few significant, albeit small and fragmented, remnant vegetation sites along the coastal strip. Sites such as Pelican point, Tennyson Dunes, Kingston Park, Port Stanvac Scrub and Headland Reserve are important remnants of coastal vegetation.

Linear Remnants
Some roadside vegetation has been retained throughout the Adelaide region. While this land is owned by Transport SA the management of the land along the road reserve is the responsibility of the local council. Although the linear nature of roadside remnant vegetation makes these sites susceptible to weed invasion, often roadside vegetation can act as a valuable corridor between more significant stands of remnant vegetation.

A set of fact sheets produced by Transport SA outlines some of the management issues associated with roadside vegetation. These fact sheets have been reproduced in Appendix 5 (p.162).

Isolated Trees
Isolated remnant trees can also contribute to overall biodiversity conservation. In the metropolitan area, these are usually large eucalypts such as **River Red Gums** (*Eucalyptus camaldulensis*). Large remnant trees are considered as a part of the ecosystem that surrounds them. They contribute to overall habitat, food resources and genetic diversity (Graham 2000). Faunal groups that are known to utilise individual mature trees include birds, some mammals, many invertebrates (Hill *et al.* 1997, in Graham 2000), and reptiles.

4.2 Priority Plant Associations

The publications by Davies (1982) and Neagle (1996) provide a summary of the priority plant associations for South Australia. Five of these plant associations are found in the metropolitan area. They are considered to have conservation significance and require further protection:

- *Eucalyptus dalrympleana* ssp. *dalrympleana* (syn. *E. rubida*) (Mt Lofty Ranges Candlebark) **Open Forest**
- *Banksia marginata* (Silver Banksia) **Low Woodland**
- *Eucalyptus microcarpa* (Grey Box) **Woodland**
- *Eucalyptus porosa* (Mallee Box) **Woodland**
- *Leptospermum lanigerum,* (Silky Tea-tree) *L. continentale* (Prickly Tea-tree) **Closed Heath**

In the Mount Lofty Ranges, *Eucalyptus dalrympleana* ssp. *dalrympleana* Open Forest occurs in the wetter, colder valleys on fertile soils between Mylor and Gumeracha (Nicolle 1997). It is more common in New South Wales, Victoria and Tasmania. Due to the scarcity of preferred climate in the Mount Lofty Ranges, this association was never widespread. As this association occurs on highly productive soils (Nicolle 1997), it has been preferentially cleared.

The association is considered significant because it is poorly conserved in South Australia, with most remaining examples being small and/or degraded and/or atypical (Priority 3) (Neagle 1995). Good stands of this vegetation type can be found in Cleland Conservation Park, Morialta Conservation Park, Mount George Conservation Park, Mylor Conservation Park, and at Bridgewater and Norton Summit.

Banksia marginata Low Woodland occurs on a variety of soils, but in the Adelaide region it is

primarily on sandy soils immediately below the foothills of the Mount Lofty Ranges. It is conservation significant because it is poorly conserved in South Australia, with most remaining examples being small and/or degraded and/or atypical (Priority 3) (Neagle 1995).

Eucalyptus microcarpa Woodland occurs on heavy soils such as clays and on flat sites is associated with *Eucalyptus camaldulensis*. In South Australia, it occurs in three small, disjunct populations- Bordertown/Naracoorte region, Melrose/Quorn region and in the eastern and southern suburbs of Adelaide. It is much more abundant on the inland slopes of the Great Dividing Range.

Neagle (1995) describes the association as being poorly conserved in South Australia that is much depleted, but has a few large examples remaining (Priority 4). This association is found relatively close to the city on the footslopes of the Mount Lofty Ranges between Stonyfell and Willunga. Known as the "Black Forest" it once occurred on the Adelaide Plains, but has since been almost completely cleared. Heywood Park at Unley Park, less than 4km from the city centre, contains the last remaining patch of this association on the Adelaide Plains.

Some concern has been raised over the possibility that firewood collection from *Eucalyptus microcarpa* Woodlands represents a serious threat to this already threatened association (Driscoll *et al*, 2000). The close proximity of this association to built up areas makes it particularly susceptible to this activity.

The natural distribution of *Eucalyptus porosa* Woodland is widespread in southern South Australia, extending eastward from the north of Streaky Bay to Eyre and Yorke Peninsulas, the Flinders Ranges and south to the region around Keith (Nicolle 1997). It is not found in the higher rainfall parts of the Mount Lofty Ranges or on Kangaroo Island. This association is usually found on heavy soils over limestone in large shallow depressions (Nicolle 1997). Small disjunct populations occur in New South Wales and Victoria.

Its preferred habitat occurs in areas suited to rain fed agriculture. Consequently, it has been preferentially cleared and is considered significant because it is poorly conserved in South Australia; there are moderately large examples that still remain but many have degraded understoreys and/or are under threat (Priority 4) (Neagle 1995).

Leptospermum lanigerum/ L. continentale Closed Heath is considered as being adequately conserved interstate, but threatened in South Australia and often occurring as disjunct outliers (Davies 1999).

In the Adelaide region this plant community is found only adjacent permanent water and primarily in the Mount Lofty Ranges. This threatened plant community frequently contains many threatened plants. Some of the better areas of this plant community are found in Cleland Conservation Park, Scott Creek Conservation Park, Sturt Gorge Recreation Park, Onkaparinga River National Park and at Blewitt Springs.

4.3 Plant Communities and Habitats of the Adelaide Metropolitan Area

Table 2 Remnant Plant Communities and approximate Area (ha)

- **(NPWSA information after Neagle 1995)**
- **Highlighted entries are priority plant associations after Neagle (1995)**

Floristics/ Structure	Understorey	Site name	Area
Eucalyptus camaldulensis **Closed Forest**	Over **Lycium, ferocissimum, *Piptatherum miliaceum* and *Cyperus gymnocaulos,*	Playford Reserve 201	15.7
Eucalyptus camaldulensis **Open Forest**	Over *Acacia pycnantha, Pteridium esculentum, ±Hibbertia exutiacies, ±Olearia ramulosa,* exotic grasses	Black Hill Conservation Park	63.1*
	Over **Olea europaea* and **Lycium ferocissimum*	Clements rd Reserve	
	Over **Olea europaea, *Fraxinus rotundifolia* and **Schinus areira*	Clonlea Park	3.95
	Over *Acacia salicina* and *A. paradoxa*	Cobbler Creek Reserve	2.43
	Over *Bursaria spinosa, Acacia paradoxa, *Lycium ferocissimum, Cyperus vaginatus, *Pennisetum clandestinum*	Shannon rd Reserve	1.5
	Over *Bursaria spinosa, Acacia paradoxa, *Lycium ferocissimum, Cyperus vaginatus, *Pennisetum clandestinum*	Smart rd Reserve	4*
	Over **Olea europaea, Eremophila longifolia, Myoporum*	Whitelaw Creek	0.1
	Over *Callitris gracilis, Acacia pycnantha, Allocasuarina verticillata, Austrostipa* spp., *Bursaria spinosa, Pimelea stricta, Themeda triandra, Goodenia amplexans, Hibbertia sericea, *Fraxinus rotundifolia*	Ferguson Conservation Park	0.8
Eucalyptus camaldulensis **Woodland**	*Over Acacia pycnantha, ±A. retinodes, ±Themeda triandra, +* widespread exotic herbs and grasses	Black Hill Conservation Park	161.2*
	(along drainage lines and the main river channel)	Onkaparinga River Recreation	
	Over sedges and rushes, plus many exotics (along drainage lines and the main river channel)	Onkaparinga River National Park	
	Over **Olea europaea* and *Phragmites australis*	Dead Man's Pass, Gawler	2.37*
	Over *Acacia melanoxylon*	Zig-Zag Reserve	
		First Creek Tusmore	1.00
		Wadmore Park	17*
Eucalyptus camaldulensis **Woodland**	Over *Paspalum distichum, Phragmites australis, Typha* sp., *Cyperus vaginatus, *Oxalis pes-caprae.* With **Fraxinus oxycarpa* occurring as a sub-dominant.	Sturt Gorge Recreation Park	5.3
Eucalyptus camaldulensis **Woodland →Open Woodland**	Over predominantly exotic shrubs and herbs	Shepherds Hill Recreation Park	<44*
Eucalyptus camaldulensis **Open Woodland**	Over **Schinus areira, Acacia salicina, *Olea europaea*	Walkley Heights	3.27*
		Douglas Scrub	22.00*
Eucalyptus camaldulensis, E. leucoxylon **Open Forest**	Over *Callitris gracilis,* and *Acacia paradoxa*	Coulls Rd Reserve	1.8
	Over *Callitris gracilis, Bursaria spinosa, *Olea europaea, Dodonaea viscosa* ssp. *spatulata,* and exotic grasses	Smart rd Reserve	4*
	Over *Bursaria spinosa, Acacia pycnantha, Allocasuarina*	Kaplan Reserve	2.00*
	Over *Bursaria spinosa* and *Acacia paradoxa*	Kaplan Reserve	2.00*
	Over *Dodonaea viscosa,* heath, sedges and exotic grasses	Player Reserve	2.00
	Over **Fraxinus rotundifolia, *Populus* spp., *Dodonaea viscosa* ssp. *spatulata, *Olea europaea, Callitris gracilis, Bursaria spinosa* and exotic grasses	Sandalwood Reserve	0.5
Eucalyptus camaldulensis **Open Forest→ Woodland → Open Woodland**	Over exotic grasses	Anstey Hill Recreation Park	3.8*
Eucalyptus camaldulensis, E. leucoxylon **Woodland**	(highly modified, with many exotics)	Dry Creek Linear Park	
	Over *Acacia salicina*	Harry Bowey and Carrisbrooke Reserve	
	Over *Acacia pycnantha, Acacia paradoxa* and native and exotic	Bell Yett Reserve	0.5
		Tangari Reserve	18
		Chambers Gully	21.5*
		Fourth Creek, Rostrevor	0.5
		Third Creek University of SA	1.50
		Fifth Creek Walking Trail	1.00
		Wadmore Park	17*
		The Gums	
Eucalyptus leucoxylon, ±E. camaldulensis **Woodland →Low Woodland**	Over *Acacia pycnantha; Bursaria spinosa, Dodonaea viscosa,* plus exotics	Cobbler Creek Recreation Park	144
Eucalyptus leucoxylon, ±E. camaldulensis **Woodland →Low Open Forest**	Over *Acacia pycnantha, Dodonaea viscosa* ssp. *spatulata, Olearia ramulosa, Astroloma conostephioides, Hibbertia sericea, H. exutiacies, Scaevola albida* var. *albida, Themeda triandra, Austrostipa* sp., *Cassytha glabella, Cheilanthes austrotenuifolia, Geranium retrorsum,* plus exotics Or Over (in creeklines) **Rubus ulmifolius, Pteridium esculentum, *Oxalis pes-caprae, *Olea europaea, Acacia pycnantha, Cyperus vaginatus, Juncus subsecundus,* exotic grasses and herbs	Morialta Conservation Park	75.6

Eucalyptus camaldulensis, E. leucoxylon **Open Woodland**	Over *Danthonia racemosa* and *Cotula australis*	Kensington Gardens Recreation Reserve (Pile Paddock)	
		Brownhill Creek Recreation Park	
		Hazelwood Park	
		Nightingale Reserve	
Eucalyptus camaldulensis, E. leucoxylon, E. microcarpa, Acacia melanoxylon, A. pycnantha, Allocasuarina verticillata **Woodland**		Danthonia Reserve	2.00
Eucalyptus camaldulensis, E. leucoxylon, E. microcarpa, Acacia dodonaeifolia **Open Woodland**	Over exotic grasses	Glen Osmond Creek	
		Ridge Park	1.9
Eucalyptus leucoxylon, E. camaldulensis **Open Forest**	Over *Acacia pycnantha, Callitris gracilis, Allocasuarina verticillata, Acacia paradoxa*, exotic grasses	Callitris Reserve	2.36*
		Kaplan Reserve	2.00*
Eucalyptus leucoxylon **Open Forest**	Over *Callitris gracilis, Allocasuarina verticillata, Bursaria spinosa, Acacia paradoxa* and native grasses	Abercrombie Reserve	2.33
	Over *Callitris gracilis, Allocasuarina verticillata, Acacia paradoxa*	Callitris Reserve	2.36*
	Over *Allocasuarina verticillata, Bursaria spinosa, *Olea europaea*	Xavier Creek	
	Over *Bursaria spinosa, Acacia paradoxa, Acacia salicina, Acacia pycnantha, *Olea europaea, Callitris gracilis, Dodonaea viscosa* ssp. *spatulata*	Smart rd Reserve	4*
	Over *Acacia pycnantha, Pteridium esculentum, ±Hibbertia exutiacies, ±Olearia ramulosa*, exotic grasses	Black Hill Conservation Park	63.1*
Eucalyptus leucoxylon **Open Forest→ Woodland → Open Woodland**	Over (Western side- near Perseverance road) *Hakea rugosa, Hibbertia riparia, Themeda triandra, Lepidosperma lineare, Chloris truncata, Aristida behriana*, (±*Acacia pycnantha*), plus heavy invasion of exotics	Anstey Hill Recreation Park	<15.3
	Over *Acacia pycnantha, Hibbertia exutiacies, Acrotriche serrulata*	Anstey Hill Recreation Park	3.8*
Eucalyptus leucoxylon **Woodland → Open Forest**	Over *Callitris gracilis, Acacia pycnantha, Allocasuarina verticillata, Austrostipa* spp., *Bursaria spinosa, Pimelea stricta, Themeda triandra, Goodenia amplexans, Hibbertia sericea, *Fraxinus rotundifolia*	Ferguson Conservation Park	6.7
Eucalyptus leucoxylon **Woodland →Open Woodland**	Over predominantly exotic shrubs and herbs	Shepherds Hill Recreation Park	<44*
Eucalyptus leucoxylon **Open Woodland → Woodland**	Over *Acacia pycnantha*, (±*A. paradoxa*) and a predominantly exotic understorey	Greenhill Recreation Park	27*
Eucalyptus leucoxylon **Open Woodland**	Over *Allocasuarina verticillata*	Zig-Zag Reserve	
*Eucalyptus leucoxylon/ *Olea europaea* **Woodland →Low Woodland**	Over ±*Dodonaea viscosa* ssp. *angustissima*, ±*Acacia pycnantha*, plus heavy invasion of exotics	Morialta Conservation Park	16.2
Eucalyptus leucoxylon, Allocasuarina verticillata **Woodland**	Over *Xanthorrhoea quadrangulata* and native grasses	Chambers Gully	21.5*
Eucalyptus leucoxylon (*Allocasuarina verticillata*) (*E. fasciculosa*) **Woodland**	Over *Acacia pycnantha, A. retinodes, Scaevola albida, Olearia tubuliflora, Lomandra densiflora, Hibbertia sericea, H. exutiacies, Gonocarpus elatus, Astroloma humifusum, Dianella revoluta, Acaena agnipila, Themeda triandra*, exotics	Morialta Conservation Park	16.2
Eucalyptus leucoxylon **Woodland**	Over *Acacia pycnantha*, ±*A. retinodes*, ±*Themeda triandra*, + widespread exotic herbs and grasses	Black Hill Conservation Park	161.2*
	Over *Olearia tubuliflora, Ixodia achillaeoides, Acacia pycnantha*, ±*Dodonaea viscosa, Astroloma humifusum, Danthonia* spp., *Acaena agnipila, Dichelachne longiseta, Scaevola albida, Lomandra multiflora* var. *dura, Hydrocotyle* sp., plus exotics Or Over sparse *Acacia pycnantha, Olearia tubuliflora, Hibbertia sericea, Lomandra multiflora* var. *dura, Themeda triandra*, ±*Scaevola albida*, plus exotics Or Over dense *Acacia pycnantha*, ±*Olearia tubuliflora, Astroloma conostephioides, Hibbertia exutiacies*, Or Over *Acacia pycnantha, A. retinodes, Scaevola albida, Themeda triandra*, plus invasion of exotics	Horsnell Gully Conservation Park	41.7
	Over *Olea europaea*, exotic grasses	Sturt Gorge Recreation Park	3.6
		Turramurra Reserve	
Eucalyptus leucoxylon, E. fasciculosa **Open Forest**	Over *Acacia paradoxa, A. pycnantha*	Gunda Flora Reserve	0.8
Eucalyptus leucoxylon, E. fasciculosa, Allocasuarina verticillata **Woodland**		Wadmore Park	17*
Eucalyptus leucoxylon, E. microcarpa **Woodland**	Over *Danthonia* sp., *Austrostipa* sp. and *Themeda triandra*	Ilfoud Dve Reserve	0.25
		Gully Reserve	
		Gully Reserve	

Eucalyptus microcarpa E. leucoxylon **Open Woodland**	Over native and exotic grasses	Beaumont Common	
Eucalyptus microcarpa E. leucoxylon **Woodland**	Over native and exotic grasses	Alan E Cousins Reserve	1.13
Eucalyptus microcarpa, E. leucoxylon **Low Woodland**		Heywood Park	
Eucalyptus microcarpa, (±*Allocasuarina verticillata*), (±*E. leucoxylon*), (±*E. camaldulensis*) **Open Forest→ Woodland**	Over typical sclerophyllous understorey- *Acacia pycnantha, A. myrtifolia, Leptospermum myrsinoides, Pultenaea daphnoides, P. largiflorens, Acrotriche fasciculiflora, A. serrulata, Hakea rostrata, H. rugosa, Allocasuarina muelleriana, Hibbertia sericea, H. riparia, H. exutiacies, Dianella revoluta, Astroloma humifusum, Gonocarpus tetragynus, Lomandra multiflora* ssp. *dura, L. micrantha, Lepidosperma semiteres, Danthonia* spp. Plus ±*Acacia paradoxa, A. acinacea, Bursaria spinosa, Lissanthe strigosa, Dodonaea viscosa* ssp. *angustissima, Thysanotus patersonii, ±Lomandra densiflora, ±Austrostipa* spp., *Cassytha pubescens, Tricoryne elatior,* +exotics Or Over *Pultenaea largiflorens, Dodonaea viscosa* ssp. *angustissima, Gonocarpus tetragynus, Hibbertia exutiacies,* plus widespread exotics (savannah understorey)	Belair National Park	163.2
Eucalyptus microcarpa, Allocasuarina verticillata **Low Woodland**	Over *Dodonaea viscosa* ssp. *angustissima, Xanthorrhoea quadrangulata, Acacia paradoxa, *Oxalis pes-caprae, ±*Asclepias rotundifolia, *Foeniculum vulgare*	Sturt Gorge Recreation Park	16
Eucalyptus microcarpa **Open Forest**	Over *Acacia pycnantha, A. paradoxa, Olearia ramulosa,* plus exotics	Sturt Gorge Recreation Park	30.3
Eucalyptus microcarpa **Low Open Forest**	Over *Allocasuarina verticillata, Melaleuca lanceolata* (upper ridges and slopes of the eastern end of the gorge)	Onkaparinga River National Park	
Eucalyptus microcarpa **Woodland**	Over *Acacia pycnantha, ±A. paradoxa, ±Allocasuarina verticillata, Dodonaea viscosa* ssp. *angustissima, ±*Olea europaea, *Chellanthes austrotenuifolia, ±Lomandra* sp., plus exotic grasses	Sturt Gorge Recreation Park	2.3
	Over *Acacia paradoxa*	Tangari Reserve	27
	Over *Austrostipa* spp., *Danthonia* spp., and *Themeda triandra*	Tangari Reserve	25
		Langman Reserve	
		Brownhill Creek Recreation Park	
		Wattparinga Reserve	28
Eucalyptus microcarpa **Open Woodland**		Brownhill Creek Recreation Park	
Eucalyptus microcarpa **Open Woodland → Woodland**	Over *Acacia pycnantha,* (±*A. paradoxa*) and a predominantly exotic understorey	Greenhill Recreation Park	27*
Eucalyptus microcarpa **Woodland →Open Woodland**	Over predominantly exotic shrubs and herbs	Shepherds Hill Recreation Park	<44*
Eucalyptus obliqua **Open Forest**	Over *Banksia marginata, Pultenaea daphnoides, Exocarpus cupressiformis, Leptospermum myrsinoides, Daviesia leptophylla, Platylobium obtusangulum, Acrotriche fasciculiflora, A. serrulata, Olearia grandiflora, Epacris impressa, Goodenia ovata, Lepidosperma semiteres, Senecio hypoleucus*	Eurilla Conservation Park	7.4
		Upper Sturt River Bushland Protection group	4.5
Eucalyptus obliqua **Low Open Forest→ Open Forest**	Over *Acacia pycnantha, A. myrtifolia, Daviesia leptophylla, D. ulcifolia, Pultenaea daphnoides, *Cytisus scoparius, *Genista monspessulana, Epacris impressa, Leptospermum myrsinoides, Tetratheca pilosa, Banksia marginata, Hakea carinata, Pteridium esculentum, Hibbertia exutiacies, H. sericea, Gonocarpus tetragynus, Cassytha glabella, Grevillea lavandulacea* var. *lavandulacea, Lomandra multiflora* ssp. *dura, Ixodia achillaeoides, *Rubus* sp., *Lepidosperma semiteres, Olearia ramulosa, Astroloma humifusum, Dianella revoluta, Platylobium obtusangulum*	Horsnell Gully Conservation Park	66.2
Eucalyptus obliqua **Low Open Forest**	Over *Xanthorrhoea semiplana, Leptospermum myrsinoides, Hibbertia exutiacies,* + other sclerophyllous spp.	Black Hill Conservation Park	42.1
Eucalyptus obliqua (*E. fasciculosa*), (±*E. cosmophylla*) **Low Open Forest→ Open Forest**	Over typical sclerophyllous understorey- *Acacia pycnantha, A. myrtifolia, Leptospermum myrsinoides, Pultenaea daphnoides, P. largiflorens, Acrotriche fasciculiflora, A. serrulata, Hakea rostrata, H. rugosa, Allocasuarina muelleriana, Hibbertia sericea, H. riparia, H. exutiacies, Dianella revoluta, Astroloma humifusum, Gonocarpus tetragynus, Lomandra multiflora* ssp. *dura, L. micrantha, Lepidosperma semiteres, Danthonia* spp. Plus ±*Banksia marginata, ±Xanthorrhoea semiplana* ssp. *semiplana, ±Poa* spp. ±*Epacris impressa, ±Olearia grandiflora* Or over very sparse *Acrotriche fasciculiflora, Pultenaea largiflorens* Or over *Astroloma conostephioides, Leucopogon virgatus, Ixodia achillaeoides, Olearia tubuliflora, Dillwynia hispida, Ixodia achillaeoides, Tetratheca pilosa*	Belair National Park	187.7

Eucalyptus obliqua, E. leucoxylon **Low Open Forest**	Over *Acacia pycnantha, Hakea carinata, Hibbertia sericea, H. exutiacies, Olearia ramulosa, Pultenaea daphnoides, Daviesia leptophylla, Leptospermum myrsinoides, Lomandra densiflora, Scaevola albida, Grevillea lavandulacea* var. *lavandulacea, Ixodia achillaeoides, Lepidosperma semiteres*	Horsnell Gully Conservation Park	14.7
Eucalyptus dalrympleana ssp. *dalrympleana* (syn. *E. rubida*) (± *E. obliqua*) **Open Forest**	Over *Pteridium esculentum, Acacia myrtifolia, Leptospermum continentale, Danthonia* spp., *Themeda triandra*, exotics	Cleland Conservation Park	29.8
Eucalyptus porosa **Low Closed Forest**	Over *Acacia pycnantha, A. acinacea, A. ligulata, Rhagodia candolleana* ssp. *candolleana, Clematis microphylla, Billardiera cymosa, Tetragonia implexicoma, Hardenbergia violacea*	Aldinga Scrub Conservation Park	15.9*
Eucalyptus porosa ±*Pittosporum phylliraeoides*, **Low Open Forest**	Over *Acacia paradoxa, A. acinacea, A. ligulata, Scaevola angustata, Boyeria lechenaultii, Myoporum insulare Helichrysum bilobum*	Aldinga Scrub Conservation Park	15.9*
Eucalyptus porosa **Open Forest**	Over *Acacia paradoxa, Maireana brevifolia, *Hyparrhenia hirta*	Castieau Reserve	6.00
	Over *Acacia salicina* and **Olea europaea*	Coomurra Gully	1.3
Eucalyptus porosa **Woodland**	Over **Olea europaea* and native grasses	Dead Man's Pass	2.37*
	Over *Acacia paradoxa, Pittosporum phylliraeoides* and **Olea europaea*	Cobbler Creek Reserve West	
	Over *Acacia paradoxa Pittosporum phylliraeoides* and **Olea*	Valour crt	2
		West Terrace Cemetery	-
		Field River	-
		Beach rd Scrub	2.0
Eucalyptus porosa **Open Woodland**	Over **Olea europaea* and *Acacia saligna*	Upper Little Para Reserve	7*
	Over *Acacia paradoxa, *Olea europaea, Acacia ligulata, *Piptatherum miliaceum, Themeda triandra* and *Austrostipa* sp.	Walkley Heights	3.27*
Eucalyptus porosa **Low Woodland**	Over *Halosragis* spp., *Austrostipa* spp., **Avena* sp., **Trifolium* sp.	Black Hill Conservation Park	42.1
	co-dominant with **Olea europaea* Over ±*Dodonaea viscosa* ssp. *angustissima*, ±*Acacia pycnantha*, plus heavy invasion of exotics	Moriatta Conservation Park	54
	Over **Olea europaea* and *Austrostipa* sp.	Christine Reserve	0.2*
Eucalyptus porosa, Callitris gracilis, E. socialis **Low Woodland**		Folland Park	3.47
Eucalyptus porosa **Low Open Woodland**	Over *Olearia ramulosa, Pimelea glauca*	Magill Stone Mine Reserve	
Eucalyptus porosa, E. socialis **Woodland**	Over *Myoporum platycarpum, Eremophila deserti*	Willaston Cemetery	2.5
Eucalyptus porosa, E. odorata **Open Forest**	Over *Acacia paradoxa* and *Senna artemisioides*	Kesters rd Reserve	3.00
Eucalyptus porosa, E. camaldulensis **Open Forest**	Over *Acacia paradoxa, Dodonaea viscosa*	Peppermint Gum Gully	4.5
Melaleuca halmaturorum **Low Open Forest**	Over *Maireana decalvans, Maireana brevifolia, Danthonia* sp.	Patawalonga Creek Wetland	
Callitris gracilis **Open Forest**	Over *Acacia pycnantha, Allocasuarina verticillata, Austrostipa* spp., *Bursaria spinosa, Pimelea stricta, Themeda triandra, Goodenia amplexans, Hibbertia sericea, *Fraxinus rotundifolia*	Ferguson Conservation Park	0.5
Eucalyptus fasciculosa, (±*E. leucoxylon*), (*E. obliqua*), (±*E. cosmophylla*) **Low Open Forest**	Over typical sclerophyllous understorey- *Acacia pycnantha, A. myrtifolia, Leptospermum myrsinoides, Pultenaea daphnoides, P. largiflorens, Acrotriche fasciculiflora, A. serrulata, Hakea rostrata, H. rugosa, Allocasuarina muelleriana, Hibbertia sericea, H. riparia, H. exutiacies, Dianella revoluta, Astroloma humifusum, Gonocarpus tetragynus, Lomandra multiflora* ssp. *dura, L. micrantha, Lepidosperma semiteres, Danthonia* spp.. Plus ±*Astroloma conostephioides* ±*Poa* spp., ±*Austrostipa* spp., ±*Thysanotus patersonii*, ±*Cassytha* spp., ±exotics Or over *Olearia tubuliflora, Ixodia achillaeoides, Epacris impressa, Astroloma conostephioides, Xanthorrhoea semiplana* ssp. *semiplana, Calytrix tetragona, Stackhousia* sp., *Dillwynia hispida, Leucopogon virgatus, Lomandra densiflora*	Belair National Park	24.5
Eucalyptus fasciculosa – E. baxteri **Low Open Forest**	Over *Acacia myrtifolia, Calytrix tetragona, Cassytha* spp., *Dillwynia hispida, Hakea carinata, H. rostrata, Haloragis* spp., *Hibbertia sericea, Isopogon ceratophyllus, Ixodia achillaeoides, Leptospermum myrsinoides, Leucopogon virgatus, Pultenaea daphnoides, Pultenaea largiflorens*	Black Hill Conservation Park	231.3
±*Eucalyptus leucoxylon*, ±*E. viminalis* ssp. *viminalis* **Low Open Forest→ Open Forest**	Over exotics	Horsnell Gully Conservation Park	17.2
Eucalyptus viminalis ssp. *viminalis, E. obliqua* **Low Open Forest→ Open Forest**	Over *Spyridium parvifolium, Acacia myrtifolia, Pultenaea daphnoides, *Genista monspessulana, Exocarpus cupressiformis, Epacris impressa, Bursaria spinosa, Hibbertia exutiacies, H. sericea, Grevillea lavandulacea* var. *lavandulacea, Scaevola albida, Ixodia achillaeoides, Lepidosperma semiteres, Chellanthes austrotenuifolia, Gonocarpus mezianus*	Horsnell Gully Conservation Park	2.5

Eucalyptus viminalis ssp. *cygnetensis* **Open Forest**	Over *Acacia pycnantha, Pteridium esculentum, ±Hibbertia exutiacies, ±Olearia ramulosa,* exotic grasses	Black Hill Conservation Park	63.1*
Eucalyptus leucoxylon and */or E. viminalis* ssp. *cygnetensis, (±E. camaldulensis), (±E. fasciculosa), (±E. obliqua)* **Woodland**	Over typical sclerophyllous understorey- *Acacia pycnantha, A. myrtifolia, Leptospermum myrsinoides, Pultenaea daphnoides, P. largiflorens, Acrotriche fasciculiflora, A. serrulata, Hakea rostrata, H. rugosa, Allocasuarina muelleriana, Hibbertia sericea, H. riparia, H. exutiacies, Dianella revoluta, Astroloma humifusum, Gonocarpus tetragynus, Lomandra multiflora* ssp. *dura, L. micrantha, Lepidosperma semiteres, Danthonia* spp..	Belair National Park	253
Eucalyptus leucoxylon (± *E. viminalis* ssp. *cygnetensis*), (±*E. camaldulensis*), (±*E. obliqua*), (±*Exocarpus cupressiformis*), (± *Allocasuarina verticillata*) **Woodland**	Over ±**Olea europaea, Acacia retinodes, Acacia pycnantha,* ± *Pteridium esculentum, ±Bursaria spinosa, ±Acrotriche fasciculiflora, ±Pultenaea daphnoides, ±Xanthorrhoea quadrangulata, ±Dodonaea viscosa* ssp. *angustissima, Olearia tubuliflora, ±Themeda triandra, Gonocarpus tetragynus, ±Hibbertia exutiacies,* exotics	Cleland Conservation Park	119.2
Eucalyptus leucoxylon, E. viminalis ssp. *cygnetensis, E. camaldulensis, *E. cladocalyx, *E. ficifolia, (E. fasciculosa), (*E. globulus)* **Woodland**	Over *Dodonaea viscosa* ssp. *angustissima, Acacia pycnantha, Themeda triandra, Gonocarpus elatus Danthonia* spp., exotics Or Over widespread exotics, *Bursaria spinosa, Exocarpus cupressiformis, Dodonaea viscosa* ssp. *angustissima, Danthonia* spp., *Poa* spp..	Morialta Conservation Park	27
Eucalyptus camaldulensis, (±E. leucoxylon), (±E. viminalis ssp. *cygnetensis)* **Woodland**	Over ±*Dodonaea viscosa* ssp. *angustissima, ±Gonocarpus tetragynus, ±Hibbertia exutiacies,* plus widespread exotics, Or Over *Gahnia trifida, Typha* sp., exotics (in creeks)	Belair National Park	130.6
	Over ±**Olea europaea, Acacia retinodes, Acacia pycnantha,* ± *Pteridium esculentum, ±Bursaria spinosa, ±Acrotriche fasciculiflora, ±Pultenaea daphnoides, ±Xanthorrhoea quadrangulata, ±Dodonaea viscosa* ssp. *angustissima, Olearia tubuliflora, ±Themeda triandra, Gonocarpus tetragynus, ±Hibbertia exutiacies,* exotics	Cleland Conservation Park	29.8
Eucalyptus camaldulensis, E. viminalis, (E. leucoxylon), (E. obliqua), (±E. fasciculosa) **Woodland**	Over *sparse Acacia retinodes, Scaevola albida,* plus many exotics Or Over *Allocasuarina verticillata, Pteridium esculentum, Acacia retinodes, Olearia tubuliflora, ±Platylobium obtusangulum, ±Scaevola albida, ±Acrotriche fasciculiflora, ±Senecio hypoleucus, Microseris lanceolata, Wahlenbergia stricta, Stellaria palustris, Cheilanthes austrotenuifolia, Adiantum aethiopicum,* plus many exotics Or Over *Exocarpus cupressiformis, Acacia pycnantha, Ixodia achillaeoides, Olearia tubuliflora, ±Phragmites australis, ±Typha domingensis, ±Allocasuarina muelleriana, ±Hakea rostrata, ±Leptospermum continentale, ±Spyridium vexilliferum, ±Acacia paradoxa, ±A. myrtifolia, ±Pultenaea daphnoides, Hydrocotyle* sp., *Bulbine bulbosa,* plus exotics	Horsnell Gully Conservation Park	14.7
Eucalyptus camaldulensis, (E. leucoxylon), (±E. obliqua), (±E. viminalis ssp. *cygnetensis), (±E. fasciculosa)* **Woodland**	Over sparse *Allocasuarina verticillata, Acacia rupicola, A. myrtifolia, A. pycnantha, Bursaria spinosa, Exocarpus cupressiformis, Dodonaea viscosa* ssp. *angustissima, Xanthorrhoea quadrangulata, Poa* spp., *Olearia tubuliflora, Themeda triandra,* widespread exotics	Morialta Conservation Park	5.4
Eucalyptus viminalis ssp. *cygnetensis* (± *E. leucoxylon*) (±*E, camaldulensis*) (±*E. obliqua*) (*Allocasuarina verticillata*) **Woodland**	Over ±**Olea europaea, Acacia retinodes, Acacia pycnantha,* ± *Pteridium esculentum, ±Bursaria spinosa, ±Acrotriche fasciculiflora, ±Pultenaea daphnoides, ±Xanthorrhoea quadrangulata, ±Dodonaea viscosa* ssp. *angustissima, Olearia tubuliflora, ±Themeda triandra, Gonocarpus tetragynus, ±Hibbertia exutiacies,* exotics	Cleland Conservation Park	198.6
Allocasuarina verticillata **Woodland**		Angove Conservation Park	
Allocasuarina verticillata, Xanthorrhoea quadrangulata, (Eucalyptus fasciculosa), Exocarpus cupressiformis **Low Open Woodland**	Over *Acacia rupicola, Astroloma conostephioides, Dodonaea viscosa* ssp. *angustissima, Hibbertia sericea, Olearia tubuliflora, Calytrix tetragona, Austrostipa* spp., *Danthonia* spp.. Or Over *Acacia pycnantha, A. rupicola, Spyridium spathulatum, Olearia tubuliflora, Danthonia* spp., *Austrostipa* spp., widespread exotics Or Over *Banksia marginata, Acacia retinodes, Dodonaea viscosa* ssp. *angustissima, Poa* spp., *Austrostipa* spp., widespread exotics	Morialta Conservation Park	27
Callitris gracilis **Woodland**		Angove Conservation Park	
Callitris gracilis, Allocasuarina verticillata **Open Woodland**		Angove Conservation Park	
Eucalyptus fasciculosa, E. leucoxylon **Woodland**		Cherry Gardens Cemetery	4.00*
Eucalyptus obliqua ±*E. cosmophylla* **Woodland**		Cherry Gardens Cemetery	4.00*

Banksia marginata **Low Woodland**		Sauerbier Creek	
		One Tree Hill (roadside)	0.6
	in association with *Dodonaea viscosa*	One Tree Hill (roadside)	0.2
		Black Hill Conservation Park	0.2
		Para Wirra (roadside)	
	in association with *Allocasuarina verticillata*	Morialta Conservation Park	2.0
	in association with *Dodonaea viscosa*, growing as sub dominant to *Eucalyptus camaldulensis*	Player Reserve	1.7
Banksia marginata, Eucalyptus fasciculosa **Very Low Open Woodland**		Para Wirra (roadside)	
Eucalyptus fasciculosa, **Low Woodland**	Over *Acacia pycnantha, A. ligulata, Myoporum insulare, Leucopogon parviflorus, Exocarpus cupressiformis, Pteridium esculentum, Banksia marginata*	Aldinga Scrub Conservation Park	108.7
	Over *Allocasuarina verticillata, Melaleuca lanceolata*(upper ridges and slopes of the eastern end of the gorge)	Onkaparinga River National Park	
Eucalyptus leucoxylon, E. viminalis ssp. *cygnetensis* **Low Woodland** (wetter sites scattered throughout the park)		Onkaparinga River National Park	
Eucalyptus leucoxylon, (±*E. microcarpa*), (*Allocasuarina verticillata*) **Low Woodland**	Over typical sclerophyllous understorey- *Acacia pycnantha, A. myrtifolia, Leptospermum myrsinoides, Pultenaea daphnoides, P. largiflorens, Acrotriche fasciculiflora, A. serrulata, Hakea rostrata, H. rugosa, Allocasuarina muelleriana, Hibbertia sericea, H. riparia, H. exutiacies, Dianella revoluta, Astroloma humifusum, Gonocarpus tetragynus, Lomandra multiflora* ssp. *dura, L. micrantha, Lepidosperma semiteres, Danthonia* spp.. Plus *Banksia marginata, Allocasuarina verticillata, Xanthorrhoea semiplana* ssp. *semiplana, Lissanthe strigosa, Austrostipa* spp	Belair National Park	16.2
Allocasuarina verticillata, **Olea europaea* **Low Woodland**		Cleland Conservation Park	9.9
Callitris gracilis **Low Woodland**	Over grasses	Romalo Walk	
Eucalyptus fasciculosa **Low Woodland**	Over *Acacia pycnantha* and heathy understorey	Douglas Scrub	22.00*
Avicennia marina var. *resinifera* **Low Woodland**		Torrens Island Conservation Park	47.4
Eucalyptus viminalis ssp. *cygnetensis* **Open Woodland →Woodland**	Over *Acacia pycnantha*, (±*A. paradoxa*) and a predominantly exotic understorey	Greenhill Recreation Park	27*
Eucalyptus cosmophylla, E. baxteri (*E. fasciculosa*), (*E. obliqua*) **Low Open Woodland**	Over *Ixodia achillaeoides, Leptospermum myrsinoides, Acacia myrtifolia, Epacris impressa, Astroloma conostephioides, A. humifusum, Hakea rostrata, H. carinata, Platylobium obtusangulum, Pultenaea daphnoides*, ±*Spyridium vexilliferum, Tetratheca pilosa, Isopogon ceratophyllus, Dillwynia hispida, Hibbertia sericea, Acrotriche serrulata, Leucopogon virgatus, Grevillea lavandulacea, Scaevola albida, Calytrix tetragona, Burchardia umbellata, Dianella revoluta, Lomandra* sp., *Poa* spp., *Gonocarpus* spp., *Danthonia* spp., *Goodenia* spp..	Horsnell Gully Conservation Park	14.7
Eucalyptus fasciculosa (*E. baxteri*), (*Allocasuarina verticillata*), (*Exocarpus cupressiformis*) **Low Open Woodland**	Over *Xanthorrhoea semiplana* ssp. *semiplana, Hakea rostrata, Leptospermum myrsinoides, Acacia myrtifolia, Pultenaea daphnoides, P. largiflorens, Olearia tubuliflora, Ixodia achillaeoides, Spyridium spathulatum, Astroloma conostephioides*, ±*Leptospermum continentale*, ±*A. rupicola, Acrotriche serrulata, A. fasciculiflora, Pimelea linifolia, Calytrix tetragona, Hibbertia sericea, Dichelachne crinita, Lepidosperma semiteres, L. viscidum, Danthonia* spp., *Austrostipa* spp., *Gonocarpus* spp..	Morialta Conservation Park	54
Callitris gracilis (*syn. C. preissii*), *Alyxia buxifolia, Pittosporum phylliraeoides* **Low Open Woodland**		Port Gawler Conservation Park	17.3*
Eucalyptus fasciculosa, (*E. baxteri*), (*E. obliqua*), (*E. leucoxylon*), (*E. camaldulensis*) **Low Woodland→Woodland**	Over *Ixodia achillaeoides, Olearia tubuliflora*, (*Acacia paradoxa*), (*Pultenaea daphnoides*), (*Hibbertia sericea*), *Dianella revoluta*, **Senecio pterophorus, Gonocarpus mezianus*, (*Astroloma conostephioides*), *Cheilanthes austrotenuifolia*, exotic grasses	Horsnell Gully Conservation Park	2.5
Eucalyptus viminalis ssp. *cygnetensis* (trees in poor condition) **Low Woodland→Woodland**	Over *Allocasuarina verticillata, Leptospermum lanigerum, Bursaria spinosa, Xanthorrhoea quadrangulata, Dodonaea viscosa* ssp. *angustissima, Acacia retinodes, Juncus pallidus Pteridium esculentum, Cyperus vaginatus*, widespread exotics	Morialta Conservation Park	5.4
Eucalyptus fasciculosa **Open Forest → Woodland→Open Woodland**	Over *Leptospermum myrsinoides, Xanthorrhoea semiplana* ssp. *semiplana, Hakea rostrata, Acacia paradoxa, Hibbertia* spp., *Allocasuarina muelleriana, Olearia ramulosa, Astroloma conostephioides* Or Over *Dodonaea viscosa* ssp. *angustissima, Acacia paradoxa*, ±*Hardenbergia violacea*, plus heavy invasion of exotics	Anstey Hill Recreation Park	107.5

Eucalyptus fasciculosa, Callitris gracilis (*syn. C. preissii*), *Allocasuarina verticillata* **Open Forest→ Woodland→ Open Woodland**	Over *Xanthorrhoea quadrangulata, Exocarpus sparteus, E. cupressiformis, Pultenaea largiflorens, Lomandra multiflora* ssp. *dura, L. densiflora*	Anstey Hill Recreation Park	<3
Eucalyptus obliqua **Low Open Forest→ Low Open Woodland**	Over ±*Acacia melanoxylon, ±Pteridium esculentum, Ixodia achillaeoides, Acrotriche fasciculiflora, Epacris impressa, Platylobium obtusangulum, Pultenaea daphnoides, P. involucrata, Leptospermum myrsinoides, Hakea rostrata, ±Banksia marginata, ±Allocasuarina muelleriana, Dillwynia hispida, Calytrix tetragona, Spyridium vexilliferum, Acrotriche serrulata, Hibbertia sericea, Helichrysum apiculatum, H. scorpioides, Gonocarpus tetragynus, Lepidosperma semiteres, Lomandra micrantha, Danthonia* spp., *Poa* spp., *Cassytha glabella*	Cleland Conservation Park	556*
Eucalyptus obliqua, E. baxteri Low **Open Forest→ Low Open Woodland**	Over ±*Acacia melanoxylon, ±Pteridium esculentum, Ixodia achillaeoides, Acrotriche fasciculiflora, Epacris impressa, Platylobium obtusangulum, Pultenaea daphnoides, P. involucrata, Leptospermum myrsinoides, Hakea rostrata, ±Banksia marginata, ±Allocasuarina muelleriana, Dillwynia hispida, Calytrix tetragona, Spyridium vexilliferum, Acrotriche serrulata, Hibbertia sericea, Helichrysum apiculatum, H. scorpioides, Gonocarpus tetragynus, Lepidosperma semiteres, Lomandra micrantha, Danthonia* spp., *Poa* spp., *Cassytha glabella*	Cleland Conservation Park	556*
Eucalyptus obliqua, E. baxteri, E. cosmophylla **Low Open Forest→ Low Open Woodland**	Over ±*Acacia melanoxylon, ±Pteridium esculentum, Ixodia achillaeoides, Acrotriche fasciculiflora, Epacris impressa, Platylobium obtusangulum, Pultenaea daphnoides, P. involucrata, Leptospermum myrsinoides, Hakea rostrata, ±Banksia marginata, ±Allocasuarina muelleriana, Dillwynia hispida, Calytrix tetragona, Spyridium vexilliferum, Acrotriche serrulata, Hibbertia sericea, Helichrysum apiculatum, H. scorpioides, Gonocarpus tetragynus, Lepidosperma semiteres, Lomandra micrantha, Danthonia spp., Poa spp., Cassytha glabella*	Cleland Conservation Park	556*
Eucalyptus obliqua, E. baxteri, (*E. fasciculosa*), (*Allocasuarina verticillata*), (*Exocarpus cupressiformis*) **Open Forest→ Low Open Forest→ Woodland→ Low Woodland**	Over *Ixodia achillaeoides, Olearia grandiflora, Acacia myrtifolia, Pultenaea daphnoides; Epacris impressa, Daviesia virgata, Dillwynia hispida, Tetratheca pilosa, Pimelea linifolia, Hibbertia exutiacies, H. sericea, Platylobium obtusangulum, Grevillea lavandulacea, Scaevola albida, Drosera auriculata, Stackhousia aspericocca, Goodenia primulacea, Poa* spp., *Lepidosperma semiteres, Lomandra multiflora* ssp. *dura*	Horsnell Gully Conservation Park	56.4*
Eucalyptus baxteri, (*E. obliqua*), (*E. fasciculosa*) **(Open Forest)→ Low Open Forest→(Low Open Woodland)**	Over *Xanthorrhoea semiplana* ssp. *semiplana, Hakea rostrata, Leptospermum myrsinoides, Acacia myrtifolia, Pultenaea daphnoides, P. largiflorens, Olearia tubuliflora, Ixodia achillaeoides, Spyridium spathulatum, Astroloma conostephioides, ±Leptospermum continentale, ±A. rupicola, Acrotriche serrulata, A. fasciculiflora, Pimelea linifolia, Calytrix tetragona, Hibbertia sericea, Dichelachne crinita, Lepidosperma semiteres, L. viscidum, Danthonia* spp., *Austrostipa* spp., *Gonocarpus* spp..	Morialta Conservation Park	237.6*
Eucalyptus obliqua, (*E. baxteri*), (*E. fasciculosa*) **(Open Forest)→ Low Open Forest→(Low Open Woodland)**	Over *Xanthorrhoea semiplana* ssp. *semiplana, Hakea rostrata, Leptospermum myrsinoides, Acacia myrtifolia, Pultenaea daphnoides, P. largiflorens, Olearia tubuliflora, Ixodia achillaeoides, Spyridium spathulatum, Astroloma conostephioides, ±Leptospermum continentale, ±A. rupicola, Acrotriche serrulata, A. fasciculiflora, Pimelea linifolia, Calytrix tetragona, Hibbertia sericea, Dichelachne crinita, Lepidosperma semiteres, L. viscidum, Danthonia* spp., *Austrostipa* spp., *Gonocarpus* spp..	Morialta Conservation Park	237.6*
Eucalyptus viminalis ssp. *cygnetensis* **Open Forest→ Woodland→ Open Woodland**		Anstey Hill Recreation Park	3.8*
Eucalyptus goniocalyx, E. fasciculosa **Open Forest→ Woodland→ Open Woodland**	Over *Hakea rostrata, Xanthorrhoea semiplana* ssp. *semiplana, Leptospermum myrsinoides* *Or Over* Acacia paradoxa, Prostanthera behriana	Anstey Hill Recreation Park	30.7
Eucalyptus goniocalyx, Callitris gracilis (syn. *C. preissii*), (±*Eucalyptus fasciculosa*) **Open Forest→ Woodland→ Open Woodland**	Over *Astroloma conostephioides*	Anstey Hill Recreation Park	3.8*
Eucalyptus cosmophylla **Low Open Forest→ Low Open Forest**	Over ±*Acacia melanoxylon, ±Pteridium esculentum, Ixodia achillaeoides, Acrotriche fasciculiflora, Epacris impressa, Platylobium obtusangulum, Pultenaea daphnoides, P. involucrata, Leptospermum myrsinoides, Hakea rostrata, ±Banksia marginata, ±Allocasuarina muelleriana, Dillwynia hispida, Calytrix tetragona, Spyridium vexilliferum, Acrotriche serrulata, Hibbertia sericea, Helichrysum apiculatum, H. scorpioides, Gonocarpus tetragynus, Lepidosperma semiteres, Lomandra micrantha, Danthonia* spp., *Poa* spp., *Cassytha glabella*	Cleland Conservation Park	556*

Avicennia marina var. *resinifera* **Low Open Forest→ Low Woodland**		Port Gawler Conservation Park	363.7
Eucalyptus fasciculosa **Open Scrub**	Over *Acacia pycnantha, A. ligulata, Banksia marginata, Leucopogon parviflorus, L. rufus, Xanthorrhoea semiplana* ssp. *semiplana, Exocarpus cupressiformis, Myoporum insulare, Leptospermum myrsinoides, Rhagodia candolleana, ±Santalum murrayanum, Calytrix tetragona, Hakea carinata, Thomasia petalocalyx, Pimelea stricta, ±Scaevola angustata, Grevillea lavandulacea, Isopogon ceratophyllus, Astroloma conostephioides, A. humifusum, Correa reflexa, Hibbertia riparia, H. virgata, Dampiera lanceolata* var. *intermedia*	Aldinga Scrub Conservation Park	19.9
Eucalyptus odorata, E. leptophylla **Open Scrub**	Over *Acacia paradoxa, Allocasuarina muelleriana, Olearia ramulosa, *Pentaschistis* sp., Scaevola albida*	Black Hill Conservation Park	7
Eucalyptus dumosa, E. porosa **Open Scrub**		Polland Park	
Leptospermum myrsinoides, Calytrix tetragona **Open Heath**		Angove Conservation Park	
Alyxia buxifolia, Beyeria lechenaultii, Pomaderris paniculosa **Closed Heath**	Over *Grevillea lavandulacea, Eutaxia microphylla* var. *microphylla, Billardiera cymosa, Allocasuarina verticillata, Banksia marginata, Acacia ligulata, Calytrix tetragona, Cassytha pubescens, Hakea rostrata*	Aldinga Scrub Conservation Park	2.7
Leptospermum lanigerum **Closed Heath**		McLaren Vale Swamp	
		Blewitt Springs	
Leptospermum lanigerum **Swamp Heath**	Surrounded by *Acacia retinodes, ±Goodenia ovata, ±Gahnia sieberiana, Blechnum nudum, ±B. minus, ±Adiantum aethiopicum, ±Gleichenia microphylla, ±Pteridium esculentum, ±Leptospermum continentale*, exotics	Cleland Conservation Park	19.9
Leptospermum lanigerum, L. continentale, Gahnia sp. **Low Open Shrubland**	Over *Gleichenia microphylla, Blechnum* spp., *Lepidosperma semiteres, Todea barbara*	Eurilla Conservation Park	0.1
Myoporum insulare, Lawrencia squamata, Adriana klotzschii, Olearia axillaris **Shrubland**		Pelican Point	
Allocasuarina verticillata **Tall Shrubland**	Over *Santalum acuminatum, Leptospermum myrsinoides, Banksia marginata, Xanthorrhoea semiplana* ssp. *semiplana, Alyxia buxifolia, Myoporum insulare, Leucopogon parviflorus, Scaevola crassifolia, Calytrix tetragona*	Aldinga Scrub Conservation Park	23.9
Myoporum insulare, Olearia axillaris, Acacia ligulata **Tall Shrubland**	Over *Atriplex paludosa, Frankenia pauciflora, Alyxia buxifolia, Nitraria billardierei*	Port Gawler Conservation Park	17.3*
Olearia ramulosa, ±Allocasuarina verticillata **Tall Shrubland**	With (*Acacia pycnantha*), *Xanthorrhoea quadrangulata, Dodonaea viscosa* ssp. *angustissima*	Sturt Gorge Recreation Park	1.8
Acacia ligulata, A. pycnantha, Adriana klotzschii **Tall Shrubland**		R.B. Connelly Reserve	1.15
		Carlson Reserve	0.30
Eremophila longifolia **Tall Shrubland**	Over *Acacia ligulata* and native grasses	Christine Reserve	0.2*
Atriplex cinerea, Olearia axillaris **Low Shrubland**	Over *±Leucopogon parviflorus, ±Myoporum insulare, ±Calocephalus brownii, ±Rhagodia candolleana* ssp. *candolleana, ±Nitraria billardierei, ±Enchylaena tomentosa, ±Scaevola crassifolia*	Aldinga Scrub Conservation Park	8
Acacia ligulata, Olearia ramulosa, Pomaderris paniculosa **Low Shrubland**	Over *Acrotriche patula, Adriana klotzschii, Bursaria spinosa, Pittosporum phylliraeoides, Lavatera plebeia, Santalum acuminatum, Acacia pycnantha, A. acinacea, A. victoriae, Hardenbergia violacea, Lotus australis,* (plus in more exposed areas) *Myoporum insulare, Scleranthus pungens, Ptilotus nobilis* var. *nobilis* This community represents a relic of the *Eucalyptus porosa, Allocasuarina verticillata, ±Melaleuca lanceolata* LOW WOODLAND that was formerly widespread in this area.	Marino Conservation Park	15
"coastal heath"		Onkaparinga Recreation Park	
Sarcocornia blackiana, Halosarcia halocnemoides ssp. *halocnemoides* **Low Shrubland**	With" saltbushes, sedges, chenopods and other saline species".	Onkaparinga Recreation Park	
Sarcocornia quinqueflora (*±Halosarcia* sp.) **Low Shrubland**		Port Gawler Conservation Park	8.7
Sarcocornia spp., *Halosarcia* sp. **Low Shrubland**		Torrens Island Conservation Park	31.6

Halosarcia halocnemoides (±*Sarcocornia quinqueflora*) **Low Shrubland**		Port Gawler Conservation Park	43.3*
Maireana oppositifolia **Low Shrubland**	Over *Wilsonia* sp	Port Gawler Conservation Park	43.3*
	on dunes with Mangroves	Port Gawler Conservation Park	<4.3*
Nitraria billardieri **Low Shrubland**	Over *Suaeda australis*	Port Gawler Conservation Park	<4.3
Atriplex paludosa (*Maireana oppositifolia*) **Low Shrubland**		Port Gawler Conservation Park	<4.3*
Acacia ligulata, Beyeria lechenaultii, Pomaderris paniculosa **Low Shrubland**		Kingston Park	2.6
Chenopod (inc *Sarcocornia quinqueflora*) **Low Closed Shrubland**		Little Para Estuary	
Beyeria leschenaultia, Dodonaea viscosa ssp. *spatulata*, ±*Allocasuarina verticillata* **Open Heath/ Low Shrubland** (in the amphitheatre- ranging to a tall shrubland in sheltered gullies)	Over *Grevillea lavandulacea, Dianella revoluta, Eutaxia microphylla, Zygophyllum billardierei, Lepidosperma* sp., *Cheilanthes austrotenuifolia, Lomandra effusa, Kennedia prostrata* (Plus, in gullies) *Santalum acuminatum, Acacia ligulata, A. acinacea, Pomaderris paniculosa, ±Melaleuca lanceolata*	Hallett Cove Conservation Park	4.5
Acacia paradoxa **Open Heath/ Low Shrubland**	Over *Pomaderris paniculosa, Gahnia lanigera, Maireana brevifolia, Convolvulus erubescens, Sclerolaena diacantha, Dianella revoluta, Lomandra effusa*	Hallett Cove Conservation Park	1.5
Calocephalus brownii, Olearia ramulosa **Open Heath/ Low Shrubland**	Over *Enchylaena tomentosa, Einadia nutans, Muehlenbeckia gunnii*	Hallett Cove Conservation Park	1.5
*Cyperus gymnocaulos, Typha domingensis, *Lycium ferocissimum* **Open Heath/ Low Shrubland**	Over *Asparagus asparagoides, Muehlenbeckia gunnii, Disphyma crassifolium* ssp. *clavellatum*	Hallett Cove Conservation Park	1.5
Calytrix tetragona **Low Open Shrubland**	Over *Astroloma conostephioides, Hibbertia* spp., *Kunzea pomifera, Acrotriche affinis, Leucopogon rufus, Lepidosperma carphoides, Lomandra leucocephala, L. juncea, Gonocarpus* spp., *Opercularia scabrida*	Aldinga Scrub Conservation Park	4
Olearia axillaris (dunes) **Low Open Shrubland**	Over *Isolepis nodosa, Spinifex sericeus, ±Muehlenbeckia gunnii; Rhagodia candolleana* ssp. *candolleana, Tetragonia implexicoma, Threlkeldia diffusa, Carpobrotus rossii, ±Dianella revoluta, ±Nitraria billardierei, ±Atriplex cinerea, ±Enchylaena tomentosa, ±Calocephalus brownii*	Moana Sands Conservation Park	21.4*
Sarcocornia quinqueflora, Suaeda australis, Apium prostratum, ±Myoporum insulare, Juncus, kraussii, Bolboschoenus caldwellii **Low Open Shrubland**		Moana Sands Conservation Park	21.4*
Muehlenbeckia florulenta (*syn. M. cunninghamii*) **Low Open Shrubland**		Moana Sands Conservation Park	21.4*
Melaleuca halmaturorum **Tall Open Shrubland**	Over *Maireana aphylla* and *Muehlenbeckia florulenta* (*syn. M. cunninghamii*)	Thompson's Creek Reserve	0.2
Muehlenbeckia florulenta (*syn. M. cunninghamii*), *Cyperus* spp., *Juncus* spp., **Sedgeland**	Over *Phragmites australis, Typha domingensis Carex* sp., *Bolboschoenus caldwellii*	Aldinga Scrub Conservation Park	17.2
Gahnia filum **Sedgeland**	Over *Nitraria billardieri, Austrostipa* spp., *Danthonia* spp.,	Brooks rd, Penrice Saltfields	1.5
Pteridium esculentum, **Fernland**	Over *Correa reflexa, Eutaxia microphylla* var. *microphylla, Astroloma conostephioides, Scaevola angustata, Thomasia petalocalyx*	Aldinga Scrub Conservation Park	11.9
Enneapogon nigricans, (±*Dodonaea viscosa* ssp. *angustissima*) **Grassland**		Sturt Gorge Recreation Park	3.6

Acacia melanoxylon, Acacia pycnantha, Allocasuarina verticillata, Eucalyptus leucoxylon **Grassland**	Over grasses	Wheal Gawler Reserve.	
Typha domingensis, Phragmites australis **Closed Grassland/ Herbland**		Moana Sands Conservation Park	21.4*
Wilsonia sp. (*Sarcocornia quinqueflora*) **Herbland**		Port Gawler Conservation Park	<4.3*

*= area quoted includes more than one community for that particular NPWSA reserve

4.4 Fauna of the Adelaide Region

Native and Introduced Mammals

The following list represents information from a number of sources (Jan Birrell, Cath Kemper of the SA Museum, Tyler *et al.* (1976) and Maxwell *et al.* (1996)). Mammals are listed according to taxonomic relationship; taxonomy follows Robinson *et al.* (2000). Where the animal is extinct regionally, in South Australia or nationally this information has been recorded too. Australian conservation status is from Schedule 1 of the *Endangered Species Protection Act (1992)*. South Australian conservation status is after *National Parks and Wildlife Act (1972)* (Updated Schedule 2000) (see Appendix 3, p.154 for explanation of conservation status codes).

Note that under *National Parks and Wildlife Act (1972)* there is no schedule for the category "Extinct," instead all species that are presumed extinct are placed in the category "Endangered." For example, the **White-footed Tree-rat** (*Conilurus albipes*) was one of the first mammals to disappear throughout Australia. It has not been seen for over 150 years and is listed as extinct in Australia under national legislation. Under the *National Parks and Wildlife Act (1972)* it is listed under Schedule 7 (Endangered). The same state legislation only recognises subspecies if they are listed as a subspecies in Robinson *et al.* (2000).

Several species of introduced mammals with self-sustaining populations can be found in the Adelaide Metropolitan Area. In the following list introduced mammals are marked with ✱. Introduced mammals have generally faired well in the Australian environment, and their impact on the Australian landscape is often devastating. Of the six key threatening processes to biodiversity, four are associated with the impacts of introduced mammals (Commonwealth of Australia 2000a), three of which are found in the Adelaide Metropolitan Area.

Platypus and Echidna — ORDER MONOTREMATA

Platypus — FAMILY ORNITHORHYNCHIDAE

Platypus (*Ornithorhynchus anatinus*) **EXTINCT**[Adel] **ENDANGERED**[SA]

Once found in the River Torrens and Onkaparinga River (Tyler *et al.* 1976), this elusive animal survives in SA only as translocated populations on Kangaroo Island and possibly in the Murray River (Carrick 1995). A breeding population exists at Warrawong Sanctuary. Although rarely seen, this animal remains widespread in eastern Australia over a variety of habitats and vegetation types, including in alpine areas and tropical lowland rainforests. The Platypus feeds on a variety of adult and larval invertebrates and occasionally small vertebrates, finding its prey through receptors on it lower bill that detect electric currents produced by movement in its prey. Officially, this species is not considered to be threatened nationally (Maxwell *et al.* 1996), but is in decline due to water pollution and water extraction. For this reason it "...must be considered Vulnerable" (Carrick 1995).

Echidna — FAMILY TACHYGLOSSIDAE

Short-beaked Echidna (*Tachyglossus aculeatus*)

This species is comprised of five subspecies. The subspecies from the Adelaide region (*T.a. aculeatus*) is found in the coastal regions and slopes of the Great Dividing Range, between southern Queensland, New South Wales, Victoria and South Australia; *T.a. acanthion* is found in the Northern Territory, Western Australia and the arid regions of all other states; *T.a. lawesii* is found in Papua New Guinea *T.a. multiaculeatus* is found on Kangaroo

Island and *T.a. setosus* can be found in Tasmania (Augee 1995). The most widely distributed Australian mammal the Short-beaked Echidna can be found in virtually all habitats from the alpine regions to the desert, although it is not always abundant (Augee 1995). The Short-beaked Echidna has been sighted at the following NPWSA areas: Aldinga Scrub Conservation Park, Belair National Park, Cleland Conservation Park, Port Gawler Conservation Park, Black Hill Conservation Park, Morialta Conservation Park, Horsnell Gully Conservation Park, Mark Oliphant Conservation Park and Para Wirra Recreation Park.

Carnivorous Marsupials — ORDER DASYUROMORPHIA

Numbat — FAMILY MYRMECOBINDAE

Numbat (*Myrmecobius fasciatus*) **EXTINCT**[Adel]; **ENDANGERED**[SA]; **VULNERABLE**[AUS]

The natural distribution of this species is described as "widespread across southern semi-arid and arid Australia, from western NSW through SA and southern Northern Territory to the south-west of WA" (Maxwell *et al.* 1996). The numbat existed in the northwest of South Australia until about the 1950s (Environment Australia 1997a). Former habitat was primarily Acacia and Eucalypt woodlands (arid and semi-arid) but extended into the wetter forests in south-west WA. The wet forests of south-west WA where the only extant populations remain, represent the wettest and extreme western extent of its natural distribution. Captive population exists at Yookamurra Sanctuary. As the numbat feeds primarily on termites, the distribution of these insects is the primary determinant of the habitat of this animal (Friend 1995). This animal is dependent on hollow logs and branches for shelter, in which it builds its nest (Friend 1995).

Dasyurids — FAMILY DASYURIDAE

Spotted-tailed Quoll (*Dasyurus maculatus*) **EXTINCT**[Adel]; **ENDANGERED**[SA]; **VULNERABLE**[AUS]

Two subspecies are known. *D.m. maculatus* is the species that was once known from the Adelaide region, while *D.m. gracilis* is known from north east tropical Queensland and is listed as **ENDANGERED** under the EPBC Act. *D.m. maculatus* was once found from southeastern Queensland, through eastern New South Wales, Victoria, Tasmania and South Australia. Since European settlement, it has suffered a 50-90% decline (Maxwell *et al.* 1996), primarily at the western end of its range, which included South Australia (Edgar & Belcher 1995). This animal is extinct in South Australia (Robinson *et al.* 2000).

Found in a variety of habitats, such as rainforests, forests, woodlands, coastal heaths, coastal wet scrub, estuarine areas and rocky headlands (Maxwell *et al.* 1996), this species' western distribution has contracted since European settlement (Edgar & Belcher 1995). Its nests are made in rock caves, hollow logs or in trees. This animal has been described as an efficient predator, feeding on a variety of prey ranging from small wallabies to insects, birds and other small vertebrates (Edgar & Belcher 1995).

Eastern Quoll (*Dasyurus viverrinus*) **EXTINCT**[Adel]; **ENDANGERED**[SA]

Once found in South Australia between Southern Flinders Ranges and Fleurieu Peninsula, this species was also found in Victoria and New South Wales. It is now extinct on mainland Australia (Maxwell *et al.* 1996). In Tasmania it occurs at all altitudes and over a range of plant communities, however, specific habitat requirements are unknown (Maxwell *et al.* 1996). Captive population at Warrawong Sanctuary. Insects are an important dietary component, although this animal is also known to eat birds and small mammals such as Bandicoots, Rabbits and Rats. Grasses and fruits are also regularly eaten (Godsell 1995). At the national level, this species is considered **CONSERVATION DEPENDANT** (Maxwell *et al.* 1996).

Yellow-footed Antechinus (*Antechinus flavipes*)

There are three subspecies of the Yellow-footed Antechinus. The subspecies from the Adelaide region (*A.f. flavipes*) is an outlier of the subspecies found between Mackay in Queensland and western Victoria. *A.f. rubeculus* is found in the Cairns region and *A.f. leucogaster* is found in the southwest of Western Australia. Habitats are diverse, and include tropical forests, swamps, and dry mulga country. Following mating the male dies, leaving an environment free from intra-species competition (Van Dyck 1995). Has been sighted at Eurilla Conservation Park, Belair National Park, Cleland Conservation Park, Morialta Conservation Park, Black Hill Conservation Park, Horsnell Gully Conservation Park, Montacute Conservation Park, Scott Creek Conservation Park, Mark Oliphant Conservation Park and Para Wirra Recreation Park.

Brush-tailed Phascogale (*Phascogale tapoatafa*) **EXTINCT**[Adel] **ENDANGERED**[SA]
The Brush-tailed Phascogale has two subspecies, the southern subspecies (*P.t. tapoatafa*) had a widespread natural distribution, extending from the eastern seaboard to south western WA. The northern subspecies (*P.t. pirata*) is found in the Top End of the Northern Territory, the Kimberley region and on the tip of Cape York Peninsula (Soderquist 1995). The habitat of this subspecies is dry sclerophyll forests and open woodlands that have hollow-bearing trees (in the Adelaide region this was primarily the *Eucalyptus obliqua* (Messmate Stringybark) Woodlands, higher in the Mount Lofty Ranges).. The diet of this animal largely consists of arthropods such as spiders and centipedes; small vertebrates are sometimes eaten (Soderquist 1995). The southern mainland subspecies has had its range reduced by approximately 50%, primarily from land clearing as this animal requires several thousand hectares of suitable habitat for populations to be reproductively viable. Maxwell *et al.* (1996) list the species as extinct in SA and **NEAR THREATENED** nationally. The last SA Museum specimens were from Mount Lofty and Blackwood in the early 1900s. The last confirmed sighting was in the Northern Mt Lofty Ranges in 1967.

Following several recent credible, unconfirmed sightings in the Mount Lofty Ranges, efforts are currently underway to search for this species. Some of these sightings and subsequent search efforts are in the metropolitan area (Peter Hornsby *pers. comm.*).

Fat-tailed Dunnart (*Sminthopsis crassicaudata*) **EXTINCT**[Adel]
Once found on the northern Adelaide plains, this animal is divided into two subspecies- *S.c. crassicaudata* is found on the inland slopes of the Great Dividing Range between southern Queensland and Eyre Peninsula. *S.c. centralis* is found in the arid regions of Australia. Considered common at the national level, this animal lives in a variety of vegetation habitats including open woodland, low shrublands, tussock grasslands, gibber plains, and even farmlands (Morton 1995). It is nocturnal, emerging at night to feed indiscriminately on different types of invertebrates. It does not need to drink free water as, all water requirements are obtained from its food. During periods of high temperature this animal shelters in nests found under logs or rocks, the nest is made of grass or other dried plant material (Morton 1995).

Bandicoots and Bilbies — ORDER PERAMELEMORPHIA
Bandicoots and Bilbies — FAMILY PERAMELIDAE

Greater Bilby (*Macrotis lagotis*) **EXTINCT**[Adel]; **ENDANGERED**[SA]; **VULNERABLE**[AUS]
The Greater Bilby once covered 70% of the Australian mainland (Maxwell *et al.* 1996), including all mainland states (Johnson 1995). Now however, it is restricted to the Tanami, Great Sandy and Gibson Deserts (WA and NT), and an isolated population between Boulia and Birdsville in Queensland. Former distribution was over a variety of climatic zones and plant communities. Captive populations exist in several South Australia sanctuaries including Yookamurra Sanctuary and on Thistle Island. The Greater Bilby is strictly nocturnal; during the day it lives in burrows, leaving the burrow well after sunset to feed on larval insects, seeds, bulbs, fruit and fungi (Johnson 1995). Until the early 20th century, the Greater Bilby was considered common throughout its range. Possible reasons for its widespread decline include changes to fire regimes, competition for food resources from Rabbits and livestock and predation from introduced carnivores (Johnson 1995).

Western Barred Bandicoot (*Perameles bougainville*) **EXTINCT**[Adel]; **Endangered**[SA]; **Extinct** [AUS]
The mainland subspecies (*P.b. fasciata*) of this animal is extinct. Previously it occurred from Western Australia through SA to western NSW and northern Victoria. The subspecies *P.b. bougainville* is found only in the Shark Bay region of WA and is listed as **ENDANGERED** under the EPBC Act. Its preferred habitat was arid and semi arid woodlands, shrublands and heaths (Maxwell *et al.* 1996). Its well concealed nest is made from grasses and other vegetation and is usually located in a hemispherical hollow, underneath shrubs- here it spends most of its daylight hours (Friend & Burbidge 1995). At night, it emerges to forage for food such as insects, other small animals, seeds, roots and herbs (Friend & Burbidge 1995).

Southern Brown Bandicoot (*Isoodon obesulus*) **VULNERABLE**[SA]
Three subspecies of this animal exist. *I.o. obesulus* occurs in southern Australian from southern New South Wales to Eyre Peninsula; southwest of Western Australia has the subspecies *I.o. fusciventer*; and *I.o.peninsulae* is found at the tip of Cape York Peninsula (Maxwell *et al.* 1996). Each of these subspecies is considered **NEAR**

THREATENED at the national level (Maxwell *et al.* 1996). The Southern Brown Bandicoot prefers areas of heath, shrubland and heathy forest and woodland (Maxwell *et al.* 1996). It is believed that in order for a particular area to support a stable population, parts of it must be subject to fire regularly (Braithwaite 1995). However, areas subject to too frequent fires will not support this species (Maxwell *et al.* 1996). Areas regenerating after fire support abundant insects and are considered very favourable habitat.

This animal is considered nocturnal (Braithwaite 1995), however, it is sometimes seen feeding during the day also. Food includes insects (adult and larval), earthworms, other invertebrates, fungi and other subterranean plant material (Braithwaite 1995). A solitary animal, the home range of large individuals may be as much as 7 hectares with some overlapping. The Southern Brown Bandicoot is threatened by introduced carnivores such as Foxes , which may preferentially predate on females (Maxwell *et al.* 1996). In the Adelaide area, this animal is known to utilise areas for cover, invaded by blackberry (*Rubus fruticosis* L. agg.) (see p.110). Destruction of large areas of this habitat over a short period of time should not occur where this animal is known to occur (see "Conservation Dilemmas" p.9). This animal has been sighted in Belair National Park, Cleland Conservation Park, Scott Creek Conservation Park and Mark Oliphant Conservation Park.

Koala, Wombats, Possums & Macropods — ORDER DIPROTODONTIA

Koala — FAMILY PHASCOLARCTIDAE

*** Koala** (*Phascolarctos cinereus*)

Today the Koala is relatively common in the Adelaide Hills and even sometimes ventures onto the plains. The existence of Koalas at the time of European settlement has been the topic of considerable debate. Tyler *et al.* (1976) indicate this animal became extinct early in the Adelaide region as the animal was hunted for its fur. However, more recently, experts claim that evidence for the existence of the Koala in the Adelaide region prior to European settlement is either inconclusive (Cath Kemper *pers. comm.*), or indicates this animal was not here when Europeans arrived (Barbara St John *pers. comm.*). Whatever its pre-European settlement status, the Koala is a common animal in the Adelaide region today.

Koalas are described as folivores, that is, they eat only leaves. Furthermore, they eat the leaves from just one genus- Eucalyptus (Martin & Handasyde 1995). Eucalyptus leaves are considered poor quality food, as they are low in energy and contain a variety of toxic compounds (Martin & Handasyde 1995). Koalas have developed a variety of adaptations that enable them to exist on this diet. As little energy is obtained from eating Eucalyptus leaves, Koalas exert minimal amounts of energy. Indeed, they remain inactive for about 20 hours of the day. Digestive tract adaptations allow the Koala to inactivate and excrete toxic compounds in the liver; food that passes beyond the stomach is retained for long periods to allow microbial fermentation (Martin & Handasyde 1995). Some energy is made available to the Koala following the process of fermentation (Martin & Handasyde 1995).

Wombats — FAMILY VOMBATIDAE

Hairy-nosed Wombat (*Lasiorhinus latifrons*) **EXTINCT**[Adel]

Natural distribution is in the arid and semi arid regions of southern western Australia and South Australia. Extinct in the Adelaide region but has no national or state conservation rating. Early records indicate this animal was found in the Port Adelaide area at the time of European settlement. Nationally, it is estimated that this animal has declined 10-50% in extent of occurrence since European settlement. In SA, it is found today on Eyre Peninsula, the Gawler Ranges and the Nullarbor Plain. Smaller colonies occur west of the River Murray and on Yorke Peninsula. As this species is essentially a plains dweller of the arid and semi-arid regions, it is unlikely to have been found higher in the Mount Lofty Ranges. The Hairy-nosed Wombat is a sedentary animal that lives in burrows, venturing out to feed when temperature and humidity are at levels that will allow the animal not to lose too much moisture (Wells 1995). Like the Koala (*Phascolarctos cinereus*) the metabolic rate of this animal is very slow, allowing it to survive on plant matter that is nutritionally poor by the standards of other animals.

Common Brushtail Possums, Cuscuses & Scaly-tailed possums — FAMILY PHALANGERIDAE

Common Brushtail Possum (*Trichosurus vulpecula vulpecula*)

Perhaps the most abundant native mammal in the Adelaide region, the Common Brushtail Possum is divided into five subspecies- the local animal- *T.v. vulpecula* is found throughout south eastern and south western Australia;

T.v. arnhemensis is found in tropical Northern Territory and Western Australia; *T.v.eburacensis* is from Cape York; *T.v. johnsoni* is from central Queensland; and *T.v. fuliginosus* is found in Tasmania (How & Kerle 1995). Before European settlement, the distribution of this animal covered the entire country (How & Kerle 1995). However, while it was considered common virtually everywhere, today it is either extinct or very rare in the arid zone and has declined in all regions that have undergone forest clearance (Kemper & Foulkes 1997). The exception to the above is in areas of human settlement where Brushtails have survived and even flourished in some instances (Bird 1997).

This rather unusual situation where an animal is endangered in some areas and considered a pest in other areas, can be explained by the significant alteration to ecological factors since European settlement (see section 2.2, p.9), in particular, availability of food, cover, den sites and the influence of competitors and predators (Bird 1997). The Brushtail commonly uses tree hollows for den sites, however most dark, confined spaces are suitable. Consequently, much to the dismay of humans, roof spaces in houses make an ideal substitute (Bird 1997). Brushtails have also found excellent food substitutes in areas inhabited by humans. Roses, ornamental trees, fruit trees, geraniums and grapes are just a few plants that provide Brushtails with nutritional value (Bird 1997).

The decline in Brushtail numbers in the arid region has been attributed to the compounding effects of disturbance of drought refuge habitats by introduced animals, changes in fire regimes and extended droughts between 1920 and 1970 (Kemper & Foulkes 1997). While in the agricultural regions habitat loss, competition from introduced herbivores, changes to fire regimes and predation from introduced carnivores are the likely causes of their decline (Bird 1997).

The Common Brushtail has been successful in New Zealand also, where following introduction in 1837, it has multiplied significantly and is now considered a major pest (Department of Conservation 2000a).

It is likely that all NPWSA parks in the Adelaide area contain the Common Brushtail Possum. Confirmed sightings are officially recorded for Aldinga Scrub Conservation Park, Eurilla Conservation Park, Belair National Park, Onkaparinga River National Park, Cleland Conservation Park, Morialta Conservation Park, Ferguson Conservation Park, Horsnell Gully Conservation Park, Sturt Gorge Recreation Park, Mark Oliphant Conservation Park and Para Wirra Recreation Park.

Potoroos, Bettongs, and Musky Rat-kangaroo — FAMILY POTOROIDAE

Burrowing Bettong (*Bettongia lesueur*) **EXTINCT**[Adel]; **ENDANGERED**[SA]; **EXTINCT**[AUS]

There are several subspecies of this animal. *B.l. graii* was the only mainland subspecies, and is now extinct, while *B.l. lesueur,* and *B.l. harveyi* remain on islands off the coast of WA (both are considered **VULNERABLE** at the national level). The Burrowing Bettong once inhabited half of mainland Australia, from the northwest of Western Australia through much of southern Western Australia and South Australia. It was also found in western New South Wales and northwestern Victoria. There is a captive population of *B.l. lesueur* in the Arid Recovery Project, Roxby Downs and Yookamurra Sanctuary. Last SA recorded sighting in the wild of the mainland subspecies was near Gawler River in 1904. This subspecies is now considered extinct (Maxwell *et al.* 1996). The mainland Burrowing bettong was a nocturnal animal, emerging at dusk to feed on tubers, bulbs, seeds, nuts and the green part of some plants (Burbidge 1995). This animal persisted in some areas of the mainland until the 1940s, when rabbits took over their warrens and those few remaining animals were later killed by foxes (Burbidge 1995).

Brush-tailed Bettong (*Bettongia penicillata*) **EXTINCT** [Adel]; **RARE** [SA]; **EXTINCT** [AUS]

This species has two subspecies- *B.p. penicillata* and *B.p. ogilbyi*. *B.p.penicillata* is the species that once occurred throughout southeastern Australia including the Adelaide region. This subspecies is now extinct throughout Australia (Maxwell *et al.* 1996). Extant populations of *B.p. ogilbyi* survive only in the southwest of Western Australia. Several translocated populations of *B.p. ogilbyi* exist in Western Australia and in South Australia (Wedge Island, St Peter Island, Venus Bay Conservation Park, and Yookamurra Sanctuary).

Despite having a very restricted range, *B.p. ogilbyi* is only listed as **CONSERVATION DEPENDANT** at the national level (Maxwell *et al.* 1996). Both subspecies formerly inhabited a wide range of habitats from desert spinifex grasslands to forests. In the few localities where this species remains, the habitat is characterised by a clumped

low understorey of tussock grasses or clumped woody scrub (Christensen 1995). This animal feeds primarily on underground fungi, but also on bulbs, tubers, seeds, insects and resin (Christensen 1995).

Wallabies, Kangaroos and Tree Kangaroos — FAMILY MACROPODIDAE

Tammar Wallaby (*Macropus eugenii*) **EXTINCT**[Adel;] **ENDANGERED** [SA;] **EXTINCT**[AUS]

The Tammar Wallaby consists of three subspecies (*M.e.derbianus* (WA), *M.e. decres* (Kangaroo Island) and *M.e. eugenii* (mainland SA)). Federal legislation lists *M.e. eugenii* as extinct throughout its range. However, following recent genetic testing, it is believed that individuals introduced to New Zealand are the same subspecies (Robinson *et al.* 2000; Poole *et al.* 1991, in Maxwell *et al.* 1996). Formerly found on Eyre, Yorke and Fleurieu Peninsulas and near Adelaide. Dense, low vegetation is required by the Tammar Wallaby for shelter and open grassy areas are required for feeding (Smith & Hinds 1995).

Western Grey Kangaroo (*Macropus fuliginosus*)

This animal consists of two subspecies. *M.f. melanops* is the mainland subspecies and is found from inland southern Queensland, through western New South Wales, western Victoria, and southern South Australia and southern Western Australia. The other subspecies, *M.f. fuliginosus* is found on Kangaroo Island only (Poole 1995b), and considered **NEAR THREATENED** (Maxwell *et al.* 1996). There are significant morphological differences between east and west populations of the mainland subspecies. It has been suggested that the composite group on the mainland intergrades clinally in morphological traits along an east-west gradient (Poole 1995a). This animal has been sighted at Belair National Park, Cleland Conservation Park, Onkaparinga River National Park, Onkaparinga Estuary Recreation Park, Morialta Conservation Park, Horsnell Gully Conservation Park, Mark Oliphant Conservation Park and Para Wirra Recreation Park.

Euro (*Macropus robustus erubescens*) **EXTINCT**[Adel]

Four subspecies of this animal exist (Poole 1995b). The subspecies formerly of the Adelaide region, *M.r. erubescens* is found throughout most of the mainland, east of the Great Dividing Range. *M.r. robustus* is found east of the Great Dividing Range in temperate and tropical habitats. *M.r. woodwardi* can be found between the Kimberleys in Western Australia and the western Top End of the Northern Territory. *M.r. isabellinus* is found on Barrow Island, Western Australia. The habitat of the Euro is varied but usually consists of steep escarpments, rocky hills or stony rises- these areas provide cool shelter from intense heat in areas that experience prolonged periods of high temperature (Poole 1995b). In the cool of the evening, this animal will venture from its shelter to graze on grasses and shrubs (Poole 1995b).

Pygmy-possums — FAMILY BURRAMYIDAE

Western Pygmy-possum (*Cercartetus concinnus*) **EXTINCT**[Adel]

Likely to be extinct in the Adelaide region, the last Museum specimen was from Reynella in 1945. The South Australian subspecies (*C.c. minor*) is found also in Victoria. One other subspecies exists (*C.c. concinnus*) and is found in southern Western Australia (Maxwell *et al.* 1996). Inhabiting dry sclerophyll forest and mallee heath, especially in areas where the understorey is composed of banksias, grevilleas, callistemons and melaleucas, the Western Pygmy-possum is mainly arboreal and is nocturnal (Smith 1995). During the day, it nests in hollows or in the leaves of *Xanthorrhoea* spp. (Smith 1995). It feeds on nectar, pollen, insects and possibly small lizards (Bennet & Lunden (1995) in NSW NP&WS (1999)).

While this animal is common prey for feral and domestic cats, its reproductive rate is adapted for heavy predation. Clearing of native vegetation for urban development is considered a more significant threat to this small mammal (Smith 1995). It is remotely possible that this animal remains in suitable habitat in the Adelaide region.

Ringtail possums and Greater glider — FAMILY PSEUDOCHEIRIDAE

Common Ringtail Possum (*Pseudocheirus peregrinus*)

There are four subspecies that together make up this species. The subspecies from the Adelaide region, *P.p. peregrinus* is the most widely distributed and is found in a band between Cape York Peninsula and South Australia (not including the eastern slopes of the Great Dividing Range south of Brisbane). The Adelaide region represents the western edge of this animal's distribution. *P.p.cooki* is found in the coastal scrubs of the south-

eastern mainland; *P.p. pulcher* is found in the rainforests of south-eastern Queensland and north-eastern New South Wales; *P.p. convolutor* is found in Tasmania and on the Bass Strait Islands (McKay & Ong 1995). There is a possibility that these subspecies are probably several closely related, separate species (McKay & Ong 1995).

This animal can be found in a variety of vegetation types throughout its range. While its diet varies with geographic range it is strictly herbivorous, eating leaves, flowers and fruits (McKay & Ong 1995). Like the Common Brushtail Possum (*Trichosurus vulpecula*), this animal has adapted its behaviour to live close to humans, feeding on introduced flowers and fruits (McKay & Ong 1995). It builds a spherical nest made from leaves and can be found in a hollow limb, in a bunch of mistletoe, or in dense undergrowth (McKay & Ong 1995). The abundance of this animal declines on the extremities of distribution, due possibly to habitat destruction and predation by the fox and Feral Cat (McKay & Ong 1995). This animal has been sighted at Belair National Park, Onkaparinga River National Park, Cleland Conservation Park, Morialta Conservation Park, Horsnell Gully Conservation Park, Ferguson Conservation Park, Sturt Gorge Recreation Park, Mark Oliphant Conservation Park and Para Wirra Recreation Park.

Feathertail Glider — FAMILY ACROBATIDAE

Feathertail Glider (*Acrobates pygmaeus*) **EXTINCT**[Adel] **ENDANGERED**[SA]

Extinct in the Adelaide region, this species is still found in the Murray mallee and in the South East of South Australia. Nationally, this species, known as 'the world's smallest gliding mammal' (Woodside 1995) has suffered a less than 10% decline (Maxwell *et al.* 1996) and is found in Queensland, New South Wales and Victoria (Environment Australia 1997b).

The Feathertail Glider is found in woodlands, dry forests and wet forests that have a good understorey. It builds a spherical nest (drey) made from vegetation, particularly casuarina and eucalypt leaves. Bark, tree-fern fibre, fresh leaves, feathers and other soft material line the nest (Woodside 1995). In the wild, this animal feeds on nectar, pollen and insects; this is done at a variety of locations and canopy levels (Woodside 1995). Analysis of fox (*Vulpes vulpes*) and Cat (*Felis catus*) scats indicate that these introduced predators frequently include the Feathertail Glider in their diet (Woodside 1995).

Bats — ORDER CHIROPTERA

Flying Foxes — FAMILY PTEROPODIDAE

Little Red Flying-fox (*Pteropus scapulatus*)

There are less than ten records of this species for the entire state. One specimen was caught at Henley Beach in the 1960s. Not considered normal residents of SA, they are however the most nomadic and have a much broader distribution than any other flying fox (Churchill 1998). It is the only species from this list that is not insectivorous, feeding primarily on blossoms (Churchill 1998).

Sheathtail Bats — FAMILY EMBALLONURIDAE

Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) **RARE**[SA]

Rare in SA only 16 records although three are from suburban Adelaide. All records are from between March and June. This species is found in virtually all habitats such as wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee grasslands and desert (Churchill 1998). This species forages for flying insects such as beetles, grasshoppers, shield bugs and flying ants well above the tree canopy (Churchill 1998).

Freetail Bats — FAMILY MOLOSSIDAE

White-striped Freetail-bat (*Tadarida australis* (syn. *Nyctinomus australis*))

Several records from Adelaide suburbs near the CBD and one record from the south parklands and one from the Adelaide University grounds. This species is distributed across all of southern Australia, except Tasmania. It feeds on moths, beetles, grasshoppers and ants; it has been known to fly into water in pursuit of prey (Churchill 1998). Reflecting its wide-ranging distribution, this species is also found in a range of habitats including forest, woodland, shrubland and grassland (Churchill 1998). While this animal roosts in trees, it is also very agile on the ground where it has been observed eating ants and non-flying beetles (Churchill 1998). This animal has been sighted at Belair National Park, Aldinga Scrub Conservation Park and Torrens Island Conservation Park.

Southern Freetail-bat (*Mormopterus planiceps*)
Several records from Adelaide suburbs near the CBD and one record from the south parklands. This animal is found inland of the Great Dividing Range, from western New South Wales and central Victoria to south eastern South Australia (Churchill 1998). This species inhabits dry open forest and woodlands and feeds at the edge of remnant vegetation, between trees and even on the ground. Its diet includes bugs, beetles, ants and moths (Churchill 1998). This animal has been sighted at Aldinga Scrub Conservation Park.

Ordinary Bats — FAMILY VESPERTILIONINAE

Lesser Long-eared Bat (*Nyctophilus geoffroyi*)
Several records from the Adelaide CBD and near suburbs. This species is found throughout Australia except along the east coast of Queensland, inhabiting a variety of habitats from arid areas to temperate and tropical eucalypt forest and woodlands, rainforests, alpine vegetation and open grasslands (Churchill 1998). This species utilises a variety of techniques to catch insects; it gleans insects from the surface of plants or off the ground and forages for flying insects (Churchill 1998). Moths are the most common prey, but they also eat insects such as ants, cricket nymphs, spiders, beetles, crickets, bugs, lacewings and flies (Churchill 1998). Unlike many other bats, this species can take flight off the ground and from water (Churchill 1998). The Lesser Long-eared Bat has been sighted at Aldinga Scrub Conservation Park, Onkaparinga River National Park and Port Gawler Conservation Park.

Gould's Wattled Bat (*Chalinolobus gouldii*)
Several records from the Adelaide CBD and near suburbs. Distributed throughout mainland Australia, Tasmania and Norfolk Island, this species is found in virtually all habitats (Churchill 1998). It roosts in tree hollows especially River red gums (*Eucalyptus camaldulensis*), but also amongst leaves and in buildings (Churchill 1998). Diet includes primarily moths and bugs, but also beetles, katydids, ants and flies (Churchill 1998). This species will often emerge just after sunset, while there remains some ambient light. Consequently, they are vulnerable to predation from birds such as Brown falcons (*Falco berigora*), Barn owls (*Tyto alba*), Boobook owls (*Ninox novaeseelandiae*) and Feral Cats (*Felis catus*) (Churchill 1998). This animal has been sighted at Aldinga Scrub Conservation Park, Port Gawler Conservation Park and Morialta Conservation Park.

Chocolate Wattled Bat (*Chalinolobus morio*)
Recorded in Semaphore in 1925 and Fulham in 1946. Still common in the Adelaide Hills and likely to be present on the plains. Distributed across much of southern Australia, this species occurs in wet and dry sclerophyll forest, woodlands, mallee and shrublands (Churchill 1998). As they are opportunistic feeders, the choice of prey reflects the availability of aerial insects; moths, beetles, bugs and lacewings are commonly caught (Churchill 1998). They most commonly forage in the area between the bottom of the canopy and top of the understorey (Churchill 1998). This species has been sighted at Aldinga Scrub Conservation Park and Port Gawler Conservation Park.

Inland Broad-nosed Bat (*Scotorepens balstoni*)
A single record from Adelaide in 1931. Still uncommon in surrounding regions but could be in the Adelaide region. This animal is primarily an arid and semi arid species, being found inland and west of the Great Dividing Ranges in open woodland, shrubland, mallee and grasslands (Churchill 1998). It will eat cockroaches, termites, crickets, katydids, cicadas, leaf hoppers, bugs, beetles, flies, moths and ants (Churchill 1998).

Large Forest Bat (*Vespadelus darlingtoni*)
Two records, 1902 and 1946 from the SA Museum building on North Terrace - no other records for the Adelaide plains. Still common in the Adelaide Hills, this species is distributed along the Great Dividing Range of south eastern Australia in wet and dry sclerophyll forest, coastal mallee, and alpine habitats (Churchill 1998). As it is adapted to cool climates, this species can feed at times of the year when other bats are in hibernation (Churchill 1998). This species will eat a variety of insects including beetles, moths, flies and bugs (Churchill 1998). This animal has been sighted at Scott Creek Conservation Park.

Southern Forest Bat (*Vespadelus regulus*)
One record from Adelaide, 1902. Possibly on the Adelaide plains, still common in the Adelaide Hills. This species is distributed across Southern Australia in a band between Brisbane and Perth. It is found in rainforests,

wet and dry sclerophyll forest, shrublands, woodlands and mallee (Churchill 1998). These animals are aerial insectivores, eating moths, flies, beetles, bugs and termites (Churchill 1998). These animals forage close to the ground, and are able to fly between understorey plants with considerable agility. They are capable of taking off from the ground (Churchill 1998). This animal has been sighted at Onkaparinga River National Park and Scott Creek Conservation Park.

Little Forest Bat (*Vespadelus vulturnus*)
Has been recorded from the Fleurieu Peninsula, but not yet from the Mount Lofty Ranges or the Adelaide plains, but is a likely inhabitant. This animal is distributed in south eastern Australia from southern Queensland, New South Wales, Victoria, Tasmania and south east South Australia (Churchill 1998). It feeds opportunistically within the upper levels of the forest understorey on insects such as moths, flies, bugs, beetles, wasps and termites (Churchill 1998). This species has been sighted at Aldinga Scrub Conservation Park.

Large Bentwing-bat (*Miniopterus schreibersii*)
The natural distribution of this species is unclear. While they are relatively abundant around Naracoorte and have been found as far north as Melrose in the Southern Flinders Ranges (Duncan *et al.* 1999), this animal has not been seen in the Adelaide region since 1925. Churchill (1998) indicates that the South Australia distribution of this species includes only the south-east corner of the state. Indeed the animal is common around the caves at Naracoorte. Therefore, it is likely that these northern records do not represent its natural distribution. The Australian distribution is from the tip of Cape York Peninsula all the way down the eastern seaboard to the south east of South Australia. A separate population exists in the northwest from western Gulf of Carpentaria through the Top End to the Kimberley region (Churchill 1998).

There are concerns for the conservation of this species; in some areas of Victoria it has declined significantly (Duncan *et al.* 1999). In the past, this species has been found at Port Adelaide and at Mount Lofty (Duncan *et al.* 1999). The Large Bentwing-bat has no formal national or state conservation rating, but it is listed as ***conservation dependant*** in Duncan *et al.* (1999). This animal uses a broad range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands (Churchill 1998). It feeds primarily on moths (Churchill 1998), but other insects are also eaten (Dwyer 1995).

Carnivores — ORDER CARNIVORA
Dogs, Foxes and relatives — FAMILY CANIDAE

Dingo (*Canis lupus dingo*) **EXTINCT**[Adel]
Based on the most accurate dating of dingo remains, the Dingo has been in Australia for at least 3500 years (Corbett 1995a), yet it is sometimes considered being an introduced animal (Robinson *et al.* 2000; Environment Australia 1997b). Recent evidence suggests that there are three subspecies of the Dingo in Australia, all of which are genetically distinct from each other and the Southeast Asian populations (Corbett 1995a). Therefore, the Dingo is shown here as an animal native to Australia. Despite the apparently inconsistent status of the Dingo it is often subject to specific conservation measures and protection policies (see for example Commonwealth of Australia 1999b; Australian Conservation Foundation 1985).

The Dingo eats a range of prey "...from insects to buffalo" (Corbett 1995a). Being blamed for the loss of stock, the Dingo has been regarded for many years as a pest animal. However, it is likely that the Dingo predates on stock only during periods of drought when native prey is scarce (Corbett 1995a). Despite hunting, scalp bonuses, poisoning and fencing the Dingo remains widespread throughout northern Australia (Corbett 1995b). However, widespread interbreeding with the domestic dog (*Canis lupus familiaris*) suggests that the inevitable consequence will be the loss of the pure bred Dingo (Corbett 1995a).

✱**European Red Fox** (*Vulpes vulpes*)
The European Red Fox was introduced into Australia in the 1860s and 1870s, for sporting purposes (Coman 1995). It spread quickly throughout southern Australia and in favourable seasons occupies all mainland habitats except in the tropics (Coman 1995). It is not found in Tasmania, or on Kangaroo Island (Biodiversity Group 1999c). While the Fox is considered an opportunistic predator and scavenger, it will also eat invertebrates and fruits (Coman 1995). Predation by the Fox is a known threat to several endangered/ vulnerable animals

(Biodiversity Group 1999c). Section 5.3, p.111 discusses in greater detail the threat to biodiversity from the European Red Fox.

Cats and relatives — FAMILY FELIDAE

***Feral Cat** (*Felis catus*)

The origin of the Feral Cat in the Australian environment is unclear. Some authors suggesting that the existence of the Feral Cat in Australia pre-dates formal European settlement (Newsome 1995; Biodiversity Group 1999b). During the 1600s, some Dutch ships on their way to Indonesia were blown ashore on the Western Australian coast. These ships usually carried cats as pets and as a way to reduce the number of rodents (Newsome 1995). From these sources cats may have either escaped or been deliberately released. Whatever its origins, the Feral Cat is found throughout the Australian environment and is widely accepted to have a significant impact on Australian wildlife, in particular birds and small mammals (Biodiversity Group 1999b). They are also known to eat reptiles, amphibians and invertebrates (Newsome 1999). Section 5.3, p.110 flags the issue of the Feral Cat as being a major threat to Adelaide's biodiversity.

Rodents — ORDER RODENTIA
Murids — FAMILY MURIDAE

White-footed Tree-rat (*Conilurus albipes*) EXTINCT[Adel]; ENDANGERED[SA]; EXTINCT[AUS]

Little is known of this animal. Not seen in the Adelaide region since the 1840s, this animal was one of the first mammals to disappear following European colonisation. It was described early as being widespread, but never abundant; it was nocturnal, sleeping during the day in hollows on or near the ground (Dixon 1995).

Water Rat (*Hydromys chrysogaster*)

The water rat usually lives within close proximity to permanent bodies of fresh or brackish water, and even on some beaches (Olsen 1995). While this animal does search for food on land most of its diet originates in the water. Being an opportunistic predator very little plant material is eaten; instead, large aquatic insects, fish, crustaceans and mussels constitute most of this animal's diet. Frogs, lizards, small mammals, fresh carrion and water birds may also be taken (Olsen 1995). It has been sighted at Belair National Park, Sturt Gorge Recreation Park, Mark Oliphant Conservation Park and is common along the River Torrens.

Mitchell's Hopping-mouse (*Notomys mitchellii*) **Extinct**[Adel]

While still considered common at the national level (Watts 1995a) this species is extinct in the Adelaide area. This nocturnal animal shelters during the day in burrows and feeds on insects, seeds and green plants at night (Watts 1995a). Its habitat consists primarily of the mallee regions of southern Australia (Watts 1995a).

***House Mouse** (*Mus musculus*)

The house mouse has followed humans all over the world. Indeed, it is considered as the most widely distributed mammal in the world- second only to humans (Singleton 1995). It is found throughout mainland Australia and most of its offshore islands, feeding on anything that humans will eat and more. In Australia, it is most common in the settled and cultivated areas (Singleton 1995).

Bush Rat (*Rattus fuscipes greyi*)

There are four subspecies of this animal. *R.f. coracius* is known from Townsville to Cooktown in Queensland; *R.f. assimilis* from Rockhampton to about Portland, Victoria; *R.f. fuscipes* is found along the coast of south west Western Australia; and *R.f. greyi*, the Adelaide subspecies is found from Eyre Peninsula to about Portland (Lunney 1995a). Rarely seen in the wild, this timid animal can be found in sub alpine woodland, coastal scrub, eucalypt forest and rainforest, in particular if there is undergrowth of shrubs or ferns (Lunney 1995a). Of all native rats, the Bush rat is the most insectivorous, yet it is able to survive on fungus, fruit, seeds, leaves and lilies (Lunney 1995a). In the Adelaide region the Bush rat has been sighted at Eurilla Conservation Park, Belair National Park, Cleland Conservation Park, Port Gawler Conservation Park, Morialta Conservation Park, Horsnell Gully Conservation Park and Scott Creek Conservation Park.

Swamp Rat (*Rattus lutreolus*)
Three separate subspecies of this animal exist. The Adelaide animal (*R.l. lutreolus*) belongs to the subspecies that extends along the coast from about Brisbane to Adelaide (including Kangaroo Island). *R.l. lacus* is known only from the Atherton Tableland in Queensland, while *R.l. velutinus* is found in Tasmania (Lunney 1995b). A poor swimmer, the Swamp Rat can however, swim small distances if it is absolutely necessary (Lunney 1995b). Preferred habitats are river flats, sedge swamps and low–lying heaths where the animal constructs an elaborate network of tunnels. Such a network of tunnels providing cover reflects its diurnal behaviour (Lunney 1995b).

The Swamp Rat feeds primarily on grasses and sedges; however, this diet is sometimes supplemented by fleshy fruits, seeds and arthropods. Sensitive to farming, grazing and clearing of habitat, there is some suggestion that this animal might be a good indicator of the quality of habitat rehabilitation (Lunney 1995b). The last museum specimen of this animal was collected from Fulham in 1917. It has however, been sighted at Kyeema Conservation Park, and is likely to exist in pockets on the edge of the Adelaide Metropolitan Area.

✱**Brown Rat** (*Rattus norvegicus*)
A native of Europe, the Brown Rat arrived in Australia with the early British fleets and has failed to extend its range beyond major coastal cities and ports (Watts 1995b). Being found primarily in cellars, sewers, and ports, it is rarely far away from humans, however, sometimes it can be found in farm buildings and along creek banks of the wetter southern areas (Watts 1995b). It feeds primarily on human foods, but will also eat shellfish, bird eggs, seeds and some insects. If given the opportunity it can predate on small birds and mammals (Watts 1995b).

✱**Black Rat** (*Rattus rattus*)
The Black Rat is common around settled and agricultural areas, and is also be found in some areas unaltered by humans. It is however, restricted to the coastal fringes where water is usually abundant (Watts 1995c). Around the settled areas, this animal will eat most things that are utilised by humans or domestic pets (Watts 1995c). While in New Zealand the Black Rat is implicated in destroying eggs and preying upon young native birds (Department of Conservation 2000b), little evidence exists to suggest similar occurrences here in Australia (Watts 1995c).

Rabbits, Hares and relatives — ORDER LAGOMORPHA
Rabbits and Hares — FAMILY LEPORIDAE

✱**European Rabbit** (*Oryctolagus cuniculus*)
The rabbit was introduced into south eastern Australia in 1858, and spread across the mainland, now occupying 60% of the continent (Biodiversity Group 1999a). It is found in most habitats from watercourses in arid regions to open grassy valleys in subalpine habitats (Myers 1995). Competition and land degradation associated with grazing from the rabbit is listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2000a). Section 5.1, p.105 discusses in greater detail the threat to biodiversity from the rabbit.

✱**Brown Hare** (*Lepus capensis*)
The Brown hare was introduced into the wild on mainland Australia in 1859, 1865 and to Adelaide in 1869 (Jarman 1995). Being a nocturnal animal, the Brown Hare feeds at night on grasses and a variety of forbs (Jarman 1995). It shelters during the day amongst rocks and vegetation; as it does not burrow, this animal escapes predators by running at up to 50 kilometres per hour and hiding (Jarman 1995). This animal is not generally associated with intact plant associations; instead, its habitat is modified pastures and croplands (Jarman 1995).

Threats to Marsupials and Rodents

Australian non-flying mammals have suffered significant rates of decline following European settlement. Indeed, in modern times one third of the world's mammal extinctions have occurred in Australia (Kennedy (1992) in Lee (1995)). Furthermore, these statistics are likely to be an underestimate, as some species probably became extinct before being recorded by naturalists (Maxwell *et al.* 1996).

Virtually all extinctions have occurred in the non-flying, medium sized mammals in the "critical weight range" (CWR). The CWR is defined as adult body weights between 35 and 5500 gram (Maxwell *et al.* 1996). Indeed, of the 20 rodents and marsupials to become extinct since European settlement only two of these are not in the CWR. Any deviation from this trend between mammal species within this weight range can almost be entirely explained by variations in rainfall and to a lesser extent, species habitat and dietary preferences (Maxwell *et al.* 1996). CWR mammals that are most threatened are from arid and semi-arid areas; species that spend most of their time at the ground's surface; and species that are omnivores or herbivores are the most likely to be faced with extinction (Maxwell *et al.* 1996). Mammals that have declined or become extinct are not restricted to one particular taxonomic group and include species from most families of marsupials and native rodents (Maxwell *et al.* 1996).

Maxwell *et al.* (1996) identifies three factors, interacting together that are the primary causal factors behind the historical decline of Australian mammals. First, the spread of exotic predators such as the **European Red Fox** (*Vulpes vulpes*) and **Feral Cat** (*Felis catus*) have placed significant pressure on smaller ground dwelling mammals (see section 5.3, p.111). Second, the introduction of exotic herbivores, in particular the **European Rabbit** (*Oryctolagus cuniculus*), **Sheep** (*Ovis aries*) and **Cattle** (*Bos taurus*) have in many cases out competed native herbivores. Third, changed fire regimes have effectively homogenised the Australian landscape. Previously, through land management by Aboriginal people, the landscape was subject to many small fires throughout the year. Today large, infrequent fires occurring mainly in the summer have reduced the habitat variety, resulting in fewer small patches of vegetation in different stages of recovery (Kennedy 1992). The last two factors it is argued, have "...emulated an increase in aridity by reducing the environmental productivity available to vertebrates" (Lee 1995). The impacts of fewer resources available to native mammals in the CWR has been exacerbated by predation form introduced carnivores.

Smaller (<35 grams) non-flying mammals have largely escaped the effects of a reduction in environmental productivity because they have a smaller energy requirement per individual. While larger mammals (>5500 grams) have escaped a reduction in environmental productivity through their higher mobility, giving them the capacity to roam over larger areas and colonise new habitats (Lee 1995).

In the Adelaide region, non-flying mammals are threatened by the above pressures as well as extensive habitat loss and fragmentation and predation from domestic animals.

Threats to Bats

Due to their nocturnal habits and small size, bats are largely unnoticed by the casual observer. Indeed most people would be surprised to hear that in metropolitan Adelaide about nine species of bats are regularly observed, and that bats can be seen on warm nights foraging for insects around street lights. There is almost no record of bat diversity and abundance at the time of European settlement of Adelaide, but biologists believe that bats have coped better with environmental changes caused by urbanisation than have other native mammal species. This is perhaps due to the generalist feeding nature of bats and their ability to escape widespread predation from introduced carnivores through flight. It is likely that nearly all the bat species that were present before 1836 are present today, although the relative abundance of each has almost certainly declined.

Management strategies for the preservation of native bat species are founded upon three major factors Terry Reardon (*pers. comm.*):

- the availability of suitable roosting sites
- the availability of food, and
- reducing environmental pollutants.

Roost sites The natural roost sites for most bat species in Adelaide are in tree hollows or under bark. Prior to European settlement, a range of tree species including eucalypts provided all the roosting requirements for bats. The large scale felling of old hollow-bearing trees in South Australia has probably been a major cause of stress on bat populations. The loss of trees means that there is increased competition for remaining hollows from birds and other native mammals but also from introduced honey-bees.

Some bat species are more adaptable than others and have taken to roosting in buildings and other structures. Management strategies for the conservation of bats must include the protection of remaining old growth trees, the commencement of a program to plant trees for the future, and widespread placement of artificial bat roost-boxes as interim roost sites.

Food Requirements As all of the bat species commonly found in the Adelaide region are insectivorous, any measures that result in the number and diversity of insects being increased will aid bat conservation through provision of a reliable food source. Insect diversity is closely correlated with plant diversity (in particular in the shrub and ground layer). Consequently, conservation activities such as revegetation and weed management to increase plant diversity will contribute significantly to the protection of bats.

Although bats generally derive their water intake through their insect diet, most bats will drink water from creeks and ponds. The recent trend to construct wetlands and to clean up our major waterways will be of benefit to bats.

Pesticide Susceptibility Aside from depleting their food supply, it is well established that widespread herbicide and insecticide use impacts negatively on bats through the poisoning of their food supply. In particular organo-phosphates and organo-chlorines are highly soluble and stored accumulatively in fat tissue. Measures to reduce the use of these insecticides are also likely to contribute to the conservation of bats.

No studies have been undertaken to examine the effect of vehicle exhaust emissions on the health of bats. Given the presence of bats in urban areas and the proven toxicity of exhaust emissions on some species an understanding of this effect would be useful within the context of bat management strategies.

Reptiles and Amphibians

The following is a list of all reptiles and amphibians that have been collected or confidently sighted on the Adelaide plains. A brief description of the preferred habitat of each of the listed species is also provided so that any efforts to rehabilitate natural areas with the aim of introducing indigenous reptiles are based on habitat requirements of the species in question. Where no conservation status has been provided, the species in question is either not considered as being currently under threat or its 'natural' occurrence on the Adelaide Plains is questionable. Of the following species, only *Tiliqua adelaidensis* has conservation significance at the national scale (Endangered). Taxonomy follows Robinson *et al.* (2000). See Appendix 3, (p.154) for an explanation for conservation status codes. Introduced species are marked ✸.

Turtles and Tortoises — ORDER TESTUDINES
Side-necked Tortoises — FAMILY CHELIDAE

✸Common Long-necked Tortoise (*Chelodina longicollis*)

Probably introduced in the Adelaide region, its natural distribution extends from eastern South Australia through Victoria much of New South Wales and eastern Queensland as far north as Townsville (Cogger 2000). Inhabitant of swamps, oxbow lakes, billabongs or slow moving rivers. Feeds on a variety of aquatic organisms, such as molluscs, crustaceans, tadpoles and small fish. Often in the early summer this animal will lay its eggs in a hole excavated in the bank of a stream or swamp (Cogger 2000).

Lizards and Snakes — ORDER SQUAMATA
Dragon Lizards — FAMILY AGAMIDAE

Tawny Dragon (*Ctenophorus decresii*)

Closely associated with rocky habitats, this species is found between the Flinders Ranges in the north and Fleurieu Peninsula/ Kangaroo Island in the south. Apart from an outlier population at Mootwingee, NSW this animal is found nowhere else in Australia (Cogger 2000). In the Adelaide region this animal is found primarily in the Mount Lofty Ranges

Painted Dragon (*Ctenophorus pictus*) UNCOMMON Metro Region

Short burrows in sandy soils. Found in low vegetation (especially dense litter around base of shrubs) ground debris such as fallen logs (aided by the presence of undisturbed habitat) (Cogger 2000). Currently found on Torrens Island, Onkaparinga River mouth and Noarlunga Coastal complex. Australian distribution extends from eastern Western Australia through most of South Australia into western New South Wales and north western Victoria (Cogger 2000).

✸Water Dragon (*Physignathus lesueurii*)

This animal is found naturally along the eastern seaboard between Cape York and far eastern Victoria. It is also found in Papua New Guinea (Cogger 2000). A feral population exists in the Adelaide Metropolitan Area along the upper reaches of the River Torrens. It is unlikely that this animal inhabits a niche of any other native animal; and is therefore of little concern in regards to competing directly with native animals (Mark Hutchinson *pers. comm.*). This lizard is a semi-aquatic, arboreal animal that is usually seen on branches overhanging rivers and creeks. It feeds on a variety of insects and aquatic organisms, including frogs and other terrestrial vertebrates (Cogger 2000).

Eastern Bearded Dragon (*Pogona barbata*) VULNERABLE Metro Region

Semi-arboreal, seen during the day on fallen timber, stumps and fenceposts. Frequently feeds on flowers and soft herbage (Cogger 2000). Although the natural distribution of this species includes the Adelaide Plains it is far less common on the plains than in the Adelaide Hills. *Frequently killed by dogs.* The contribution of suitable habitat in the hills region means the population of this species is reasonably secure. Australian distribution extends along the Great Dividing Range from Cairns to central Victoria and as far west as Eyre Peninsula (Cogger 2000).

Five-lined Earless Dragon (*Tympanocryptis lineata*) ENDANGERED Metro Region
Found in a variety of terrestrial habitats from desert sandhills and *Triodia* through gibber and black-soil plains to open woodland and grasslands. Frequently found living in earth cracks, grasses and ground litter (Cogger 2000). Distributed in Australia from eastern and south eastern Western Australia through the interior of all mainland states to the western slopes of New South Wales and southern Victoria (Cogger 2000).

Geckos and Legless Lizards — FAMILY GEKKONIDAE

Marbled Gecko (*Christinus marmoratus*)
This animal is an arboreal species found in dry sclerophyll forests and woodlands of southern Australia between central New South Wales and Western Australia (Cogger 2000).

Eastern Stone Gecko (*Diplodactylus vittatus*) UNCOMMON Metro Region
Range of habitats from arid scrubs to wet sclerophyll forests (Cogger 2000). In South Australia this animal is found in the mallee and very open woodland. Terrestrial animal that is usually found during the day under fallen timber, stones and litter (Cogger 2000).

Barking Gecko (*Nephrurus milii*) UNCOMMON Metro Region
Nocturnal terrestrial lizard found in various habitats from wet coastal heathlands and wet sclerophyll forests to the arid scrubs. A nocturnal animal that shelters in burrows, under rocks or under litter and debris, emerging at night to forage in open grassed or sandy areas (Cogger 2000). This species is more common on the slopes of the Adelaide Hills, but it is likely that its preferred habitat was once on the Adelaide plains.

Tree Dtella (*Gehyra variegata*)
Australian distribution is throughout the inland of eastern and southeastern Australia; also found in southern Western Australia. This animal is primarily an arboreal species spending much of its day within rock crevices or under the bark of trees. Often found on exfoliating granite outcrops (Cogger 2000).

Red-tailed Worm-lizard (*Aprasia inaurita*)
Once found in the Virginia, Two Wells region. Adelaide region was always only on the edge of its distribution (no rating provided). This animal burrows in sandy arid habitats (eg mallee) and is often found living in association with leaf litter and the root systems of arid shrubs (Cogger 2000). Found in a thin band between southeastern Western Australia and northwestern Victoria (Cogger 2000).

Flinders Worm-lizard (*Aprasia pseudopulchella*) UNCOMMON Metro Region
Found in Flinders Ranges, Yorke Peninsula and Northern Adelaide Plains (north of Salisbury). Sympatric with *A. striolata* around Salisbury and Para Wirra Recreation Park. Burrowing species found in a variety of habitats on loamy and sandy soils. Feeds on ants.

Lined Worm-lizard (*Aprasia striolata*)
Burrowing species found in a variety of habitats on loamy and sandy soils. This animal burrows in sandy arid habitats (eg mallee) and is often found living in association with litter below and the root systems of, arid shrubs (Cogger 2000). Feeds on ants.

Adelaide Snake-lizard (*Delma molleri*)
South Australian endemic found only in the southeastern corner of SA; inhabiting semi-arid shrublands and woodlands (Cogger 2000).

Common Scaly-foot (*Pygopus lepidopodus*) UNCOMMON Metro Region
Variety of habitats. Wet sclerophyll coastal forests and coastal heaths/dunes to semi-arid mallee associations and heathy woodland. Distributed widely across southern Australia, from south eastern Queensland to Shark Bay, Western Australia (Cogger 2000). Usually found foraging under/in low vegetation or under fallen timber and other ground litter. Feeds mainly on spiders but also takes insects (Cogger 2000).

Skinks — FAMILY SCINCIDAE

Speckled Wall Skink (*Cryptoblepharus plagiocephalus*) UNCOMMON[Metro Region]
Occupies a wide range of habitats, from coastal sand dunes, rocky shores through to dry sclerophyll forests, woodlands, mallee and arid scrubs (Cogger 2000). Semi arboreal, but also seen on rocks and screes (Cogger 2000). On the Adelaide plains, known to occur in *Eucalyptus porosa* Woodlands. Distributed across inland Australia excluding very arid central regions (Cogger 2000).

Eastern Striped Skink (*Ctenotus robustus*)
Large active, diurnal species found in a variety of habitats including coastal beach dunes and heaths, wet/dry sclerophyll forests, savannah and mallee woodlands (Cogger 2000). Widely distributed from north western Western Australia, through the Top End, Queensland, eastern New South Wales, Victoria and south eastern South Australia (Cogger 2000).

Eastern Spotted Ctenotus (*Ctenotus orientalis*)
Found in a variety of arid habitats, including chenopod shrublands, arid scrubs and open woodlands. Often associated with small rocky outcrops on open sandy and stony plains (Cogger 2000). Distributed across the southern interior of Western Australia, southern Northern Territory, arid South Australia and western New South Wales (Cogger 2000).

Cunningham's Skink (*Egernia cunninghamii*) ENDANGERED[Metro Region] VULNERABLE[SA]
Found along Great Dividing Range from southern Queensland to western Victoria and Mount Lofty Ranges, Adelaide plains. Lives in rock crevices (primary limiting factor) or under large exfoliating rock slabs. Diet consists of fruit and seeds, sometimes arthropods and small vertebrates (Cogger 2000). In the Adelaide region this species is found along the Sturt Creek, Torrens River Gorge and Montacute rd. The Sturt Creek population may consist of less than 100 individuals.

White's Skink (*Egernia whitii*)
Found in the Adelaide Hills, but not on the Adelaide plains. It is a burrowing species, with somewhat generalist habitat preferences, but does not like climate that is too hot and dry. Found in a band from Eyre Peninsula South Australia, through most of Victoria and the eastern slopes of the Great Dividing Range as far north as the Queensland border (Cogger 2000). This lizard is fast and diurnal. It is found in a variety of habitats from coastal heath and grasslands, through dry sclerophyll forests to open woodland (Cogger 2000). Often found closely associated with rocky outcrops where it shelters under rocks and in crevices; also found in and around fallen timber and other ground cover (Cogger 2000).

Eastern Water Skink (*Eulamprus quoyii*) VULNERABLE[Metro Region]
From tropical rainforests, wet/dry sclerophyll, coastal/mountain heaths, inland wetlands and riverine environments. Requires boulders, logs etc. for perching and shelter. Found in the Adelaide region only on the permanent watercourses (ie River Torrens, Sturt Creek and Onkaparinga River). In locations where the river environment is 'manicured' into neat grassy areas with a few trees this species is not found. This animal is distributed along the coast from northern Queensland to southern New South Wales, it extends inland to the Adelaide region via the Darling River and the River Murray (Cogger 2000).

Three-toed Earless Skink (*Hemiergis decresiensis*)
Perhaps the most common lizard in the Adelaide region. This animal is a burrowing species that is most often found under stones and fallen timber in wet and dry sclerophyll forests (Cogger 2000). Distributed from south eastern South Australia through to the eastern highlands and tablelands of New South Wales (Cogger 2000).

Four-toed Earless Skink (*Hemiergis peronii*)
This animal is a burrowing species that is most often found under stones and fallen timber in coastal heaths and scrubs (Cogger 2000). Found in a thin band across southern Australia from far western Victoria to south west Western Australia (Cogger 2000)

Garden Skink (*Lampropholis guichenoti*)
Distributed from south eastern South Australia through Victoria and eastern New South Wales to south eastern Queensland, this animal is one of the most abundant species of suburban gardens (Cogger 2000). Most often it is seen basking or foraging for ants and other insects in leaf litter, grass, rock piles in wet and dry sclerophyll forests, moister woodlands and in coastal mountain heaths (Cogger 2000).

Bougainville's Skink (*Lerista bougainvillii*)
Feeding at night on ants, termites and small insects, this animal is often found burrowed under rocks, logs and leaf litter in heaths, dry sclerophyll forests and tall woodlands (Cogger 2000). It is distributed across south eastern South Australia, through Victoria to south eastern New South Wales. Also found in Tasmania and on islands of Bass Strait (Cogger 2000).

Southern Four-toed Slider (*Lerista dorsalis*)
This animal is distributed along the coast and hinterland between south eastern Western Australia and south east South Australia. Burrowing species, found feeding on ants, termites and other insects in loose soil or sand, beneath stones, logs, or termite mounds (Cogger 2000). This animal will venture to the surface at night to feed. Habitat of this animal includes coastal heathlands, chenopod shrublands, and a variety of semi arid and more mesic woodlands (Cogger 2000).

Southern Three-toed Slider (*Lerista terdigitata*)
Possibly on the Adelaide plains, this species natural distribution is within the arid zone. This animal is distributed across the islands, coast and hinterland of the Great Australian Bight. The distribution extends north into the north west of South Australia and includes Eyre and Yorke Peninsulas (Cogger 2000). Burrowing species, found feeding on ants, termites and other insects in loose soil or sand, beneath stones, logs, or termite mounds (Cogger 2000). This animal will venture to the surface to feed at night. Habitat commonly consists of mulga (*Acacia aneura*) and other arid Acacia scrubs, mallee, low shrublands, spinifex sandplain desert, in particular at the bases of stony hills and ranges (Cogger 2000).

Dwarf Skink (*Menetia greyii*)
Widely distributed animal found throughout continental Australia except Cape York Peninsula and east of the Great Dividing Range. Habitat variety is vast also, from dry sclerophyll forests and temperate and tropical woodlands, to mallee, Acacia and other arid scrubs and hummock grasslands. It is a diurnal animal, most often seen scuttling in leaf litter or grasses (Cogger 2000).

Adelaide Snake-eye (*Morethia adelaidensis*)
This animal is found in south eastern Western Australia through arid South Australia to western New South Wales, south western Queensland and north western Victoria (Cogger 2000). Most frequently found in ground litter and on fallen timber in open woodland, low chenopod shrubland, mallee and arid Acacia scrubs (Cogger 2000).

Southern Grass Skink (*Pseudomoia entrecasteauxii*) **ENDANGERED**[Metro Region]
Found in southern South Australia, Victoria and Tasmania. Variety of forest and grassland habitats, usually seen on or around fallen timber or foraging in leaf litter (Cogger 2000). On the Adelaide plains, this species is sometimes seen along the coast, in reedbeds and samphire communities.

Pygmy Bluetongue (*Tiliqua adelaidensis*) **ENDANGERED**[AUS, SA] **EXTINCT**[Metro Region]
All but one species of genus is confined to Australia. Previous specimens from Adelaide region (Dry Creek (1899), Mitchell Park (1959) and Gawler (1864)). Now restricted to a few isolated populations near Burra. Two recent discoveries of this species occurred at the Hummocks on Yorke Peninsula and near Blyth in the mid-north (details on numbers and distribution are currently being determined). Closely associated with grasslands (*Austrostipa, Danthonia,* and *Lomandra* tussocks) and open woodlands (eg *Eucalyptus porosa*). Listed as Endangered under both the federal *Environment Protection and Biodiversity Conservation Act 1999* and *SA National Parks and Wildlife Act 1972*. Recovery plan objectives include the assurance "...that secure, viable populations of the species are maintained within a reserve system" and to implement appropriate land

management practices to promote recovery of species (ie no ploughing) (Cogger *et al.* 1993). Extinct from the Adelaide plains, with some potential for reintroduction following habitat restoration.

Western Bluetongue (*Tiliqua occipitalis*) UNCOMMON[Metro Region]
Distributed from the coast of Western Australia to South Australia, to the south of Northern Territory, western New South Wales and north western Victoria (Cogger 2000). Found in a variety of xeric habitats, often in close association with mallee/*Triodia* communities (Cogger 2000). On the Adelaide Plains found close to the coast, in particular at St Kilda.

Sleepy Lizard (*Tiliqua rugosus* ssp. *asper*)
Widely distributed over the southern half of continental Australia. Not found on the coasts and ranges of east and south eastern Australia (Cogger 2000). This slow moving, diurnal animal is found in a wide variety of habitats including coastal heaths, dry sclerophyll forests, woodlands, mallee, chenopod shrublands, gibber plains and spinifex dominated sandy deserts (Cogger 2000). It feeds on arthropods including insects and snails, carrion, flowers, fruit and berries. When inactive it will shelter under fallen timber, leaf litter, spinifex, other grasses etc. (Cogger 2000).

Eastern Bluetongue (*Tiliqua scincoides*)
This lizard is distributed in a wide band from the Kimberley region in north west Western Australia, across the Top End of the Northern Territory, eastern Queensland, New South Wales, Victoria and South Australia as far as the Flinders Ranges. Found in a variety of habitats from coastal heaths, forests and woodlands, to montane forests and the woodlands and grasslands of the less arid interior. It is a diurnal ground dwelling animal and feeds on a variety of insects, snails, carrion, wildflowers, native fruits and berries (Cogger 2000). Common species in the Adelaide area even in suburban gardens, primarily due to its high fecundity. It is thought that it moves from property to property along back fences, where there is frequently taller grass and gaps between the fences. Its increase in numbers is thought to be at the expense of *Tiliqua rugosus* ssp. *asper*.

Goannas — FAMILY VARANIDAE

Sand Goanna (*Varanus gouldii*) ENDANGERED[Metro Region]
Extremely widespread throughout continental Australia except the wet southeast. Habitat includes coastal sclerophyll forest to interior sandy deserts. Shelters in burrows, hollows and dense litter (Cogger 2000). Ranges over large areas when searching for food. Strictly carnivorous (insects, birds, reptiles, mammals and carrion ⇨ top of food web predator). Adelaide's largest lizard.

Heath Goanna (*Varanus rosenbergi*) ENDANGERED[Metro Region] RARE[SA]
Distributed in a thin band between the south west of Western Australia and the south east of South Australia. Isolated populations in Victoria and New South Wales. Habitat includes coastal heaths, humid woodlands, and wet and dry sclerophyll forests. Shelters in burrows, hollow logs and rock crevices (Cogger 2000). Rarely seen in the Adelaide region. Numbers have declined significantly since the 1960s. Its preference for heathy habitats means it is also found on the Coorong and in Ngarkat Conservation Park, where its numbers are declining too. It is also on Kangaroo Island where it is thought to be secure.

Snakes

Elapid Snakes — FAMILY ELAPIDAE

Common Death Adder (*Acanthophis antarcticus*) EXTINCT[Metro Region]
Distributed throughout continental Australia, except far north, inland arid areas and wetter parts of Victoria and south eastern New Sales Wales (Cogger 2000). Habitat is cool temperate to tropical plains, slopes and lower ranges in rainforest, wet or dry sclerophyll forest, woodlands (especially mallee), shrublands (especially of chenopods) and heathlands (especially coastal). Adelaide Plains distribution was primarily restricted to coastal complex. Formerly seen in the Glenelg/Henley Beach area. Associated with *Leptospermum* spp. and *Olearia* spp. This snake is nocturnal and secretive; during the day, they are usually found half buried in sand or litter, often at the base of trees and shrubs. Death Adders have the capacity to attract their prey within striking distance

by twitching the tip of their tail. Prey such as rodents and lizards are lured by the insect-like movement of it tail (Cogger 2000). One of Australia's most venomous snakes.

Pygmy Copperhead (*Austrelaps labialis*)
South Australian endemic species found only in the Southern Mount Lofty Ranges and on Kangaroo Island. In the Adelaide region, it is found only on the peaks of the Mount Lofty Ranges. Its numbers are secure on Kangaroo Island.

Yellow-faced Whipsnake (*Demansia psammophis*) **ENDANGERED**[Metro Region]
This snake is distributed throughout continental Australia except coastal region between southwest Western Australia and northern half of Northern Territory. Habitat includes all terrain except subalpine areas and permanent swamps; all plant communities except rainforest. Last confirmed sighting on Adelaide Plains was at Fort Glanville in 1978.

Eastern Tiger Snake (*Notechis scutatus*) **UNCOMMON**[Metro Region]
Distributed from south eastern Queensland trough southern half of New South Wales, Victoria, extending into South Australia along the River Murray (Cogger 2000). Broad range of habitats from rainforests of southeastern Queensland to dry, open sclerophyll and river floodplains in the south. Feeds mainly on frogs. Nocturnal in warm weather (Cogger 2000). Venomous.

Red-bellied Black Snake (*Pseudechis porphyriacus*) **VULNERABLE**[Metro Region]
Distributed throughout eastern and southeastern Australia (Cogger 2000). Closely associated with streams, swamps and lagoons, sometimes found away from these locations. Feeds principally on frogs, but also eats reptiles and small mammals (Cogger 2000). Venomous.

Eastern Brown Snake (*Pseudonaja textilis*)
Distributed throughout eastern Australia, occupying a variety of habitats from wet and dry sclerophyll forests and heaths of the coast and ranges, through savannah woodlands to inland grasslands and arid scrubs (Cogger 2000). Venomous.

Desert Banded Snake (*Simoselaps bertholdi*)
This animal is distributed from southern Western Australia across the Nullarbor and except south east and north east, includes most of South Australia (Cogger 2000). Habitats include coastal dunes and heaths to the arid shrublands of the interior (Cogger 2000).

Little Whip Snake (*Suta flagellum*) **UNCOMMON**[Metro Region]
Distributed from southern New South Wales to south Victoria and south east of South Australia (Cogger 2000). Populations in the Mount Lofty Ranges are outliers. Secretive nocturnal snake, found in eucalypt woodland and associated grasslands, especially on stony hills, sheltering under rocks and logs. Feeds on scincoid lizards and frogs (Cogger 2000).

Mallee Black-headed Snake (*Suta spectabilis*)
Distributed through far western Western Australia, southern South Australia, north eastern Victoria, most of New South Wales and southern Queensland (Cogger 2000). Occupies a variety of habitats from Acacia scrubs, mallee, low open shrublands, to more mesic woodlands in the east and north of its range. This snake is nocturnal, and is often found sheltering under logs, rocks or ground litter, or in abandoned burrows of insects and lizards (Cogger 2000).

Blind Snakes — FAMILY TYPHLOPIDAE

Southern Blind Snake (*Ramphotyphlops australis*) **UNCOMMON**[Metro Region]
Distributed across southern Australia from the south west of Western Australia through most of South Australia to western New South Wales and north western Victoria (Cogger 2000). Blind, worm-like, burrowing snake feeding mainly on ants and termites. While it is harmless, when disturbed it emits a strong objectionable odour from its anal glands (Cogger 2000). Blind snakes are usually only seen when moving about the surface of the ground at night, especially in warm weather and/or after rain (Cogger 2000).

Rough-nosed Blind Snake (*Ramphotyphlops bituberculatus*)
Distributed across southern continental Australia (Cogger 2000). Blind, worm-like, burrowing snake feeding mainly on ants and termites. While it is harmless, when disturbed it emits a strong objectionable odour from its anal glands (Cogger 2000). Blind snakes are usually only seen when moving about the surface of the ground at night, especially in warm weather and/or after rain (Cogger 2000). Known to occur at the Adelaide airport.

Threats to Reptiles

The primary threats to Australian reptiles are habitat loss (see section 2.1, p.7), overgrazing by domestic stock, cropping, urban development, and predation by introduced mammals (foxes, cats, rats and dogs) (Cogger *et al.* 1993). Other threats include:

- pasture improvement,
- altered fire regimes,
- soil degradation,
- visitor disturbance,
- soil and/or water pollution,
- mining,
- native forest logging,
- climatic variation,
- rabbit grazing,
- habitat fragmentation,
- weed invasion,
- habitat drainage and
- rock removal

It is interesting to note that many of the above threats have in some way an impact on the soil or soil surface. It is at this level that most reptiles live and feed. In areas of non-degraded remnant vegetation, the habitat variety is immense. Fallen branches, stones, bark, leaf litter, open areas, clumps of grasses, mosses, and small shrubs all provide resources in the form of food and shelter. Diversity of habitat at this level also means diversity of invertebrates, and it is this faunal group that constitute a significant portion of the food resources to reptiles. As diversity in invertebrates and reptiles means more food for higher order animals, these inhabitants play an essential ecosystem role (Brown *et al.* 1999).

In the Adelaide Metropolitan Area, the main threats to reptiles are habitat loss, predation and a variety of processes that alter and homogenise the soil surface (Mark Hutchinson *pers. comm.*).

The combined predatory effect of foxes, cats and dogs impact significantly on surviving reptile populations. This is a distinctly urban due to the high numbers of cats and dogs.

From a reptile habitat perspective, the soil surface is negatively affected by a variety of human activities. The desire to have neat, manicured areas in gardens and public spaces restricts habitat diversity for reptiles.

The use of large stones such as "moss-rocks" in landscaping suburban gardens effectively destroys reptile habitat in the source area. This practice is common in new suburban developments and should be discouraged.

Amphibians — CLASS AMPHIBIA
Frogs — ORDER ANURA
Tree frogs — FAMILY HYLIDAE

Brown Tree Frog (*Litoria ewingi*)
Distributed in a band between the Mount Lofty Ranges in South Australia, through much of southern Victoria, to south eastern New South Wales (Cogger 2000). An abundant species found in a variety of habitats from coastal swamps and lagoons to wet and dry sclerophyll forests. Breeding aggregations occur around ponds, dams and creeks where thy call from the ground or low vegetation. So long as there is abundant moisture, this species is commonly found in ornamental gardens (Tyler 1978). This animal is one of only a few species that will call throughout the winter months- especially throughout the milder parts of its range (Cogger 2000). Call: "creek-creek-creek-creek" (Tyler 1977).

Golden Bell Frog (*Litoria raniformis*) **VULNERABLE** [SA]
Distributed throughout Victoria and Tasmania. Found also in southern New South Wales west of the Great Dividing Range and in south eastern South Australia (Cogger 2000). While this animal comes from the family of "tree frogs," it is actually more of an aquatic species that is often found in vegetation adjacent permanent water. Frequently active by day, the call of this summer breeding animal is a loud guttural, four-part "craw-awk, crawk, crok, crok" (Cogger 2000).

Southern frogs — FAMILY MYOBATRACHIDAE

Common Froglet (*Crinia signifera*)
Widely distributed frog across south eastern Australia along the coasts and ranges and adjacent plains between southern Queensland and Eyre Peninsula, South Australia; also found on Kangaroo Island (Tyler 1977) and Tasmania (Cogger 2000). In the foothills, it commonly occurs in creek beds and hiding underneath large stones (Tyler 1978). This animal is found in virtually all habitats throughout its range, from supra-littoral soaks behind beaches to drier inland areas. This animal shelters beneath rocks, logs, thick vegetation during dry periods, emerging after rain to breed in slow-flowing creeks, claypans, lagoons, gutters, roadside pools, rock holes etc. (Cogger 2000). Skin colour and pattern is extremely variable, even amongst a single breeding population (Cogger 2000). Its call is described as a rapid high 'crick-crick-crick...' (Tyler 1977).

Bull (Eastern Banjo) Frog (*Limnodynastes dumerilii*)
Widely distributed burrowing frog across south eastern Australia along the coasts and ranges and adjacent plains between southern Queensland and Eyre Peninsula, South Australia; also found in Tasmania (Cogger 2000). Habitat is near permanent water such as swamps, streams and farm dams of heaths and sclerophyll forests (Cogger 2000). Emerging at night for food, by day this animal commonly lives in a short burrow in loamy soils (Tyler 1978). Call is a series of distinctive 'plonks'- 'like the plucking of a banjo string' (Cogger 2000).

Spotted Grass Frog (*Limnodynastes tasmaniensis*)
Widely distributed across the eastern half of Australia (except Cape York Peninsula). This animal is found in a variety of habitats from wet coastal areas to the dry interior. Sheltering at the edge of permanent and temporary swamps, lagoons and creeks it seeks refuge under rocks and stones. Its call is a very rapid 'uk-uk-uk-uk...' (Cogger 2000).

Painted Frog (*Neobatrachus pictus*)
Distributed in the south east corner of South Australia, from Eyre Peninsula, to Flinders Ranges and south to the New South Wales and Victorian border, probably extending into these states (Cogger 2000). A burrowing species usually found only after summer rains in grassy marshes, lagoons, flooded claypans and temporary roadside pools (Cogger 2000). Its call is described as a "musical chirrup" (Tyler 1977).

Brown Toadlet (*Pseudophryne bibroni*) **ENDANGERED** [Metro Region]
Widely distributed through south eastern Queensland, eastern New South Wales, Victoria, south eastern South Australia and Tasmania (Cogger 2000). Found under rocks and logs in damp areas of wet and dry sclerophyll forests. Instead of hopping, members of this genus walk. Dependant on ephemeral swamps during breeding cycle. Removal of such swamps on the Adelaide Plains has resulted in the widespread decline of this species.

Nevertheless, this species is reasonably common in parts of the Adelaide Hills. Call is described as a short, harsh squelch (Cogger 2000). Tyler (1997) considers this species as **INSUFFICIENTLY KNOWN** and may be of concern.

Threats to Amphibians

In the recent past the abundance of frogs in urban areas was taken for granted. Recently, frog numbers have declined in both urban and non-urban areas (Tyler 1997). No clear pattern is emerging as to the causal factors behind the widespread decline in frog numbers. However, Tyler (1997) highlights four human activities that impinge on the viability of frog populations:

1. Insecticide use in agricultural and horticultural areas, particularly aerial spraying.

2. Land reclamation by drainage in wetland areas, resulting in loss of breeding sites.

3. The conversion of temporary ponds to dams for stock use resulting in the destruction of peripheral sheltering sites.

4. Introduction of the **Eastern Gambusia** (*Gambusia holbrooki*) which preys on frog eggs and tadpoles. (Mosquito fish are also a threat to native fish populations (see p.74)).

Tyler (1997) raises further potential causal factors behind the decline in frog abundance, including: global changes to air and water quality, increased exposure to ultraviolet radiation caused by depletion of the ozone layer, habitat modification, impacts of introduced species, pollution, hormonally active pesticide residues, pathogens and disease, acidification and climate change (including changes in climatic extremes).

The active constituents of herbicides undergo rigorous toxicology tests before they are released on the market. Assessment of their action on non-target organisms is a component of such testing. However, in recent years it is the dispersants (wetting agents) mixed with the herbicide that is suspected to kill frogs. These chemicals are not subject to the same level of testing (Tyler 1997).

Native and Introduced Birds

The following is a list of birds that have been sighted within the Adelaide Metropolitan Area (see A2 fold out map). The list is derived from atlas surveys by members of the South Australian Ornithological Association (SAOA) during 1984-85 (Paton *et al.* 1994). The Atlas surveyed a much larger region than the Adelaide Metropolitan Area (as defined in section 5.1.1); it included the Adelaide Hills and a portion of the mallee region, and went as far south as Lake Alexandrina. As spatial details on the location of each bird species were provided on maps in the publication, a cut-out template of the Adelaide Metropolitan Area was placed over each of the maps. Any points falling inside this template were included in the following list.

The list contains 273 species, at least 10 of which are considered extinct in the metropolitan area. A further 17 birds are introduced species. Unless otherwise indicated, Professor Hugh Possingham formerly of the Adelaide University and Nature Conservation Society of South Australia and Dr Philippa Horton, Collection Manager, Department of Vertebrates (Ornithology) of the SA Museum have provided information regarding habitat preferences, threats and migratory habits. Conservation status categories have been obtained from *Environment Protection and Biodiversity Conservation Act 1999; National Parks and Wildlife Act 1972*, Schedules 7, 8 & 9 (2000 version); and Carpenter & Reid (1987) (see Appendix 3, p.154) Taxonomy and common names are based on Robinson *et al.* (2000). All references to the sighting of birds in NPWSA reserves are from the DEH "Reserves database." These references are sometimes historical, and may represent a species that has since become extinct. Furthermore, as they are not complete, where a species is not listed as occurring in particular NPWSA reserve, this does not mean that that species cannot be found there.

Migratory birds that are covered by International treaties/agreement are automatically listed under the *Environment Protection and Biodiversity Conservation Act 1999* as "Matters of National Environmental Significance" and are therefore automatically protected under the Act. Birds listed under the following international agreements are afforded the protection of this Commonwealth legislation:

- Japan Australia Migratory Bird Agreement (JAMBA) (1974)
- China Australia Migratory Bird Agreement (CAMBA) (1986)
- Bonn Convention on Conservation of Migratory Species of Wild Animals (CMS) (1979),

Those species of Bird that are covered by any of the above International Agreements are indicated in the text with the initials of the agreement that offers it protection.

The vegetation formations used in the following list are as follows:

- Open Forest
- Woodland
- Low Woodland
- Coastal Shrubland
- Very Low Shrubland
- Reedbeds/Lignum
- Grasslands

The vegetation structural classes are identical to those of Kraehenbuehl (1996) with one variation. The Shrublands/Heath classification of Kraehenbuehl (1996) containing three vegetation assemblages has been categorised here using two classifications:

• Coastal Shrublands	*Acacia cupularis, Acacia acinacea, Pomaderris paniculosa* Low Shrubland *Olearia axillaris, Acacia longifolia* var. *sophorae* Open Heath
• Very Low Shrubland	Samphires: Mixed *Halosarcia* spp., *Sclerostegia* spp., *Atriplex paludosa, Sarcocornia* spp

Note that an additional structural classification (Very Low Shrubland) has been added to separate out the Samphires association (Mixed *Halosarcia* spp., *Sclerostegia* spp., *Atriplex paludosa*, *Sarcocornia* spp.) from the other Low Shrubland.

Key to symbols used in the text:

- ✸ *Introduced species*
- ⊗ *Infrequently seen*
- () *Migrant species*
- ↕ *Partial migrant species*

Ostriches, Cassowaries & Emus — ORDER STRUTHIONIFORMES
Cassowaries & Emus — FAMILY CASUARIIDAE

Emu (*Dromaius novaehollandiae*) **EXTINCT** [MLR (reintroduced)]
Rarely seen bird in the Adelaide region, although common in Para Wirra Recreation Park. One sighting in Belair National Park, and a few others in the Hills of the northern part of the Adelaide region. Once would have been a quite common open-woodland/grassland bird. Those that do exist are likely to be re-introductions.

Megapodes, pheasants, quails & allies — ORDER GALLIFORMES
Quails & Pheasants — FAMILY PHASIANIDAE

King Quail (*Coturnix chinensis*) **ENDANGERED** [MLR; SA]
Extinct in the metropolitan area and Mount Lofty Ranges. Habitat includes dense grassland and swampy areas.

Stubble Quail (*Coturnix pectoralis*) ↕
Grasslands species. Movements in South Australia are not well documented, but there is probably some movement north in the winter months.

✸**Indian Peafowl** (*Pavo cristatus*)⊗

Swans, Geese, Ducks & allies — ORDER ANSERIFORMES
Geese, Swans & Ducks — FAMILY ANATIDAE

Plumed Whistling-Duck (*Dendrocygna eytoni*)⊗

Blue-billed Duck (*Oxyura australis*) **RARE** [SA]; **UNCOMMON** [MLR]
Deep fresh water. Once bred at the Buckland Park Lake.

Musk Duck (*Biziura lobata*) **RARE** [SA]; **UNCOMMON** [MLR]
Aquatic environments, preferably deep water. Numbers declining. Known to have bred at Buckland Park Lake. Sighted at Belair National Park and Port Gawler Conservation Park

Freckled Duck (*Stictonetta naevosa*)⊗ **VULNERABLE** [SA]; **RARE** [MLR]
Freshwater and brackish lakes, occasionally at Buckland Park Lake.

✸**Domestic Goose** (*Anser anser*)

Cape Barren Goose (*Cereopsis novaehollandiae*) **RARE** [SA; MLR]
Could recolonise with increasing numbers of wetlands, likes grassy wetlands. Released along River Torrens in the 1980s, but birds did not survive. Sighted in Aldinga Scrub Conservation Park

Black Swan (*Cygnus atratus*)

Australian Shelduck (*Tadorna tadornoides*)

Chestnut Teal (*Anas castanea*) **UNCOMMON** [MLR]
Tolerates salinity. Sometimes seen along the River Torrens. Sighted in Aldinga Scrub Conservation Park, Para Wirra Recreation Park and Port Gawler Conservation Park.

Grey Teal (*Anas gracilis*)
Common, prefers freshwater.

✱**Mallard** (*Anas platyrhynchos*)
Common. Hybridises with **Pacific Black Duck** (*Anas superciliosa*) ⇨ genuine threat to this native species. Hybrids are regularly culled, but require more monitoring and culling.

Australasian Shoveler (*Anas rhynchotis*) **RARE** [SA]; **UNCOMMON** [MLR]
Not very common in this region- breeding population has been observed at Buckland Park Lake, but not recently due to lack of flow in Gawler River. Sighted in Aldinga Scrub Conservation Park

Pacific Black Duck (*Anas superciliosa*)
Threatened by *Anas platyrhynchos* through hybridisation. Common, but often not as pure form.

Hardhead (*Aythya australis*) **UNCOMMON** [MLR]
Sighted in Aldinga Scrub Conservation Park and Belair National Park, and occasionally recorded on the River Torrens.

✱**Muscovy Duck** (*Cairina moschata*)

Australian Wood Duck (*Chenonetta jubata*)
Increasing, becoming a pest.

Pink-eared Duck (*Malacorhynchys membranaceus*)
Uncommon.

Grebes — ORDER PODICIPEDIFORMES, FAMILY PODICIPEDIDAE

Great Crested Grebe (*Podiceps cristatus*) **RARE** [SA; MLR]

Hoary-headed Grebe (*Poliocephalus poliocephalus*)

Australasian Grebe (*Tachybaptus novaehollandiae*)
Will use urban wetlands and breed if undisturbed.

Penguins — ORDER SPHENISCIFORMES, FAMILY SPHENISCIDAE

Little (Fairy) Penguin (*Eudyptula minor*)

Tubenoses — Shearwaters, Petrels, and Diving-petrels — ORDER PROCELLARIIFORMES, FAMILY PROCELLARIIDAE

Cape Petrel (*Daption capense*) ()⊗
Non-breeding winter visitor; breeds in the Antarctic and sub-Antarctic. One beach-washed specimen was recorded by the SAOA Atlas.

Blue Petrel (*Halobaena caerulea*) ()⊗ **VULNERABLE** [AUS; SA]
An oceanic species which primarily occurs on subantarctic islands in the Southern Ocean (eg Macquarie Island). Infrequently sited on/near Australian mainland. During the SAOA atlas, this species was recorded twice in the Aldinga region as a beach-washed specimen. Garnett & Crowley (2000) list the Australian breeding population of this animal as **CRITICALLY ENDANGERED.** It is a non-breeding winter visitor, breeding in the summer on sub-Antarctic islands (see p.103).

Broad-billed Prion (*Pachyptila vittata*)⊗ **RARE** [SA]
During the SAOA atlas one beach-washed specimen was recorded.

Fluttering Shearwater (*Puffinus gavia*) ❨❩⊗
Non-breeding winter visitor, some remain over summer; others breed in New Zealand.

Short-tailed Shearwater (Muttonbird) (*Puffinus tenuirostris*) ❨❩⊗ JAMBA
Summer breeding visitor, winters in the northern Pacific.

Albatrosses — FAMILY DIOMEDEIDAE

Yellow-nosed Albatross (*Diomedea chlorohynchos*) ❨❩⊗ CMS VULNERABLE [SA]
Non-breeding visitor; breeds in sub-Antarctic.

Gannets, Darters, Cormorants, Pelicans, and Frigatebirds — ORDER PELECANIFORMES

Gannets — FAMILY SULIDAE

Australasian Gannet (*Morus serrator*) ❨❩
Most individuals are non-breeding winter visitors, breeds in New Zealand.

Darters — FAMILY ANHINGIDAE

Darter (*Anhinga melanogaster*) UNCOMMON [MLR]
Belair National Park.

Cormorants — FAMILY PHALACROCORACIDAE

Great Cormorant (*Phalacrocorax carbo*)
Require secure breeding sites in coastal areas.

Black-faced Cormorant (*Phalacrocorax fuscescens*)
Require secure breeding sites in coastal areas.

Little Pied Cormorant (*Phalacrocorax melanoleucos*)
Require secure breeding sites in coastal areas.

Little Black Cormorant (*Phalacrocorax sulcirostris*)
Require secure breeding sites in coastal areas.

Pied Cormorant (*Phalacrocorax varius*)
Require secure breeding sites in coastal areas.

Pelicans — FAMILY PELECANIDAE

Australian Pelican (*Pelecanus conspicillatus*)

Herons, Ibises & Spoonbills — ORDER CICONIIFORMES

Herons — FAMILY ARDEIDAE

Great (White) Egret (*Ardea alba*) CAMBA; JAMBA

Cattle Egret (*Ardea ibis*) UNCOMMON [MLR] CAMBA; JAMBA

White-necked Heron (*Ardea pacifica*) UNCOMMON [MLR]
Sighted at Aldinga Scrub Conservation Park, Belair National Park, Black Hill Conservation Park, Hallett Cove Conservation Park, Horsnell Gully Conservation Park and Torrens Island Conservation Park.

Australasian Bittern (*Botaurus poiciloptilus*) VULNERABLE [SA; MLR]
This species included the Adelaide Plains in its former distribution (Garnett & Crowley 2000). This species was not sighted in the Adelaide region during the SAOA Atlas, but has been sighted in the McLaren Vale-Willunga region in recent years (David Paton *pers.comm.*). It is listed as VULNERABLE at the national level by Garnett & Crowley (2000), but not under *EPBC Act 1999*. Preferred habitat is shallow vegetated freshwater or brackish

swamps. Seen most commonly in isolated ephemeral wetlands during very wet years (Garnett & Crowley 2000). Threats include diversion of water for irrigation, salinisation or drainage of permanent swamps, overgrazing by stock and inappropriate fire regimes (Garnett & Crowley 2000). Identification, protection and management of principal breeding wetlands are immediate actions required to protect this species (Garnett & Crowley 2000).

Little Egret (*Egretta garzetta*) UNCOMMON [MLR]
Sighted at Port Gawler Conservation Park and recorded breeding in Mangroves near Torrens Island (Vincent & Paton 1986).

Eastern Reef Egret (*Egretta sacra*) ⊗ VULNERABLE [MLR]; RARE [SA] CAMBA

White-faced Heron (*Egretta novaehollandiae*)

Nankeen Night Heron (*Nycticorax caledonicus*) UNCOMMON [MLR]
Torrens, Buckland Park Lake, riverine environments. Likes Willows. Sighted at Port Gawler Conservation Park and Torrens Island Conservation Park and recorded breeding in Mangroves near Torrens Island (Vincent & Paton 1986) and at Old Noarlunga (Bainbridge 1997).

Ibises and Spoonbills — FAMILY THRESKIORNITHIDAE

Royal Spoonbill (*Platalea regia*) UNCOMMON [MLR]
Sighted at Aldinga Scrub Conservation Park.

Yellow-billed Spoonbill (*Platalea flavipes*)

Glossy Ibis (*Plegadis falcinellus*) RARE [SA; MLR] CAMBA
Sighted at Torrens Island Conservation Park .

Australian White Ibis (*Threskiornis molucca*)
Possibly increasing. Limited by lack of roosting/nesting sites .

Straw-necked Ibis (*Threskiornis spinicollis*)
Limited by lack of roosting/nesting sites.

Osprey, Hawks, Eagles & Falcons — ORDER FALCONIFORMES

Hawks, Eagles and Allies — FAMILY ACCIPITRIDAE

Collared Sparrowhawk (*Accipiter cirrhocephalus*)
Occurs in most drier habitats, in particular Woodland and Low Woodland habitats. As with most birds of prey, populations of this species are stabilising and in some instances increasing. The species has been observed living and breeding in and near the city. Sighted at Aldinga Scrub Conservation Park, Para Wirra Recreation Park, Morialta Conservation Park, Horsnell Gully Conservation, Anstey Hill Recreation Park, Belair Conservation Park.

Brown Goshawk (*Accipiter fasciatus*)
Most habitats, prefers wetter areas than *Accipiter cirrhocephalus*. Population may be increasing. Lives and breeds in and near the city.

Wedge-tailed Eagle (*Aquila audax*)

Swamp Harrier (*Circus approximans*)
Swampy areas.

Spotted Harrier (*Circus assimilis*)
Prefers grassy Woodlands; Grasslands; Found in fields, numbers in decline.

Black-shouldered Kite (*Elanus axillaris*)
Found in Grasslands with scattered trees.

White-bellied Sea-Eagle (*Haliaeetus leucogaster*) **VULNERABLE** [SA; MLR] CAMBA
Very Low Shrublands; Buckland Park Lake. Sighted at Port Gawler Conservation Park.

Whistling Kite (*Haliastur sphenurus*) **UNCOMMON** [MLR]
Sighted at Para Wirra Conservation Park, Port Gawler Conservation Park, Belair National Park, Aldinga Scrub Conservation Park and Cleland Conservation Park,

Little Eagle (*Hieraaetus morphnoides*) **UNCOMMON** [MLR]
Sighted at Belair National Park, Anstey Hill Recreation Park, Aldinga Scrub Conservation Park, Cleland Conservation Park, Hallett Cove Conservation Park and Para Wirra Recreation Park

Black Kite (*Milvus migrans*)

Falcons — FAMILY FALCONIDAE

Brown Falcon (*Falco berigora*)
Reedbeds/Lignum, Grasslands and Very Open Woodlands. All open habitats.

Australian Kestrel (*Falco cenchroides*)
Grasslands and more open habitats. Nests in the city.

Grey Falcon (*Falco hypoleucos*)⊗ **RARE** [SA]
Garnett & Crowley (2000) list this animal as **NEAR THREATENED** at the national level. This animal is an inhabitant of arid and semi-arid Australia (<500mm rainfall per annum). Frequenting Acacia shrublands crossed by watercourses, it preys on birds and mammals. Farming in marginal country, overgrazing by stock in arid areas and provision of water favouring the **Peregrine Falcon** (*Falco peregrinus*) are considered the main threats to this species (Garnett & Crowley 2000).

Australian Hobby (*Falco longipennis*) **UNCOMMON** [MLR]
Possibly nesting in the city, possibly increasing in numbers. Sighted at Belair National park, Port Gawler Conservation Park, Para Wirra Recreation Park, Morialta Conservation Park, Hallett Cove Conservation Park, Black Hill Conservation Park, Anstey Hill Recreation Park, Aldinga Scrub Conservation Park and Cleland Conservation Park.

Peregrine Falcon (*Falco peregrinus*) **RARE** [SA]; **UNCOMMON** [MLR]
Nests in the city, probably increasing in numbers. Threatened by nest disturbance, keepers of pigeons sometimes shoot this species. Sighted at Morialta Conservation Park, Para Wirra Recreation Park, Cleland Conservation Park, Anstey Hill Recreation Park, Sturt Gorge Recreation Park and Horsnell Gully Conservation Park.

Black Falcon (*Falco subniger*) **UNCOMMON** [MLR]
Grasslands. Open areas. Sighted at Aldinga Scrub Conservation Park, Anstey Hill Recreation Park, Belair National Park, Hallett Cove, Port Gawler Conservation Park.

Cranes, Rails, Bustards & allies — ORDER GRUIFORMES
Rails, Crakes & allies — FAMILY RALLIDAE

Eurasian Coot (*Fulica atra*)
Common.

Dusky Moorhen (*Gallinula tenebrosa*)
Common.

Black-tailed Native-hen (*Gallinula ventralis*)
An erratic common visitor.

Buff-banded Rail (*Gallirallus philippensis*) **UNCOMMON** [MLR]

Purple Swamphen (*Porphyrio porphyrio*)
Permanent fresh water.

Australian Spotted Crake (*Porzana fluminea*)
Will frequent any muddy areas, reedbeds or wetlands.

Baillon's Crake (*Porzana pusilla*) ⊗ **RARE** [SA; MLR]
Will frequent any muddy areas, reedbeds or wetlands. Summer visitor; may overwinter in north eastern Australia.

Spotless Crake (*Porzana tabuensis*) **UNCOMMON** [MLR]
Will frequent any muddy areas, reedbeds or wetlands.

Button-quails — ORDER TURNICIFORMES, FAMILY TURNICIDAE

Painted Button-quail (*Turnix varia*) **VULNERABLE** [SA; MLR]
Almost extinct in the Mount Lofty Ranges. Once would have been a quite common Woodland bird. Preferred habitats include grassy forests and woodlands. Has in the past been sighted at Belair National Park, Anstey Hill Recreation Park and Aldinga Scrub Conservation Park.

Little Button-quail (*Turnix velox*)
Summer breeding visitor; winters inland and northern Australia. Preferred habitat is Grasslands.

Plains-wanderer, Sandpipers, Stone-curlews, Oystercatchers, Stilts, Plovers, Dotterels, Pratincoles, Gulls & Terns — ORDER CHARADRIIFORMES
Sandpipers and allies — FAMILY SCOLOPACIDAE

Latham's Snipe (*Gallinago hardwickii*) **VULNERABLE** [SA; MLR] CAMBA; JAMBA
Non-breeding summer visitor, breeds in Japan and eastern Russia (Garnett & Crowley 2000). In Australia, this bird feeds on small invertebrates, seeds and vegetation in brackish and freshwater wetlands, preferring to be close to vegetative cover (Garnett & Crowley 2000). Threatened in Australia by drainage, water diversion and urban development (Garnett & Crowley 2000).

Common Sandpiper (*Actitis hypoleucos*)
Non breeding summer visitor; breeds in northern hemisphere.

Bar-tailed Godwit (*Limosa lapponica*) CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Black-tailed Godwit (*Limosa limosa*) CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Eastern Curlew (*Numenius madagascariensis*) CAMBA; JAMBA **VULNERABLE** [SA; MLR]
Non-breeding summer visitor; breeds in the northern hemisphere. Preferred habitats are estuaries, mud-flats, mangroves and sandspits (Simpson & Day 1996). Sighted at Port Gawler Conservation Park and Torrens Island Conservation Park.

Whimbrel (*Numenius phaeopus*) CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Wood Sandpiper (*Tringa glareola*) CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Common Greenshank (*Tringa nebularia*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Marsh Sandpiper (*Tringa stagnatilis*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Common Redshank (*Tringa totanus*) ❍ ⊗ CAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Terek Sandpiper (*Xenus cinereus*) CAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Ruddy Turnstone (*Arenaria interpres*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Sharp-tailed Sandpiper (*Calidris acuminata*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Red Knot (*Calidris canutus*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Curlew Sandpiper (*Calidris ferruginea*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Pectoral Sandpiper (*Calidris melanotos*) ❍ JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Red-necked Stint (*Calidris ruficollis*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in eastern Siberia and western Alaska.

Long-toed Stint (*Calidris subminuta*) ❍ ⊗ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Great Knot (*Calidris tenuirostris*) ❍ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Ruff (*Philomachus pugnax*) ❍ ⊗ CAMBA; JAMBA
Non-breeding summer visitor, breeds in the northern hemisphere.

Red-necked Phalarope (*Phalaropus lobatus*) ❍ ⊗ CAMBA; JAMBA
Non-breeding winter visitor, breeds in the northern hemisphere.

Painted Snipe — FAMILY ROSTRATULIDAE

Painted Snipe (*Rostratula benghalensis australis*) CAMBA VULNERABLE[MLR]; RARE[SA]
Likely to have once occurred in the Adelaide region (Garnett & Crowley 2000), however it was not recorded in the SAOA Atlas. Preferred habitat is shallow, vegetated, temporary or infrequently filled wetlands (Garnett & Crowley 2000). Recent work suggests that the Australian subspecies is in fact a full species of its own. Not listed under the *EPBC Act 1999*, however Garnett & Crowley (2000) suggest the Australian status is VULNERABLE. Threats are all associated with drainage, development and reclamation of wetlands. Protection and suitable management of principal breeding wetlands and wintering grounds, along with rehabilitation of former breeding wetlands are the primary actions required to conserve this species (Garnett & Crowley 2000).

Stone-curlews — FAMILY BURHINIDAE

Bush Stone-curlew (*Burhinus grallarius*) **ENDANGERED** [MLR]; **VULNERABLE** [SA]
Most recent record from the Adelaide Metropolitan Area is from 1970s at Edinburgh Airbase. Open to very open Woodland. Has in the past been sighted at Aldinga Scrub Conservation Park. While this bird is still found over large parts of Australia, Garnett & Crowley (2000) list the species as **NEAR THREATENED** nationally because it has declined significantly in distribution and abundance. It is threatened from predation by foxes, habitat clearance for agriculture, habitat degradation by pastoralism, and removal of leaf litter and fallen timber debris from habitat remnants (Johnson and Baker-Gabb (1994) in Garnett & Crowley (2000)).

Oystercatchers — FAMILY HAEMATOPODIDAE

Sooty Oystercatcher (*Haematopus fuliginosus*)
Coastal species.

Pied Oystercatcher (*Haematopus longirostris*) **UNCOMMON** [MLR]
Coastal species. Sighted at Torrens Island Conservation Park.

Avocets and Stilts — FAMILY RECURVIROSTRIDAE

Banded Stilt (*Cladorhynchus leucocephalus*)

Black-winged Stilt (*Himantopus himantopus*)

Red-necked Avocet (*Recurvirostra novaehollandiae*)

Plovers and Dotterels — FAMILY CHARADRIIDAE

Double-banded Plover (*Charadrius bicinctus*)
Non-breeding winter visitor; breeds in New Zealand.

Red-capped Plover (*Charadrius ruficapillus*)

Black-fronted Dotterel (*Elseyornis melanops*)
Found along freshwater creeks, including River Torrens. Needs gravel banks and islands if it is to breed along Torrens. Predated upon by dogs, cats and foxes.

Red-kneed Dotterel (*Erythrogonys cinctus*)
Tolerates saline environments.

Pacific Golden Plover (*Pluvialis fulva*) ()
Non-breeding summer visitor; breeds in the northern hemisphere.

Grey Plover (*Pluvialis squatarola*) () CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Hooded Plover (eastern) (*Thinornis rubricollis*) **VULNERABLE** [SA; MLR]
Garnett & Crowley (2000) recognise the population in the Adelaide region as a separate subspecies (*T.r.rubricollis*) that once extended from the south coast of New South Wales to the Nullarbor and included Tasmania. Garnett & Crowley (2000) have listed this subspecies as **VULNERABLE** at the national level. The main threats in the Adelaide region are disturbance from dogs and people (Hugh Possingham *pers. comm.*). It is also threatened by predation from foxes, which take both chicks and eggs. Around human settlements, artificially high numbers of **Silver Gulls** (*Larus novaehollandiae*) and **Ravens** (*Corvus* spp.) are also implicated in excessive predation. Breeding success is reduced by the presence of off-road vehicles and the use of the introduced marram grass (*Ammophila arenaria*) in beach erosion control (Garnett & Crowley 2000). Specific management actions required include the development of protocols that effectively allow beaches to be shared by humans and Hooded Plovers; management of refuse areas in human settlements adjacent to the coast so that artificially high numbers of Silver Gulls and Ravens are reduced; and the integration of Hooded Plover management into beach erosion control (Garnett & Crowley 2000). Recorded several times from the Willunga/Aldinga region during the SAOA Atlas.

Masked Lapwing (*Vanellus miles*)
Common.

Banded Lapwing (*Vanellus tricolor*)
Grasslands; Open Woodlands and Low Woodlands. Infrequently seen, has been sighted at Belair National Park and Aldinga Scrub Conservation Park. Breeds at the Adelaide airport.

Pratincoles and Coursers — FAMILY GLAREOLIDAE

Australian Pratincole (*Stiltia isabella*) ()
Grassland species. Summer breeding visitor; winters in northern Australia. Very rare, recorded sometimes at the Adelaide airport.

Gulls, Skuas and allies — FAMILY LARIDAE

Great Skua (*Catharacta skua*) () ⊗
Non-breeding winter visitor; breeds in the Antarctic and sub-Antarctic region.

Arctic Jaeger (*Stercorarius parasiticus*) () ⊗ JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Silver Gull (*Larus novaehollandiae*)
Numbers have increased dramatically. Artificially high numbers caused by success in cohabitation with humans. Silver Gulls are particularly abundant in and adjacent refuse areas. The high numbers of this species now threaten the nesting of many other sea and water birds.

Pacific Gull (*Larus pacificus*) UNCOMMON [MLR]
Numbers declining. Sighted at Hallett Cove Conservation Park and Torrens Island Conservation Park.

Kelp Gull (*Larus dominicanus*) ⊗

Whiskered Tern (*Chlidonias hybridus*) ↕
Common along the coast. Breeds in the Adelaide region over summer; migrates north during the winter. Breeding of this tern is threatened by increasing Silver Gull numbers.

White-winged Black Tern (*Chlidonias leucopterus*) () ⊗ CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Little Tern (*Sterna albifrons*) () ⊗ CAMBA; JAMBA VULNERABLE [SA]
Not recorded from the Adelaide region in the SAOA Atlas or from any NPWSA areas. However, Garnett & Crowley (2000) indicate that the past range of this species included the Gulf of St Vincent. For this reason it is listed here and labelled 'locally extinct.' The Australian subspecies (*S.a. sinensis*) is endemic to Australia, other subspecies are found in Asia, Europe, Africa and America. Nest disturbance, especially in areas close to human settlement is considered to be the main threat to this subspecies.

Crested Tern (*Sterna bergii*)
Nest sites on sandbars and islands require protection.

Caspian Tern (*Sterna caspia*) CAMBA; JAMBA
Displays some seasonal movements, in South Australia these are not well documented and are not obvious. Nest sites on sandbars and islands require protection. Numbers believed to be declining. Breeding of this tern is threatened by increasing Silver Gull numbers.

Common Tern (*Sterna hirundo*) () RARE [SA] CAMBA; JAMBA
Non-breeding summer visitor; breeds in northern hemisphere. Two records during the SAOA Atlas, both in the St Kilda region.

Fairy Tern (*Sterna nereis*) VULNERABLE [SA; MLR]
Nest sites on sandbars and islands require protection. Breeding of this tern is threatened by increasing **Silver**

Gull (*Larus novaehollandiae*) numbers, **Black Rats** (*Rattus rattus*), **Ravens** (*Corvus* spp.) and dogs all of which are associated with human settlements (Garnett & Crowley 2000). Sighted at Torrens Island Conservation Park.

Gull-billed Tern (*Sterna nilotica*) ()
Breeding summer visitor (mostly) to southern regions; generally moving inland/north during the winter.

Pigeons and Doves — ORDER COLUMBIFORMES, FAMILY COLUMBIDAE

✱**Rock Dove (Feral Pigeon)** (*Columba livia*)

Diamond Dove (*Geopelia cuneata*)⊗

Peaceful Dove (*Geopelia placida*) VULNERABLE [MLR]
Prefers Red gum woodland and other open forest and woodland regions. Once much more common, but has potential for recovery. Still common at Sandy Creek Conservation Park (just outside survey areas, but with similar habitat). Possibly suffering excessive competition from the introduced exotic, *Streptopelia chinensis* (Spotted Turtle-Dove). Sighted at Aldinga Scrub Conservation Park, Anstey Hill Recreation Park, Belair National Park and Para Wirra Recreation Park.

Crested Pigeon (*Ocyphaps lophotes*)
Numbers increasing. An inland species that has colonised southern regions due to clearing and farming.

Common Bronzewing (*Phaps chalcoptera*)
Found in foothills, requires undisturbed areas.

Brush Bronzewing (*Phaps elegans*) UNCOMMON [MLR]
Mainly coastal species (Coastal Shrubland; Very Low Shrubland). Coastal strip between Torrens Island and Port Gawler is significant for this species. Likes coastal dunes with dense scrub. Sighted at Black Hill Conservation Park, Port Gawler Conservation Park, Horsnell Gully Conservation Park, Belair National Park, Aldinga Scrub Conservation Park and Para Wirra Recreation Park.

✱**Spotted Turtle-Dove** (*Streptopelia chinensis*)

✱**Ringed Turtle-Dove** (*Streptopelia 'risoria'*) ⊗

Cockatoos & Parrots — ORDER PSITTACIFORMES, FAMILY CACATUIDAE

Cockatoos & Cockatiel

Sulphur-crested Cockatoo (*Cacatua galerita*) UNCOMMON [MLR]
Numbers stable. Nest in hollows. Sighted at Para Wirra Conservation Park, Aldinga Scrub Conservation Park, Anstey Hill Recreation Park, Belair National Park, Black Hill Conservation Park.

Major Mitchell's (Pink) Cockatoo (eastern) (*Cacatua leadbeateri leadbeateri*) ⊗ VULNERABLE [SA]
This animal once included the Adelaide area in its former distribution, now it is rarely seen in the region. South Australia has both subspecies, with the western subspecies (*C.l. mollis*) found west of Port Augusta. Adelaide represents the most western point of the eastern subspecies distribution (Garnett & Crowley 2000). The eastern subspecies is considered NEAR THREATENED by Garnett & Crowley (2000) at the national level. This animal is found in the semi arid woodlands dominated by Mulga (*Acacia aneura*) and eucalypts (especially mallee and box). In these areas, it feeds on seeds, roots and fruits. Specific requirements include suitable nesting hollows and fresh surface water (Garnett & Crowley 2000). Threats include habitat loss and fragmentation, poor recruitment of breeding trees caused by grazing and weed invasion and nest robbing/trapping for aviculture (Garnett & Crowley 2000).

Galah (*Cacatua roseicapilla*)
Unclear whether this species is native to the Adelaide region. Certainly, since European settlement, numbers have increased dramatically due to clearing. Some suggest small numbers of Galahs probably always visited the Adelaide region from time to time.

Little Corella (*Cacatua sanguinea*)
Numbers increasing.

Long-billed Corella (*Cacatua tenuirostris*)⊗
Not locally indigenous. Appear to have increased in more substantial numbers since early 1990s.

Yellow-tailed Black-Cockatoo (*Calyptorhynchus funereus*) VULNERABLE [SA; MLR]
Prefers wet habitat, therefore more of an Adelaide Hills bird, although numbers are increasing in the foothills. Probably a seasonal and regular visitor (once a common visitor to Botanic Park). Likes introduced pines such as Aleppo Pine (*Pinus halepensis*) (see p.9). Native foods include *Allocasuarina* spp. and *Banksia* spp. seeds. Nests in hollows. Sighted at Cleland Conservation Park, Mark Oliphant Conservation Park, Horsnell Gully Conservation Park, Eurilla Conservation Park, Morialta Conservation Park, Black Hill Conservation Park, Belair National Park, Aldinga Scrub Conservation Park and Ferguson Conservation Park.

Glossy Black Cockatoo (*Calyptorhynchus lathami halmaturinus*) ENDANGERED [MLR; SA; AUS]
Presently confined to Kangaroo Island (**Kangaroo Island subspecies**). Past range included southern Fleurieu Peninsula, possibly extending to the South-East and Eyre Peninsula (Garnet & Crowley 2000). There are recent unconfirmed sightings of this animal from the Willunga region. However, Garnett & Crowley (2000) indicate the only verifiable mainland sighting occurred at Deep Creek Conservation Park in 1999. Robinson (2000) has no mainland record of this animal. This animal feeds almost exclusively on the seeds of **drooping sheoak** (*Allocasuarina verticillata*) occurring on rocky hills and valleys, where the acidic soils are rich in iron and aluminium (Garnett & Crowley 2000). On Kangaroo Island, this bird nests in the hollows of **sugar gums** (*Eucalyptus cladocalyx*), laying only one egg each breeding season.

With only 140 breeding birds this subspecies is threatened by loss of habitat from clearance for agriculture. This problem is compounded on the mainland where rabbits have prevented the successful regeneration of **drooping sheoak**. The greatest threat however, is thought to be the low recruitment of younger birds caused by invasion of nesting hollows and predation of eggs by **Common Brushtail Possums** (*Trichosurus vulpecula*), **Little Corellas** (*Cacatua sanguinea*), **Galahs** (*Eolophus roseicapillus*) and **Honeybees** (*Apis mellifera*) (Garnett & Crowley 2000).

Cockatiel (*Nymphicus hollandicus*) ❨❩
Migratory species, generally moves south to breed and overwinters inland.

Parrots — FAMILY PSITTACIDAE

✱**Peach-faced Lovebird** (*Agapornis roseicollis*) ⊗
A very real threat to native birds. Not yet established.

Australian Ringneck (*Barnardius zonarius*)
Local endemic of Low Woodland in the Northern Adelaide plains. These populations are now probably extinct. Those sighted are likely to be escapees.

Musk Lorikeet (*Glossopsitta concinna*)
Numbers increasing. Nests in hollows.

Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*)
Preferred habitat is dry woodland and mallee. Possibly declining due to competition with Musk Lorikeet and Rainbow Lorikeet, but still recorded regularly in the metropolitan area. Requires hollows for nesting.

Little Lorikeet (*Glossopsitta pusilla*) VULNERABLE [MLR; SA]
Not recorded during the SAOA Atlas or from any NPWSA areas. However, it is recorded as being found in the Adelaide region in Robinson *et al.* (2000). Habitat includes tall open forests and woodlands.

Rainbow Lorikeet (*Trichoglossus haematodus*)
Numbers increasing. Nests in hollows.

Swift Parrot (*Lathamus discolour*) ❮❯ VULNERABLE[MLR; SA]; ENDANGERED[AUS]
Breeding in Tasmania, the Adelaide Plains represent the western limit of this bird's distribution (Garnett & Crowley 2000). However, this bird has not been sighted in the Adelaide area for about 20 years (Gavin Carpenter *pers. comm.*). On the mainland, these birds feed primarily on nectar and show a preference for sites with high soil fertility (Garnett & Crowley 2000). The discrepancies between the rating and the national level and the rating and the regional/state level is due to a recent re-assessment at the national level and subsequent upgrading of status. These changes have yet to filter down to state and regional ratings (Adrian Stokes *pers. comm.*).

Budgerigar (*Melopsitticus undulatus*) ↕
Erratic visitor from semi-arid regions. Highly nomadic, but also generally moves south to breed and inland to overwinter.

Orange-bellied Parrot (*Neophema chrysogaster*) ❮❯ ENDANGERED[MLR; SA; AUS]
Previously thought to be extinct in the Adelaide region, however in July 1999 one individual bird was sighted in the Noarlunga region (John Stark *pers. comm.*). With about 200 individuals left, and only 50 breeding pairs, this species is one of Australia's most endangered birds (DELM 1998). The Adelaide Plains and Yorke Peninsula once represented the northern limits of this animals annual winter migration from south west Tasmania. Today, due to loss of suitable habitat this species is rarely seen north of the Coorong. However, this very rare bird is still sometimes recorded in the Adelaide metropolitan area (See p.103 for further discussion).

Blue-winged Parrot (*Neophema chrysostoma*) ❮❯ VULNERABLE[SA; MLR]
Preferred habitat is Coastal Shrubland and Very Low Shrubland, therefore relies heavily on coastal areas, eg Outer Harbour and Buckland Park Lake. Non-breeding winter visitor; breeds in southeast South Australia, Victoria and Tasmania. During the SAOA Atlas, this species was recorded three times in the Adelaide metropolitan area. More frequently sighted in the region of Lake Alexandrina and Coorong. Recorded from Aldinga Scrub Conservation Park.

Elegant Parrot (*Neophema elegans*) INDETERMINATE[MLR]
Preferred habitat is Coastal Shrubland and Very Low Shrubland. Non-breeding birds at Buckland Park Lake most of the year. Sighted at Montacute Conservation Park, Aldinga Scrub Conservation Park and Para Wirra Recreation Park.

Rock Parrot (*Neophema petrophila*), RARE[MLR; SA]
Comments as for Blue winged parrot. Sighted at Aldinga Scrub Conservation Park and Hallett Cove Conservation Park.

Ground (Swamp) Parrot (*Pezoporus wallicus*), EXTINCT[MLR]; ENDANGERED[SA]
Extinct from the Mount Lofty Ranges and Adelaide plains. May still occur in the Southeast (Robinson *et al.* 2000). However, Garnett & Crowley indicate this bird is extinct in South Australia. The eastern subspecies (*P.w. wallicus*) is listed as VULNERABLE at the national level by Garnett & Crowley (2000). Altered fire regimes represent the primary threat to this bird (Garnet & Crowley 2000). Specific management actions required include mapping of known and potential habitat; surveying and monitoring programs; reinstatement of desired fire regime; and re-establishment of a wild sub-population in South Australia (Garnett & Crowley 2000).

Crimson (Adelaide/Yellow) Rosella (*Platycercus elegans*)
Increasing in suburbs. Requires hollows for nesting.

Eastern Rosella (*Platycercus eximius*)
Increasing in suburbs. Requires hollows for nesting.

Red-rumped Parrot (*Psephotus haematonotus*)
Populations stable, likes ovals and lawns. Requires hollows for nesting.

Cuckoos — ORDER CUCULIFOPRMES, FAMILY CUCULIDAE

Fan-tailed Cuckoo (*Cacomantis flabelliformis*) ↕
Open Forest, therefore preferring the Hills. Migrates inland over winter.

Horsfield's Bronze-Cuckoo (*Chrysococcyx basalis*) ()
Probably once common in moist open, wooded and heath habitats. Now uncommon, except along coast, Buckland Park Lake and south. Breeding visitor; moves north during autumn.

Shining Bronze-Cuckoo (*Chrysococcyx lucidus*) () **RARE** SA; MLR
Prefers wet Forest habitats. Breeding summer visitor; winters in Queensland, Papua New Guinea and eastern Indonesia. Sighted at Belair National Park, Scott Creek Conservation Park, Morialta Conservation Park, Sturt Gorge Recreation Park, Anstey Hill Recreation Park, Aldinga Scrub Conservation Park, Horsnell Gully Conservation Park and Cleland Conservation Park.

Black-eared Cuckoo (*Chrysococcyx osculans*) ()
Rare irregular visitor. Breeding summer/spring visitor; migrates to northern Australia over autumn/spring.

Pallid Cuckoo (*Cuculus pallidus*) ()
Almost extinct in region, preferred habitat is woodland and Low Woodland. Breeding summer visitor; winters in northern Australia.

Owls — ORDER STRIGIFORMES

Typical Owls — FAMILY STRIGIDAE

Southern Boobook (*Ninox novaeseelandiae*)
Requires hollows for nesting, threatened by cars, yet still regularly sighted in region.

Barn Owls — FAMILY TYTONIDAE

Barn Owl (*Tyto alba*)
Grasslands and Open Woodlands. Still in region.

Frogmouths, Nightjars, Owlet-nightjars — ORDER CAPRIMULGIFORMES

Frogmouths — FAMILY PODARGIDAE

Tawny Frogmouth (*Podargus strigoides*)
Often feeds on roadsides therefore threatened by cars, yet still in region. Breeds in the Hills and appears to be tolerant of suburban fringe. Infrequent sightings in well-established suburbs.

Owlet-nightjars — FAMILY AEGOTHELIDAE

Australian Owlet-nightjar (*Aegotheles cristatus*) **UNCOMMON** MLR
Dry Woodlands; virtually disappeared from region, threatened by cars and lack of suitable nesting hollows. Sighted at Belair National Park and Para Wirra Recreation Park.

SWIFTS — ORDER APODIFORMES, FAMILY APODIDAE

Fork-tailed Swift (*Apus pacificus*) ()CAMBA JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere and south-east Asia.

White-throated Needletail (*Hirundapus caudacutus*) () CAMBA; JAMBA
Non-breeding summer visitor; breeds in the northern hemisphere.

Kingfishers, Bee-eaters & Rollers — ORDER CORACIIFORMES

Kingfishers — FAMILY ALCEDINIDAE

Azure Kingfisher (*Alcedo azurea*) EXTINCT[MLR]; ENDANGERED[SA]
Extinct in the Mount Lofty Ranges and Adelaide plains. Still in the southeast of the state (Robinson *et al.* 2000). Preferred habitat is described as rivers, creeks and mangroves (Simpson & Day 1996).

Laughing Kookaburra (*Dacelo novaeguineae*)
Numbers possibly increasing. Requires small reptiles and large invertebrates for food. Nests in hollows. Would have once been common in Woodland and Open Forest habitats.

Sacred Kingfisher (*Todiramphus sanctus*) ()
Can live in Woodland and Open Forest, although never far from permanent water. Summer breeding visitor; winters in northern Australia and Papua New Guinea. Numbers in decline, yet sometimes sighted in riparian vegetation and on the coast. Feeds on large insects and requires hollows for nesting. Likely to respond well to riparian rehabilitation.

Bee-eaters — FAMILY MEROPIDAE

Rainbow Bee-eater (*Merops ornatus*) () JAMBA
Uncommon. Summer breeding visitor; winters in northern Australia and region surrounding and including Papua New Guinea. Prefers stream banks and sandy areas to nest. Could recover with suitable management. Still breeds on the Adelaide plains, but mainly north of Gawler River.

Songbirds — ORDER PASSERIFORMES

Treecreepers — FAMILY CLIMACTERIDAE

Brown Treecreeper (*Climacteris picumnus*) VULNERABLE[MLR]
Once would have been a quite common woodland bird but currently in decline. Has been sighted at Belair National Park, Horsnell Gully Conservation Park, Brownhill Creek Recreation Park, Eurilla Conservation Park and Morialta Conservation Park.

White-throated Treecreeper (*Cormobates leucophaeus*) UNCOMMON[MLR]
Once would have been a quite common woodland bird. Sighted at Belair National Park, Black Hill Conservation Park, Cleland Conservation Park, Eurilla Conservation Park.

Fairy-wrens, Emu-wrens & Grasswrens — FAMILY MALURIDAE

Superb Fairy-wren (*Malurus cyaneus*)
Prefers dense scrub, primary threat is predation from cats. Could be encouraged down river systems and onto the plains with the revegetation of riparian habitats with dense shrubs. Like many other small birds, this one appears to be in decline.

Variegated Fairy-wren (*Malurus lamberti*)
Prefers Low Woodland, found throughout the mallee region. Once found on northern Adelaide plains- possibly still occurs near Roseworthy.

White-winged Fairy-wren (*Malurus leucopterus*)
Very Low Shrubland, adjacent saltfields, Buckland Park Lake.

Pardalotes — FAMILY PARDALOTIDAE

Spotted Pardalote (*Pardalotus punctatus*) UNCOMMON[MLR]
Possibly increasing in wet habitats (>550mm). Needs hollows for nesting. Feeds on insects in canopy, preferring Open Forest habitats. Occurs in suburbs in other cities and could recolonise eastern suburbs. ***Pardalotus punctatus xanthopygus*** (Yellow-rumped Pardalote) is a subspecies (also considered to be uncommon in MLR) and in the region prefers a Low Woodland habitat. Likely to benefit significantly from revegetation.

Striated Pardalote (*Pardalotus striatus*)
Frequently found in Open Forest and Woodland, especially in areas dominated by *Eucalyptus camaldulensis*. Numbers may continue to increase with revegetation. Needs hollows for nesting.

Bristlebirds, Thornbills, Scrubwrens & allies — FAMILY ACANTHIZIDAE

Inland Thornbill (*Acanthiza apicalis*)
Low Woodlands; Very Low Shrublands; Heaths; Buckland Park Lake region.

Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*)
Woodlands; Coastal Shrubland; prefers open areas. Remnant populations in Adelaide Parklands and along the coast are in decline. Stable populations located on the northern Adelaide plains.

Slender-billed (Samphire) Thornbill (*Acanthiza iredalei*) VULNERABLE [AUS; SA; MLR]
Very Low Shrublands; nationally threatened species, substantial breeding populations located in Buckland Park Lake region , Port Gawler Conservation Park and further south. (Therefore Very Low Shrublands in this region are high priority for conservation efforts). Threatened by coastal development and any rise in sea level (see p.103 for further discussion).

Striated Thornbill (*Acanthiza lineata*)
Open Forests; Woodlands; now only in the foothills.

Yellow (Little) Thornbill (*Acanthiza nana*) UNCOMMON [MLR]
Currently found at Aldinga Scrub Conservation Park (only breeding population in this region), Sturt Gorge Conservation Park, Greenhill Recreation Park, Anstey Hill Recreation Park, Belair National Park, and Horsnell Gully Conservation Park. Once would have been a quite common woodland bird.

Buff-rumped Thornbill (*Acanthiza reguloides*)
Quite common throughout the Mount Lofty Ranges (but few breeding populations). Once would have been a quite common woodland bird.

Chestnut-rumped Thornbill (*Acanthiza uropygialis*) VULNERABLE [MLR]
Found at Aldinga Scrub Conservation Park and on the northern Adelaide plains.

Rufous (Western) Fieldwren (*Calamanthus campestris*) EXTINCT [MLR]
Considered having a patchy and localised distribution across the arid areas of Western Australia, South Australia and Victoria (Simpson & Day 1996).

Chestnut-rumped Heathwren (*Calamanthus pyrrhopygius*) VULNERABLE [SA; MLR]
Garnett & Crowley (2000) recognise the Mount Lofty Ranges population of this bird as a separate subspecies (*C. p. parkeri*) and consider it ENDANGERED at the national level, however, this is not recognised under the *EPBC Act 1999*. The Chestnut-rumped Heathwren lives in heath and dense undergrowth of eucalypt forests and woodlands. Most commonly found in rocky areas. Vegetation clearance resulting in habitat loss and fragmentation along with degradation of habitat from woody weeds represents the main threats to this subspecies (Garnett & Crowley 2000). Has been sighted in Mark Oliphant Conservation Park, and more recently in Black Hill Conservation Park (Penny Paton *pers. comm.*). Required management actions include inclusion of vegetation requirements in revegetation programs; education and public awareness campaign; monitoring of key indicators of performance (population size, breeding success and vegetation condition), determination of the feasibility of translocation; and coordination of recovery with Southern Emu Wren Recovery Team (Garnett & Crowley 2000).

White-throated Gerygone (*Gerygone olivacea*) ( ) ⊗ RARE [SA; MLR]
Summer breeding visitor; winters mostly in Queensland. During the SAOA Atlas this animal was recorded several times from Aldinga Conservation Park. Has in the past also been sighted in Cleland Conservation Park

White-browed Scrubwren (*Sericornis frontalis*) UNCOMMON [MLR]
Adelaide Plains represents approximate boundaries between two subspecies- ***Sericornis frontalis maculatus*** (western distribution) prefers coastal scrub and mangroves; and ***Sericornis frontalis frontalis*** (eastern distribution) prefers foothills. Both prefer dense low vegetation.

Weebill (*Smicrornis brevirostris*)
All eucalypt habitats. Commonly found along the Adelaide foothills.

Honeyeaters and Australian Chats — FAMILY MELIPHAGIDAE

Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) UNCOMMON [MLR]
Woodlands; Low Woodlands; Very Low Shrublands; Coastal Shrubland; Currently found at Buckland Park Lake, Port Gawler Conservation Park and Aldinga Scrub Conservation Park. This species is likely to respond well to revegetation efforts.

Eastern Spinebill (*Acanthorhynchus tenuirostris*)
Occasionally visits suburbs and likely to naturally be a seasonal visitor anyway.

Red Wattlebird (*Anthochaera carunculata*)
Common and numbers increasing in wooded habitats, including the suburbs. Aggressive towards other native bird species.

Little Wattlebird (*Anthochaera chrysoptera*) UNCOMMON [MLR]
Numbers increasing in wooded habitats with dense shrub layer.

Black Honeyeater (*Certhionyx niger*) ↕
Irregular spring/summer visitor from the arid interior.

Tawny-crowned Honeyeater (*Gliciphila melanops*) UNCOMMON [MLR]
Low Woodland and Heaths

Yellow-faced Honeyeater (*Lichenostomus chrysops*) ↕
Prefers moist forest habitats. Tends to over winter in the northeastern parts of Australia.

Yellow-plumed Honeyeater (*Lichenostomus ornatus*)
Infrequent visitor. Has been sighted at Black Hill Conservation Park, and Cleland Conservation Park.

White-plumed Honeyeater (*Lichenostomus penicillatus*)
Open Forests; Woodlands; common in the suburbs.

Singing Honeyeater (*Lichenostomus virescens*)
Low Woodlands and coastal regions. Found in coastal suburbs.

Yellow-throated Miner (*Manorina flavigula*)
Prefers Low Woodland habitat, rarely seen in wetter hills habitats. While this species was never widespread and its preferred habitat in this region was northern Adelaide plains, its numbers have reduced significantly. Has been recorded from Para Wirra Recreation Park.

Noisy Miner (*Manorina melanocephala*)
Population numbers continue to increase, possibly at the expense of other native birds. Although indigenous to the Adelaide plains, this aggressive bird has been successful in suburban areas and excludes other native species (see p.9). One management technique to reduce their impact on native species is to revegetate with understorey shrubs and grasses, thus reducing visibility and providing a physical obstacle during flight.

Brown-headed Honeyeater (*Melithreptus brevirostris*)
Open Forests; Woodlands; Low Woodlands. Would have been once common, but now rare in this region.

Black-chinned Honeyeater (*Melithreptus gularis*) **VULNERABLE** [SA; MLR]
Open Forests; Woodlands. With the last sightings in the mid 1990s this species is possibly extinct in the northern Adelaide region. However, it is still regularly sighted in the Reynella/Morphett Vale region. Feeding on insects, nectar and lerps, preferred habitat includes the dry Eucalypt woodlands with an annual rainfall range of between 400-700mm per annum. The eastern subspecies (*M.g. gularis*) is considered **NEAR THREATENED** at the national level by Garnett & Crowley (2000). As with most woodland birds, the main threat to this species is habitat loss and fragmentation (Garnett & Crowley 2000). Recommended actions include determination of biology characteristics that make this species susceptible to fragmentation; manage at least 15% of the pre-European area of all woodland communities on public or private land for nature conservation; education of landholders with suitable woodland habitat with the aim of providing greater connectivity between sub-populations; promotion of revegetation and land reclamation that recreates woodland habitat; control and reduce wood-lot development; and reduce grazing densities where necessary (Garnett & Crowley 2000).

White-naped Honeyeater (*Melithreptus lunatus*) ↕
Tends to overwinter in more northeast parts of Australia. Preferred habitats are Open Forests and Woodlands.

White-fronted Honeyeater (*Phylidonyris albifrons*) ()
Generally moves south in the summer and north/inland during the winter

New Holland Honeyeater (*Phylidonyris novaehollandiae*)
Common in suburban gardens.

Crescent Honeyeater (*Phylidonyris pyrrhoptera*)
Foothills species (>600mm rainfall).

Striped Honeyeater (*Plectorhyncha lanceolata*) **EXTINCT** [MLR]; **RARE** [SA]
Preferred habitat includes Woodlands and Forests. Only one record for this species during the SAOA Atlas.

Regent Honeyeater (*Xanthomyza phrygia*) **ENDANGERED** [MLR; SA; AUS]
This highly nomadic species was once found within 300km of the coast between Brisbane and Adelaide. Today it is found in fragmented populations in New South Wales and Victoria; numbers total approximately 1500 individuals (Garnett & Crowley 2000). Clearance and fragmentation are the primary threats to this species. These threats have favoured more aggressive honeyeaters such as the Noisy Miner (*Manorina melanocephala*) (see p.9), displacement of the Regent honeyeater by these aggressive honeyeaters, places an additional strain on remaining populations (Garnett & Crowley 2000).

White-fronted Chat (*Epthianura albifrons*)
Coastal Shrublands; Heaths; Very Low Shrubland.

Crimson Chat (*Epthianura tricolor*) ↕ ⊗
Generally a summer visitor to southern Australia; however, not usually to breed.

Australopapuan Robins & allies — FAMILY PETROICIDAE

Western Yellow Robin (*Eopsaltria griseogularis*) ⊗
Very unusual sighting for the Adelaide region (only one record from Aldinga Conservation Park).

Hooded Robin (*Melanodryas cucullata*) **VULNERABLE** [MLR]
Once would have been a quite common woodland bird. Garnett & Crowley (2000) recognise the Adelaide population as part of a south-eastern subspecies (*M.c. cucullata*) and consider it to be **NEAR THREATENED** at the national level. Living eucalypt woodland/mallee and acacia shrubland, this bird feeds on insects and small lizards (Blakers *et al.* (1984) in Garnett & Crowley (2000)).

Jacky Winter (*Microeca fascinans*) **VULNERABLE** [MLR]
Open Forests; Woodlands; Low Woodlands; not common, but may be breeding in the region. Like other Woodland birds, in order to increase numbers, this one requires substantial revegetation.

Scarlet Robin (*Petroica multicolor*) **UNCOMMON** [MLR]
Prefers wetter forest habitats.

Red-capped Robin (*Petroica goodenovii*) **UNCOMMON** [MLR]
Dry Woodland, in particular *Callitris gracilis* (syn. *C. preissii*), *Allocasuarina verticillata, Banksia marginata* Low Woodland. Infrequently seen, but with revegetation this species could recover.

Australopapuan Babblers — FAMILY POMATOSTOMIDAE

White-browed Babbler (*Pomatostomus superciliosus*) **UNCOMMON** [MLR]
Low Woodlands; Coastal Shrublands; Heaths; still found at Grange Golf Course (Very Low Shrubland) and at Black Hill and at Aldinga Scrub Conservation Park. Until recently, this species was also found at Kooyonga Golf Course. Commonly found in areas with dense, head-high understorey. Populations are likely to be in decline. Prefers dry dense scrub.

Whipbirds, Quail-thrushes and allies — FAMILY EUPETIDAE

Mount Lofty Ranges Spotted Quail-thrush (*Cinclosoma punctatum anachoreta*) **ENDANGERED** [MLR; SA]
Preferred habitat includes sclerophyll forests; ideally on leaf-littered rocky ridges with short tussock grass. The Mount Lofty Ranges subspecies has been dubbed Australia's most endangered bird (Field 2000). This subspecies was previously found between Angaston in the north and Mount Compass in the south. Classified as **CRITICALLY ENDANGERED** by Garnett & Crowley (2000), but not currently recognised under the *EPBC Act 1999*. As this subspecies has not been sighted in the Mount Lofty Ranges for approximately 20 years, it is believed to be extinct.

Sittellas — FAMILY NEOSITTIDAE

Varied Sittella (*Daphoenositta chrysoptera*)
Forests, Woodlands and Mallee. Breeding populations probably now extinct on the Adelaide plains, but still in foothills.

Whistlers, Shrike-tits, & allies — FAMILY PACHYCEPHALIDAE

Grey Shrike-thrush (*Colluricincla harmonica*)
Found in most natural habitats, but not in built-up suburbs.

Crested Shrike-tit (*Falcunculus frontatus*) **VULNERABLE** [SA; MLR]
Prefers Open Forests; Woodlands; >500mm rainfall. Almost extinct on the Adelaide plains, populations now restricted to Hills habitats. Probably once quite common.

Golden Whistler (*Pachycephala pectoralis*)
Open Forests; coastal areas; wider habitat use during winter. Infrequently recorded in the suburbs.

Gilbert's Whistler (*Pachycephala inornata*)
Likely to be extinct in the Adelaide region. Nearest population is found on the eastern side of Mount Lofty Ranges. Has previously been sighted at Anstey Hill Recreation Park. During the SAOA Atlas just one bird was recorded from the metropolitan area.

Locally Extinct

Rufous Whistler (*Pachycephala rufiventris*) ()
Preferred habitats are Woodland and Low Woodland. Summer breeding visitor, moving inland and north during winter. Not generally seen in the suburbs.

Monarchs, Drongos, Magpie-larks & allies — FAMILY DICRURIDAE

Magpie-lark (Piping Shrike) (*Grallina cyanoleuca*)

Restless Flycatcher (*Myiagra inquieta*) **VULNERABLE** [MLR]
Open Forests; Woodlands. Requires large areas of intact vegetation. Could return with extensive revegetation.

Grey Fantail (*Rhipidura albiscapa*) (syn. *Rhipidura fuliginosa*)
Found in foothills, mangroves and coastal complex. Revegetation could increase numbers. Cats a major threat.

Willie Wagtail (*Rhipidura leucophrys*)
Common in suburbs, especially in more open habitats.

Woodswallows, Butcherbirds and allies — FAMILY ARTAMIDAE

Dusky Woodswallow (*Artamus cyanopterus*)
Woodland and Low Woodland, could re-establish. Breeds in the Roseworthy region and foothills. Would have once been quite common.

Masked Woodswallow (*Artamus personatus*) ↕
Highly nomadic over most of Australia, but also regularly migrates south over summer. Frequently found in the Adelaide region as a breeding summer visitor.

White-browed Woodswallow (*Artamus superciliosus*) ↕
Highly nomadic over most of Australia, during the summer it breeds in the south east regions of Australia; it winters in central and northeastern Australia.

Grey Butcherbird (*Cracticus torquatus*) UNCOMMON [MLR]
Low Woodland; Coastal Shrubland. Found mainly along the coast. Lives in suburban areas in Sydney and Melbourne, but not in built up areas of Adelaide.

Australian Magpie (*Gymnorhina tibicen*)

Grey Currawong (*Strepera versicolor*) UNCOMMON [MLR]
Found in Hills habitats, could recover elsewhere with revegetation.

Cuckoo-shrikes & allies — FAMILY CAMPEPHAGIDAE

Black-faced Cuckoo-shrike (*Coracina novaehollandiae*) ↕
Still common throughout the region, including the suburbs. Many move north over winter, however many remain during this period also.

White-winged Triller (*Lalage tricolor*) ↻
Woodlands; Low Woodlands; needs large blocks of habitat. Summer breeding visitor, winters inland and northern Australia.

Orioles — FAMILY ORIOLIDAE

Olive-backed Oriole (*Oriolus sagittatus*) ↻ ⊗ RARE [SA; MLR]
Summer breeding visitor to southeastern Australia; but casual breeding or non-breeding individuals may occur in the Adelaide region at anytime. Once more common, but only ever an occasional visitor. Recorded three times in Hills habitats during the SAOA Atlas.

Crows — FAMILY CORVIDAE

Australian Raven (*Corvus coronoides*)

Little Raven (*Corvus mellori*)
Numbers increasing, found in all habitats.

Chough and Apostlebird — FAMILY CORCORACIDAE

White-winged Chough (*Corcorax melanorhamphos*) VULNERABLE [MLR]
Once would have been a quite common woodland bird. Has been sighted at Belair National Park, Black Hill Conservation Park, Aldinga Scrub Conservation Park and Eurilla Conservation Park.

Thrushes and Old World flycatchers — FAMILY MUSCICAPIDAE

✱**Eurasian Blackbird** (*Turdus merula*)
Significant predator of native spiders.

Bassian Thrush (*Zoothera lunulata*) VULNERABLE [MLR]; RARE [SA]
Moist forests, seen in foothills. Garnett & Crowley (2000) consider the South Australian subspecies (*Z. l. halmaturina*- restricted to Mount Lofty Ranges and Kangaroo Island) to be nationally NEAR THREATENED. Threatened by loss of habitat that has been cleared for agriculture, altered fire regimes and possible competition from the **Eurasian Blackbird** (*Turdus merula*).

Starlings — FAMILY STURNIDAE

***Common (Indian) Mynah** (*Acridotheres tristis*)⊗
A very real threat to native birds. Destroyed each time it has appeared in the Adelaide region. Currently resident in Melbourne, Canberra and Sydney.

***Common Starling** (*Sturnus vulgaris*)
Introduced by the SA Acclimatisation society in 1881 (Thompson 1997). Significant pest species. Believed to compete with native species for nesting hollows.

Swallows and Martins — FAMILY HIRUNDINIDAE

White-backed Swallow (*Cheramoeca leucosternus*)
Rare, prefers more arid areas, nests in riverbanks. Sometimes observed at Sandy Creek (just out of survey area).

Welcome Swallow (*Hirundo neoxena*)

Tree Martin (*Petrochelidon nigricans*) ()
Prefers Open Forests and Woodlands habitats. Summer breeding visitor; winters in northern Australia and Papua New Guinea. Breeds in the city, but limited by hollows. Numbers appear to have declined.

Fairy Martin (*Petrochelidon ariel*) ()
Nests in river banks and culverts. Up to 15 birds are recorded at the Adelaide airport every spring and summer. Summer breeding visitor, winters in northern Australia. Increases in numbers could be encouraged if nesting sites are conserved.

White-eyes — FAMILY ZOSTEROPIDAE

Silvereye (*Zosterops lateralis*)
Suburbs and coastal complex. Numbers variable, but can live in the suburbs.

Warblers — FAMILY SYLVIIDAE

Australian (Clamorous) Reed-Warbler (*Acrocephalus australis*) ()
Reedbeds/Lignum; Populations stable. Summer breeding visitor; winters in northern Australia.

Brown Songlark (*Cincloramphus cruralis*) ↕
Found in fields, preferring Grasslands. Numbers in decline. Breeding visitor moves inland and to northern Australia over autumn. Highly nomadic.

Rufous Songlark (*Cincloramphus mathewsi*) ()
Prefers grassy Woodlands; Grasslands; numbers in decline. Breeding summer visitor; winters inland and northern Australia.

Little Grassbird (*Megalurus gramineus*)
Reedbeds/Lignum; Populations stable, still found in riparian habitat along the River Torrens.

Golden-headed Cisticola (*Cisticola exilis*) RARE [SA, MLR]
Requires extensive areas of Reedbeds/Lignum.

Larks — FAMILY ALAUDIDAE

***Eurasian Skylark** (*Alauda arvensis*)
Established, common.

Horsefield's (Singing) Bushlark (*Mirafra javanica*) ↕
Prefers Reedbeds/Lignum habitats. Tends to be a summer breeding visitor, although may overwinter in the south. On the verge of extinction in the region.

Flowerpeckers — FAMILY DICAEIDAE

Mistletoebird (*Dicaeum hirundinaceum*)
May breed in large blocks of native woodland and mallee. Numbers likely to increase with revegetation. Autumn visitor to the suburbs.

Old World Sparrows — FAMILY PASSERIDAE

✱**House Sparrow** (*Passer domesticus*)

Wagtails and Pipits — FAMILY MOTACILLIDAE

Richard's Pipit (*Anthus novaeseelandiae*)
Grasslands and Coastal Shrubland; declining probably due to urbanisation and planting of trees.

Grass-finches — FAMILY ESTRILDIDAE

✱**Nutmeg Mannikin** (*Lonchura punctulata*)⊗

Red-browed Finch (*Neochmia temporalis*)
Found in gullies and creeks in foothills.

Long-tailed Finch (*Poephila acuticauda*)⊗
Escapee, not established.

Beautiful Firetail (*Stagonopleura bella*) RARE [SA]; ENDANGERED [MLR]
Habitat includes dense heath and thick forests especially near she-oaks and tea-trees. Now extinct in the metropolitan area. Has in the past been recorded from Belair National Park and Aldinga Scrub Conservation Park.

Diamond Firetail (*Stagonopleura guttata*) VULNERABLE [SA; MLR]
Once would have been a quite common woodland bird, today this species has declined over most of its historic range. This bird lives in a range of grassy eucalypt communities and feeds primarily on grass seeds. It is regarded as NEAR THREATENED at the national level (Garnett & Crowley 2000).

Zebra Finch (*Taeniopygia guttata*) UNCOMMON [MLR]

Finches — FAMILY FRINGILLIDAE

✱**European Goldfinch** (*Carduelis carduelis*)

✱**European Greenfinch** (*Carduelis chloris*)

Bulbuls — FAMILY PYCNONOTIDAE

✱**Red-whiskered Bulbul** (*Pycnonotus jocosus*)⊗
Destroyed when it appears.

Threats to Birds

There are many contributing factors behind the decline of bird species in the Adelaide area. However, the main threats to birds in the temperate woodlands are vegetation clearance, herbivory (feral, domestic and native animals), inappropriate fire regimes and logging for timber and firewood (Garnett & Crowley 2000).

Land clearance resulting in loss of habitat and habitat fragmentation (see p.7) is the primary threat to birds in the Adelaide area, and indeed in Australia (Garnett & Crowley 2000). Temperate woodland birds have been subject to significant pressures from land clearance due to the suitability of this habitat type for agricultural development. Habitat loss/fragmentation resulting from vegetation

clearance has at least partly contributed to the decline of nearly two thirds of all threatened Australian birds. Of these threatened birds, more than half are from temperate/sub-tropical woodlands and mallee regions, the habitats most widely cleared for agricultural development (Garnett & Crowley 2000).

Herbivory from feral animals such as rabbits, goats and hares; domestic animals such sheep and cattle; and native animals such kangaroos and wallabies. While herbivory is a natural process in the environment, excessive herbivory can severely degrade the natural environment (see p.105). Excessive herbivory depletes grasses and inhibits regeneration, thus removing food and shelter sources for a range of native animals including birds.

The Action Plan for Australian Birds (Garnett & Crowley 2000) identify the importance of implementing a Coordinated Conservation Plan in the Mount Lofty Ranges. The conservation plan indicates that nearly all of the Mount Lofty Ranges have been cleared for grazing or agriculture and that most of the remaining habitat is degraded by grazing, weed invasion and inappropriate fire regimes. The Coordinated Conservation Plan recommends specific management actions:

- Identify areas that contain core species, and encourage sound land management, using appropriate incentives and conservation agreements.
- Promote revegetation and land reclamation that recreates woodland habitat with a full complement of biodiversity.
- Manage fire regimes, to ensure a diversity of post-fire ages in most habitats, at a scale that permits movement between patches.
- Control and reduce firewood collection.
- Investigate the feasibility of re-introductions of Ground Parrot (*Pezoporus wallicus wallicus*), Diamond Firetail (*Stagonopleura guttata*), and other woodland taxa to large rehabilitated remnants from which they have been lost.
- Undertake long-term monitoring of threatened birds, recording key indicators of performance, including population size, breeding success and vegetation condition.
- Coordinate conservation management at a regional level.

Freshwater Fishes

When discussing fishes of the Adelaide region, including the Mount Lofty Ranges, biologists commonly split the area into two subregions:

- Murray Darling Basin
- Gulf Streams

In the Adelaide region the tributaries of the Murray Darling Basin commence on the eastern and southern edges of the Mount Lofty Ranges and include the Bremer River, Angas River, Finniss River, Tookayerta Creek and Currency Creek.

The Gulf Streams commence on the western side of the Mount Lofty Ranges, running in an approximately east-west direction. Some of the more significant watercourses in this region are: Light River, Gawler River (includes North and South Para Rivers), Little Para River, Dry Creek, River Torrens (includes the six suburban creeks), Sturt River/Brownhill Creek, Field River, Christie Creek, Onkaparinga River and Pedlar Creek.

All watercourses considered in this document are contained within the Gulf Streams region. The extent of study for the purposes of this document is indicated on the attached A2 fold-out map and includes all of the watercourses listed above except the Light River.

In Australia, approximately 195 species and subspecies of native freshwater fish have been described, with another 22 undescribed but recognised (Wager & Jackson 1993). About 127 of these are considered endemic (Crowl *et al.* 1992), and 56 species are found in South Australia (Robinson *et al.* 2000). The Mount Lofty Ranges has 25 native freshwater fish species (Carter & Pierce undated). None of the species present in the Gulf region are considered threatened at the national level. While it is likely that some of the species listed are conservation significant at the state and regional level, no formal document currently exists which addresses the conservation status of our native fish at these levels. Taxonomy has followed Robinson *et al.* (2000).

The total number of native freshwater fishes in the Gulf region is 11; this figure also includes two lamprey species, and one species that is suspected to be extinct in the region. Freshwater fishes of the Gulf region can be divided into three categories; natives, translocated natives, and introduced species.

Native species:

- **Short-headed Lamprey** (*Mordacia mordax*)
- **Pouched Lamprey** (*Geotria australis*)
- **Small-mouthed Hardyhead** (*Atherinosoma microstoma*)
- **Congolli** (*Pseudaphritis urvilli*)
- **Purple-spotted Gudgeon** (*Mogurnda adspersa*)
- **Big-headed Gudgeon** (*Philypnodon grandiceps*)
- **River Blackfish** (*Gadopsis marmoratus*)
- **Swan River Goby** (*Pseudogobius olorum*)
- **Climbing Galaxias** (*Galaxias brevipinnis*)
- **Common Jollytail** (*Galaxias maculatus*)
- **Mountain Galaxias** (*Galaxias olidus*)

Native translocated species:

- **Crimson-spotted Rainbow Fish** (*Melanotaenia fluviatilis*)
- **Western Carp Gudgeon** (*Hypseleotris klunzingeri*)
- **Freshwater Catfish** (*Tandanus tandanus*)

Exotic species:

- **Eastern Gambusia** (*Gambusia holbrooki*)
- **Goldfish** (*Carassius auratus*)
- **European Carp** (*Cyprinus carpio*)
- **Tench** (*Tinca tinca*)

- **Redfin Perch** (*Perca fluviatilis*)
- **Brown Trout** (*Salmo trutta*)
- **Rainbow Trout** (*Oncorhynchus mykiss*)

The following descriptions, life histories, habitat requirements and threats are compiled from Crowl *et al.* (1992); McDowall (1996); Carter & Pierce (undated); Hicks & Sheldon (1999), Koehn & O'Connor (1990), Wager & Jackson (1993) and discussions with local freshwater fish expert, Michael Hammer. Annotations are not given here for translocated species. Introduced species are marked with ✸.

Jawless cartilaginous fishes — CLASS CEPHALASPIDOMORPHA
Lampreys — ORDER PETROMYZONTIFORMES
FAMILY PETROMYZONTIDAE

Short-headed Lamprey (*Mordacia mordax*)
Lampreys, along with hagfishes are the sole surviving representatives of the jawless vertebrates. They are conveniently lumped in with the fishes due to the aquatic/marine habit, but are indeed a totally separate class of animals (Agnantha). Within an evolutionary context, birds are more closely related to reptiles than lampreys are to what people commonly regard as fishes.

Preceding a radical metamorphosis, lampreys have a larval juvenile stage (ammocoetes) lasting several years. After about three years the Short-headed lamprey swims downstream towards the sea. It then parasitises itself to marine fish using its abrasive sucking disk. The adult grows significantly during this stage, then re-enters rivers, migrating upstream, to spawn and die.

Given the significant changes of its riverine habitat, the migratory behaviour of the Short-headed Lamprey is both an advantage and disadvantage. The species is not totally dependent upon the river/creek environment throughout its life cycle. Thus, to a certain extent this species can avoid the vagaries of watercourses drying up due to excessive water extraction. Yet, even when there is enough water in its chosen stream, the lamprey is faced with climbing over weirs and other obstacles to reach its spawning ground.

Pouched Lamprey (*Geotria australis*)
The pouched lamprey has similar feeding habits, migratory behaviour and threats as the Short-headed Lamprey.

Bony Fishes — CLASS OSTEICHTHYES
ORDER ATHERINIFORMES
Hardyheads or silversides — FAMILY ATHERINIDAE

Small-mouthed Hardyhead (*Atherinosoma microstoma*)
Not strictly a freshwater fish, the Small-mouthed hardyhead grows to 6.5cm long. It was once very abundant in the lower reaches of both the Murray Darling Basin and Gulf streams. While it remains extant in both of these drainage regions, in both, it is now far less common. The Small-mouthed Hardyhead feeds in eel-grass beds (*Zostera* sp.), primarily on crustaceans and insects.

Rainbow fishes — FAMILY MELANOTAENIDAE

Crimson-spotted Rainbow Fish (*Melanotaenia fluviatilis*)
Translocated.

Live bearers — FAMILY POECILIIDAE

✸**Eastern Gambusia (Plague Minnow)** (*Gambusia holbrooki*)
A tiny fish up to only 5cm in length. Very widespread and abundant throughout southern Australia including the Murray Darling basin and Gulf drainages, preferring still, warm waters adjacent to aquatic vegetation. Was introduced into Australia in the 1920s for mosquito control, but proved to be less effective in the control of mosquitos than many native fishes. (The species is sometimes referred to as **Mosquitofish**, but due to its poor performance in regards to predating upon mosquitos and its threat to native species this common name is no longer preferred.)

The Eastern Gambusia is from a large and diverse family called Poeciliidae, all of which are characterised by their habit of giving birth to live young, rather than laying eggs. Following birth the fish grows very rapidly and can mature in less than two months. Furthermore, the species is able to breed several times a year. Thus populations can grow very rapidly.

The Eastern Gambusia is considered a threat to many native fishes because it predates upon the eggs and young fish. It is also known to intimidate native fishes by nipping at their fins thus affecting behaviour and contributing to mortality by increased susceptibility to disease.

Eastern Gambusia have also been implicated in the decline of frog numbers in recent years (Tyler 1997).

Carps and allies — ORDER CYPRINIFORMES FAMILY CYPRINIDAE

***Goldfish** (*Carassius auratus*)
Extremely widespread species found throughout the Murray Darling Basin, the Gulf Drainages, Southern Western Australia and even in the Cooper Creek in South Australia's far northeast. The Goldfish was imported into Australia in the 1860s as an ornamental fish and was found in the wild sometime after. It has the capacity to survive in extremely degraded habitats and therefore does well in slow waters of high temperature and low oxygen content. It also has the capacity to feed on a variety of foods including plant materials, organic detritus, small aquatic insects and other animals. Sometimes found to hybridise with **Carp** (*Cyprinus carpio*).

This species is a threat due to direct competition, predation and because ornamental fish released from home aquariums may contain diseases with the capacity to affect native species. This threat is even more serious within the context of the urban environment, because it is in the waterways of urban areas that aquarium fish are likely to be released.

***European Carp** (*Cyprinus carpio*)
The Carp is reputed to be the planet's most widespread freshwater fish species. Indeed, it is found on every continent except Antarctica. It is found throughout the Murray Darling Basin and the Gulf drainages. Originally, an ornamental strain was introduced near Sydney about 1850-60. A Singaporean strain was accidentally released in to the Murrumbidgee in 1876. A third introduction occurred in 1961 when a hybrid strain escaped from an aquaculture enterprise into Lake Hawthorn near Mildura. These bred and spread up the Murrumbidgee to breed with the Singaporean strain; the result was a strain of carp with a broad genetic make-up, able to cope with a wide range of conditions. The spread of these strong fish was aided by floods, especially those occurring in the mid 1970s.

Carp prefer still or slow moving water and are capable of survival in water of low oxygen levels. Diet is variable and includes molluscs, crustaceans, insect larvae and seeds. Combined with tolerance of adverse water conditions, and a generalist feeding pattern, Carp have high fecundity and potentially rapid growth, making them a highly successful fish. This species is able to feed by sucking in large amounts of sediment, extracting any organic matter and then releasing the sediment via its gills. This activity increases turbidity and the availability of nutrients, thus restricting the growth of aquatic vegetation and increasing the chances of algal blooms.

Carp are a declared noxious pest and must not be translocated or returned to the water alive following capture. Unfortunately, despite this new introductions remain common.

***Tench** (*Tinca tinca*)
The Tench is capable of growing up to about 50cm long. It was introduced into the River Murray by acclimatisation societies in 1876 and spread rapidly throughout the Murray Darling System. A small population is thought to occur in the Onkaparinga River. Its numbers reduced drastically in the 1970s when **Carp** (*Cyprinus carpio*) became abundant. Other introduced fish pose a more serious problem to native fishes than Tench.

ORDER PERCIFORMES
Temperate icefishes — FAMILY BOVICHTHYIDAE

Congolli (*Pseudaphritis urvillii*)
The Congolli growing up to 35cm in length, was once abundant in both the lower reaches of the Murray Darling Basin as well as the Gulf Streams. Today its range remains widespread, but its abundance is much reduced. The Congolli has a significant marine phase that enables it to recolonise freshwater habitats that periodically suffer from excessive water extraction.

Gudgeons — FAMILY ELEOTRIDAE

Western Carp Gudgeon (*Hypseleotris klunzingeri*)
Translocated

Purple-spotted Gudgeon (*Mogurnda adspersa*)
This medium sized (up to 13cm) fish was once abundant in both the Gulf streams as well as the Murray Darling Basin. It is believed to have become extinct in the region at least 50 years ago. Close to extinction in the Murray Darling Basin (status in the Darling River system is still to be determined). The species prefers slow-flowing water among aquatic plants, where hard substrates are found and utilised for spawning.

The Southern purple-spotted gudgeon is heavily predated upon by both **Eastern Gambusia** (*Gambusia holbrooki*) and **Redfin Perch** (*Perca fluviatilis*). This species is considered being nationally **ENDANGERED** by Wager & Jackson 1993).

'Mogurnda' is what some Aboriginal groups call this particular genus of fish.

This species is afforded protection under the *Fisheries Act 1982.*

Big-headed (Flathead) Gudgeon (*Philypnodon grandiceps*)
This medium sized fish up to 12cm long remains common in both the Murray Darling Basin and Gulf streams. It prefers quiet waters, which explains why it is found in lakes and dams. It is usually located on weedy and muddy substrates. Can also be located in estuarine habitats.

River Blackfish — FAMILY GADOPSIDAE

River Blackfish (*Gadopsis marmoratus*)
A comparatively large fish growing up to 35cm long in this region (up to 60cm in Victoria). It was once common throughout the Murray Darling Basin and the Gulf streams (in particular River Torrens and the Onkaparinga River). The distribution of this species has been severely restricted throughout its former range. It is now thought to be extinct in the Gulf streams (nevertheless, this quite elusive and nocturnal species may still be found somewhere in the Gulf streams). It can still be found in some watercourses of the Adelaide Hills that flow into the River Murray around Lake Alexandrina (Angas River and Tookayerta Creek). These watercourses are outside of the Adelaide Metropolitan Area.

This species can be found in a wide range of stream habitats, from fast moving, clear and cooler mountain streams to medium sized rivers. However, it is only found in water where abundant cover such as snags, boulders and hollow logs exist. It is known to spawn in hollow logs, and the integrity of habitat is crucial to the long-term survival of this species. Life cycle is completed entirely in freshwater.

The River Blackfish is susceptible to increased sediment loads in its habitat. The freshly laid eggs will quickly die after being smothered by a thin layer of silt. Furthermore, such sedimentation increases the mortality rates of juvenile fish. Inappropriate agricultural landuses resulting in excessive run off and weir desilting operations are largely implicated in the increase of sedimentation in streams and rivers.

This species is afforded protection under the *Fisheries Act 1982.*

Gobies — FAMILY GOBIIDAE

Swan River Goby (*Pseudogobius olorum*)
Small fish of up to 8cm in length. Historically very abundant, remains common today in estuarine habitats between western Victoria and Western Australia, including the Murray and Gulf streams. Essentially an estuarine fish, and yet can still be found large distances inland. Spawns in upper reaches of estuaries, where aquatic vegetation is thick.

True perches — FAMILY PERCIDAE

***Redfin Perch** (*Perca fluviatilis*)
The Redfin Perch grows to a length of about 40cm. The earliest recorded introduction into Australia was in 1862, but it was possibly introduced even earlier than that. It is found in both the Murray Darling Basin and in the Gulf streams. As it is a desirable sporting fish and is reported to be good eating, it is widely stocked in dams and watercourses for recreational angling.

This species prefers slow moving water that has aquatic vegetation growth, and is able to feed on a wide range of foods including crustaceans and molluscs. Larger individuals will predate upon other fish species. Under the right conditions, the Redfin is able to breed rapidly. The eggs are laid in a gelatinous mass and are unpalatable to other fish.

Redfin Perch are considered a major threat to our native fish species. **Release following capture is illegal.**

ORDER SALMONIFORMES

Galaxiids (jollytails), minnows, native trouts — FAMILY GALAXIDAE

Climbing Galaxias (*Galaxias brevipinnis*)
This species grows to a length of up to 22cm. Historically it was most common in coastal drainages between Sydney and Adelaide. Although some have been found in the Murray Darling System, these are suspected to have 'emigrated' there via the Snowy River power system, which diverts water west from the Snowy River to the Murray River.

The Climbing Galaxias was once abundant in coastal drainages including South Australia's Gulf streams. Habitat degradation has greatly reduced its range, yet it can still be found in the Gulf streams.

The Climbing Galaxias is a secretive species that usually inhabits clear, headwater streams. It is a highly migratory species, and is known for its ability to climb virtually vertical rock faces so long as they are moist. Consequently, this species has the capacity to recolonise habitats following the removal of threats. Unfortunately, such migratory behaviour makes this species vulnerable to predation by other fish such as trout.

Apart from habitat degradation, the primary threat is from predation by introduced fish, mainly **Rainbow Trout** (*Oncorhynchus mykiss*) and from direct competition with **Brown Trout** (*Salmo trutta*).

Common Jollytail (*Galaxias maculatus*)
A medium sized fish up to 16cm in length. This species was once very common in the lower reaches of both the Murray and Gulf drainages as well as all coastal streams between about Brisbane and Adelaide. Still common but habitat destruction has significantly reduced its range. Despite this, of all the Australian galaxiids, the Common Jollytail has been able to withstand predation as well as habitat destruction better than other galaxiids. This is probably due to its ability to recolonise freshwater habitats following marine larval stage migration. Weirs and habitat alterations inhibit the ability of this species to migrate upstream.

This species feeds on a range of small aquatic and terrestrial organisms including crustaceans, insects, molluscs and midge larvae. The Common Jollytail migrates down to the edge of river estuaries to spawn. This species competes with trout for food sources and trout predate upon it.

Mountain Galaxias (*Galaxias olidus*)
Small fish up to 10cm long that was once abundant and widespread throughout the higher parts of the Murray Darling Basin and Gulf streams. Today this species remains widespread but is less common.

It is threatened by the presence of trout- in some areas it is found only where trout is not. The Mountain Galaxias feeds on aquatic insects, crustaceans and worms. Where vegetation is found overhead, the Mountain Galaxias will also eat terrestrial insects and spiders.

Salmon and Trout — **FAMILY SALMONIDAE**

✱**Rainbow Trout** (*Oncorhynchus mykiss*)
The Rainbow Trout can grow up to 70cm long, and was introduced into Australia from New Zealand in the 1890s (this stock originated from California). It has a higher temperature tolerance than **Brown Trout**, which may explain why it is able to establish self-sustaining populations in the Adelaide region. Feeds on a wide range of aquatic insects, crustaceans, molluscs, terrestrial insects and fishes. Rainbow Trout are considered a major threat to our native fish species. **Release following capture is illegal.**

✱**Brown Trout** (*Salmo trutta*)
The Brown Trout, which grows to a length of up to 70cm long, was introduced into Australia in the 1860s and spread with the assistance of humans and by migration. Self-sustaining populations require cool, swiftly flowing waters- these conditions are generally restricted to the Australian Alps and in Tasmania. Populations in the Mount Lofty Ranges are sustained through systematic introduction of hatchery reared stock.

Brown Trout feed on a variety of animals including crustaceans, molluscs, insects and other small fishes. Through predation and competition, the introduction of Brown Trout has had a detrimental effect on several Australian species, especially the galaxiids. Brown Trout are considered a major threat to our native fish species. **Release following capture is illegal.**

Eel-tailed Catfishes — **ORDER SILURIFORMES FAMILY PLOTOSIDAE**

Freshwater Catfish (*Tandanus tandanus*)
Translocated.

Threats to Freshwater Fishes

The primary text used to compile this section on threats to freshwater fishes was Wager & Jackson (1993), and as such further queries on this topic should be directed towards this publication. Other texts mentioned above were used to a lesser extent.

Approximately 8% of Australia's freshwater fishes are threatened with extinction, and 25% have seriously declined in numbers or occur only in restricted areas. With a few exceptions, all freshwater fishes are likely to have undergone reductions in distribution and abundance following European settlement. The primary causes of this decline have been habitat modification and destruction, and introduced exotic species.

Processes that threaten native freshwater fishes are frequently grouped together for convenience. Yet, threatening processes are often fundamentally connected. For example, poor water quality can be exacerbated by reduced flow rates, sediment load or change in water temperature.

The threats to native freshwater fishes can be categorised under the following headings.

Regulation or Modification of Flow

- Altered flow volumes
  Dams, weirs and barrages (impoundments) are capable of capturing vast amounts of water. Much of this is often redirected for irrigation purposes, thus reducing downstream flows. A reduction in downstream flow results in a reduction in the amount of channel submerged and a reduction in the total amount of habitat available to aquatic organisms.

  In small streams, water abstraction through farm dams also leads to a reduction in flow volume, with a detrimental effect on stream ecology, particularly during low rainfall periods. This is a particularly common threat in the Mount Lofty Ranges. Due to water retention/extraction in the many farm dams, pools of water in watercourses dry rapidly.

  Increased flow volumes also have the potential to be harmful to native fish populations. For example, summer irrigation flows in South Australian sections of the River Murray have lead to increased turbidity (previously flows would have virtually ceased, allowing sediments to settle out). It has been suggested that increased flow volumes in summer have lead to changes in fish communities. During summer in the Mount Lofty Ranges, Murray water is pumped to the upper reaches of the Torrens and Onkaparinga Rivers. This not only increases the volume of water that would naturally be found during these times, but also increases turbidity, and facilitates the introduction of exotic and native fish from the Murray River (along with any diseases they may carry).

  In urban catchments, the abundance of hard impervious surfaces has lead to increased run-off. This has resulted in the temporary flooding of streams, rather than a steady rise and fall in water flows. Most of metropolitan Adelaide's watercourses are subject to this threat. It is most severe in the built-up areas, where impervious surfaces are abundant.

- Altered seasonality of flows
  Impoundments are often built to capture the water during the wet season, and store it to be released in the dry season. Seasonal reversal in flow affects the reproductive success of many species through the removal of necessary stimuli or habitat requirements for spawning. This threat is a common occurrence in the Onkaparinga and Murray Rivers.

- Reduced frequency of floods
  Large impoundments can reduce the frequency of minor flooding and reduce the extent of major flooding. This results in a reduction of the area of floodplain that is available to fish as habitat. Some research indicates that reduced flooding favours introduced species such as **Carp** (*Cyprinus carpio*)and **Eastern Gambusia** (*Gambusia holbrooki*).

- Altered river levels
  Upstream of impoundments the aquatic environment is effectively changed from that of a stream to a lake, altering the fish community composition.

- Increased rate of change of water levels
  The rate of change of water levels in regulated rivers is often higher than in unregulated rivers. Rapidly decreasing water levels can strand eggs and fry causing them to die.

Geomorphic Alteration

- Catchment deforestation and overgrazing
  Rainfall is able to seep into the substrate under well-vegetated catchments. Degraded catchments have increased run-off, resulting in increased erosion and flooding. Well-vegetated catchments have the capacity to filter suspended sediments and absorb pollutants from run-off water.

- Removal of riparian vegetation
  Riparian vegetation is fundamental to the functioning of stream ecosystems. Virtually every aspect of stream habitat can be negatively impacted following its removal. Because of their ability to bind the soil, the roots of riparian vegetation maintain bank stability and channel morphology. Riparian vegetation is also an effective buffer as it filters sediments, organic and inorganic nutrients, and agricultural chemicals.

  Riparian vegetation provides food in the form of organic material (leaves, twigs, terrestrial insects) for aquatic invertebrates and higher animals. It is also a major source of habitat through the addition of leaves, bark, branches and trees.

  Riparian zones of the Adelaide region have suffered widespread clearance, for urban and agricultural development.

- Erosion and siltation
  Erosion results from inappropriate land management practices from within the catchment. Erosion modifies channel and bank morphology and increases the sediment load. An increase in sediment load has several potentially negative consequences including infilling of deep holes and channels, smothering of riffle areas, smothering of invertebrate fauna and fish eggs (those that are intended to sink, rather than float). In the urban environment activities such as urban development and brick/concrete cutting contribute significantly to siltation of waterways.

- Desnagging
  Snags (dead timber) are considered the main instream habitat in lowland streams. Snags are also major spawning sites for **River Blackfish** (*Gadopsis marmoratus*). Many other species are thought to spawn in or on snags. With the presence of snags also comes increased habitat diversity, providing shelter and rest areas for fish and other species. Furthermore, snags are effective substrates for food organisms (water plants, molluscs and other crustaceans).

- Barriers to fish movement
  Barriers such as dams, weirs, and barrages are discussed above, but culverts, fords and excessive log jams also impede the movement of our freshwater fishes. This is detrimental to many fish, as migration is frequently required to access estuarine, marine areas, or upstream localities for spawning or maturation. Barriers also prevent dispersal of fish in search of new habitats and the mixing of genetic material between populations. **Lampreys** (*Mordacia mordax* and *Geotria australis*), **Congolli** (*Pseudaphritis urvilli*), **Climbing Galaxias** (*Galaxias brevipinnis*), and the **Common Jollytail** (*Galaxias maculatus*) all have a migratory component to their life cycle, consequently physical barriers restricting their movement are a threat.

- River engineering
  Engineering schemes on streams and rivers are frequently intended to enhance the ability of the watercourse to drain water. Removal of logs, debris, and riparian vegetation, dredging of gravels and sediments, and straightening of natural bends all aid this drainage process. The best example of this is found in our own city. Sturt Creek has had all of its riparian vegetation removed, and has been straightened, and concreted

throughout much of its course on the Adelaide plains. Consequently, it provides little habitat for freshwater fishes.

Water quality

- Toxic substances
  Toxic substances such as organo-chloride insecticides (eg DDT, dieldrin, lindane) and heavy metals are commonly implicated in stream pollution. While they may not kill particular freshwater fishes outright, they may bio-accumulate and affect overall fitness, behaviour and growth.

- Temperature
  Temperature is a critical environmental cue necessary to induce spawning in native fishes. It can also affect growth rates and inhibit feeding. Following the release of water from impoundments, stream temperature regimes are altered significantly.

- Dissolved oxygen
  An adequate in stream oxygen level is required for fish to exist. Water released from the lower levels of impoundments is generally depleted of oxygen (decomposing organic matter at the bottom of lakes depletes the water of oxygen). Under these circumstances, oxygen levels are likely to be unsuitable for fish for several kilometres below an impoundment.

- Suspended sediments
  High levels of suspended sediments can have negative impacts on fish communities. Algal growth is reduced due to lack of penetration by light, thus reducing overall productivity; respiration of aquatic organisms is inhibited; movement of pesticides is assisted; and fish behaviour is affected (presence of **Purple-spotted Gudgeon** (*Mogurnda adspersa*) is strongly correlated with low turbidity in the Murray-Darling Drainage). The primary source of excessive suspended sediments is catchment and bank erosion.

- Eutrophication
  Eutrophication refers to the input of nutrients into waterbodies, leading to increased production. Eutrophication is a natural and indeed essential biological process, but human activities have accelerated the process to a point where excessive eutrophication is now a serious problem in many waterways. Human induced eutrophication has various sources: increased erosion in catchments; sewerage input (intentional and accidental); fertiliser run-off from agricultural land; domestic animal waste (agricultural and other domestic animals); and stormwater run-off from residential and industrial areas.

  Excessive eutrophication can result in algal blooms, increased turbidity and changes in community composition. Some algal blooms are toxic (blue-green algae) and will harm wildlife, humans and stock. All algal blooms contribute to an overall depletion of oxygen, through decomposition of dead algae (see section on depleted oxygen). Eutrophication is closely associated with water flow. An overall reduction in water flow leads to an increased concentration of nutrients downstream, simply because there is less water.

- Salinity
  Australian inland waters and soils are naturally quite saline. Despite this, human activities have increased the salinity levels in water and soil significantly since European settlement. The primary causes of increased salinity are rising groundwater due to irrigation and land clearing; and drainage flows from irrigation areas. While Australian freshwater fish have adaptations to cope with moderate levels of salinity, the drastic increases in salinity in recent years are increasingly having devastating affects on all aquatic organisms, including fish.

Introduced exotic and native species

- Introduced exotic species

  Predation- direct predation has the obvious effect of declining prey populations. A more subtle predatory effect may affect native fish populations by influencing native fish behaviour. Prey fish may simply avoid habitats of streams and lakes where predators exist- the result being non-overlapping distributional patterns. Furthermore, the presence of predatory fish may simply alter feeding patterns in prey fish, thus causing they

prey fish to restrict feeding time or to select sub-optimal feeding locations. This last predatory effect is difficult to distinguish from effects of competition.

Redfin, **Eastern Gambusia**, **Rainbow Trout** and **Brown Trout** are considered the primary introduced predators of native fishes. The effects of each of these introduced predators are well documented and consequently they are considered significant threats to native freshwater fishes. Indeed, **Eastern Gambusia** has been implicated in the extinction of several small species of fish in Asia and Africa.

Trout are known to predate heavily upon Mountain galaxias and Climbing Galaxias. In many instances, these Galaxias are only found where trout are absent.

Competition- Introduced species can compete with native species for both space and food. For competition to be considered a threat, one must show two things. First, that the resource is limiting at some point in time and second, that the resource limits the population through either increased mortality or through decreased growth rates (affecting individual fitness and reproductive capacity).

In particular, the diets of **Redfin** (*Perca fluviatilis*) and **Trout** (*Oncorhynchus mykiss* and *Salmo trutta*) overlap with the **River Blackfish** (*Gadopsis marmoratus*). Furthermore, as Trout have been found to predate upon River Blackfish, they are a direct threat to this species. Any re-introduction of River Blackfish into the Gulf streams must be accompanied by a threat abatement program, one aspect of which addresses the deleterious impact of competition by Trout and Redfin on River Blackfish.

- Introduced native species
  Some larger native species favoured by anglers have been actively translocated to areas outside their natural distribution, sometimes having a detrimental impact through competition, predation, introduction of diseases and loss of genetic diversity.

- Diseases and parasites
  Native fish are often more susceptible to the diseases of introduced fish because they have not had the chance to evolve an immunity response to the exotic pathogen. The introduced **Redfin Perch** (*Perca fluviatilis*) carries a virus that is highly pathogenic for **Mountain Galaxias** (*Galaxias olidus*), **Silver Perch** (*Bidyanus bidyanus*), **Macquarie Perch** (*Macquaria australasica*) and to a lesser extent **Murray Cod** (*Maccullochella peeli*). Furthermore, it is likely that other native species are also susceptible. Goldfish and other aquarium fish frequently have exotic diseases, with significant potential to harm native freshwater fishes. The release of unwanted aquarium goldfish in waterways is apparently common, particularly in urban areas. Such releases are not only illegal, but they also have the capacity to introduce exotic diseases to native fish populations.

Overfishing

The worldwide trend is that overfishing almost always affects only the larger fish species. In the Northern Hemisphere, overfishing has been implicated in several extinctions of fish. There is little doubt that the decline of some freshwater fish in Australia has been the result of overfishing. So serious in some cases, that special protection of particular species has been required.

Lack of knowledge

The biology and ecology of many of our native fishes are poorly understood. Conservation and management options are restricted because of this. Research is often guided by commercial interests rather than the essential basic understanding of our native fish species. Monitoring is too often only a component of short-term programs, rather than long-term programs which would contribute to a proper understanding of the effects of threatening processes.

Butterflies

This list was compiled from discussions with Robert Fisher OAM, and information from the SA Museum's butterfly website (http://samuseum.sa.gov.au/butterflies/butterfly.htm). Conservation ratings in the following list follow Grund (1998). No invertebrates, including butterflies are listed under Schedules 7, 8 and 9 of the *National Parks and Wildlife Act 1972*. Until recently, invertebrates were not listed under federal legislation.

Habitat degradation is the primary threat to native butterflies. The loss of a particular species of plant from a particular area can lead directly to the loss of a species of butterfly.

Urban Butterflies

Dingy swallowtail	(*Papilio anactus*)
Australian painted lady	(*Vanessa kershawi*)
Meadow argus	(*Junonia villida*)
Wanderer	(*Danaus plexippus*)
Australian admiral	(*Vanessa itea*)
Southern grass dart	(*Ocybadistes walkeri*)
White-banded grass dart	(*Taractrocera papyria*)
Small grass yellow	(*Eurema smilax*)
Caper white	(*Belenois java*)
Cabbage white	(*Pieris rapae*)
Common xenica	(*Geitoneura klugii*)
Common brown	(*Heteronympha merope*)
Tailed emperor	(*Polyura sempronius*)
Lesser wanderer	(*Danaus chrysippus*)
Long-tailed pea-blue	(*Lampides boeticus*)
Common grass blue	(*Zizina labradus*)
Two-spotted line-blue	(*Nacaduba biocellata*)
Saltbush blue	(*Theclinesthes serpentata*)

Coastal Butterflies

Cynone skipper (*Anisynta cynone cynone*) **Vulnerable**
Distributed along the coast between Adelaide and Robe; also found in the Lower North. Larvae feed on native winter grasses. Adults fly only in March and April.

Mottled grass-skipper (*Anisynta cynone gracillis*) **RARE**
Host plants are common native grasses.

Diamond sand-skipper (*Antipodia atralba*) **RARE**
Host plant includes *Gahnia lanigera, G. ancistrophylla, G. deusta.*

Bitter-bush blue (*Theclinesthes albocincta*)
Host plant includes *Adriana hookeri, A. klotzschii.*

Satin azure (*Ogyris amaryllis*)
Main host plant is *Amyema melaleucae*, which grows on *Melaleuca lanceolata* ssp. *lanceolata* (Dryland Tea-tree).

Forests and Woodlands Butterflies

Southern purple azure (*Ogyris genoveva*) **RARE**
Food host includes *Amyema pendulum* ssp. *pendulum* (Pendulous mistletoe). Larvae closely protected by sugar ants (*Camponotus* spp.).

Ringed xenica (*Geitoneura acantha*) **RARE** in SA; common in Eastern States
Feed on native grasses, in SA only lives in damp sheltered gullies of the Mount Lofty Ranges.

Common brown (*Heteronympha merope*)
Feeds on native and introduced grasses.

Heath ochre (*Trapezites phigalia*) **VULNERABLE**
Host plant includes several species of *Lomandra*. Exists mainly in conservation parks of Adelaide Hills.

Grassland Butterflies
Grassland copper (*Lucia limbaria*) **RARE in SA**
Host plants include *Oxalis perennans*. Larvae are attended to by ants of the genus *Iridomyrmex*.

Common grass-blue (*Zizina labradus*)
Native hosts include pea flowers (eg *Cullen* spp.), but also introduced legumes such as lucerne, peas and beans.

Rare white spot skipper (*Trapezites luteus*) **VULNERABLE in SA**
Extinct in the Adelaide region, recently found in the mid-north of SA. Host plant includes *Lomandra* spp., including *Lomandra densiflora* ssp. *dura*.

White veined grass-skipper (*Herimosa albovenata*)
Host plant includes *Austrostipa scabra* and *A. eremophila*.

Mallee Butterflies
Small bronze azure (*Ogyris otanes*) **VULNERABLE**
Host plant is *Choretrum glomeratum*. Larvae are attended to by *Camponotus terebrans* (sugar ant).

Dusky blue (*Candalides hyacinthinus*)
Host plants are the different species of *Cassytha* (dodder).

Fiery jewel (*Hypochrysops ignita*)
Extinct in the Adelaide region but remains on Yorke Peninsula, Flinders Ranges, Eastern Mallee and Eyre Peninsula. Host plants include *Choretrum* spp., *Acacia* spp. (including *Acacia pycnantha*). Remains vulnerable overall. The presence of *Iridomyrmex* ants are important for this species long-term survival.

Wetland Butterflies
Gahnia spp. are integral to the survival of wetland species of butterflies.

Varied sedge-skipper (*Hesperilla donnysa delos*)

Golden-haired sedge-skipper (*Hesperilla chrysotricha*) **RARE in SA**
Uncommon elsewhere.

Yellowish sedge-skipper butterfly (*Hesperilla flavescens flavia*)
This butterfly, dependent on host plant *Gahnia filum* is possibly extinct in the region. Nearest population is on Yorke Peninsula; however, this may be a separate subspecies (Coleman & Coleman 2000).

Moths

In South Australia there is a far greater diversity of moths than butterflies. This diversity in the moth fauna is repeated both at the regional and national level (McQuillan & Forrest 1985). Listed below are 114 species of commonly seen moths, seven of which are introduced and marked with ✸. The list and annotations on food plants are from McQuillan & Forrest (1985).

In most instances, feeding occurs only in the larval stage of development. This stage of development is considered important as it provides a food resource to higher animals, and contributes to the important ecosystem process of herbivory (McQuillan & Forrest 1985). The adult stage of most moths feed mainly at night, thus avoiding predation by birds. Bats however, being nocturnal rely heavily on moths as an important food source.

HEPIALIDAE
Barti moth (*Trictena argentata*)
Foodplant: *Eucalyptus* spp. especially *Eucalyptus camaldulensis*

Pindi moth (*Abantiades marcidus*)
Foodplants: *Eucalyptus camaldulensis*

Blackburn's aenetus moth (*Aenetus blackburnii*)

COSSIDAE
Giant wood moth (*Xyleutes liturata*)
Foodplants: *Eucalyptus* spp. especially *Eucalyptus camaldulensis*

Cossid moth (*Ptilomacra senex*)
Foodplants: *Xanthorrhoea semiplana*

Marbled cossid moth (*Archaeoses polygraphus*)

TORTRICIDAE
Light brown apple moth (*Epiphyas postvittana*)
Foodplants: **Arctotheca calendula, *Citrus reticulata, *Lycopersicon esculentum, *Malus domestica, Olearia* spp., **Pisum sativum, *Prunus armeniaca, *Rosa* spp., **Rubus* spp., **Sonchus oleraceus, *Vitus vinifera*

Maroon epitymbia moth (*Dichelia isoscelana*)
Foodplants: dead eucalypt leaves.

Lucerne leaf roller (*Merophyas divulsana*)
Foodplants: a range of introduced species. No recorded native food plants.

✸**Codling moth** (*Cydia pomonella*)
Foodplants: **Cydonia oblonga, *Juglans regia, *Malus domestica*

✸**Cotton tipworm** (*Crocidosema plebejana*)

PSYCHIDAE
Faggot case moth (*Clania ignobilis*)
Foodplants: *Eucalyptus* spp.

Ribbed case moth (*Hyalarcta nigrescens*)
Foodplants: *Eucalyptus* spp. especially saplings of *E. cladocalyx*

TINEIDAE
Black monopis moth (*Monopis ethelella*)
Foodplants: decomposing animal fibres such as fur and wool

Blotched monopis moth (*Monopis meliorella*)
Foodplants: probably animal fibre or refuse of plant origin.

Detritus moth (*Opogona amoscopa*)
Foodplants: damp dead plant material (eg rotting leaves, moist decaying bark and wood)

CHOREUTIDAE
Small thistle moth (*Tebenna bradleyi*)
Foodplants: **Carduus* spp.

PLUTELLIDAE
✱ **Cabbage moth** (*Plutella xylostella*)
Foodplants: **Brassica* spp.

COLEOPHORIDAE
✱ **Clover casebearer moth** (*Coleophora frischella*)
Foodplants: **Trifolium repens*, **Medicago* spp.

STATHMOPODIDAE
Eriococcus moth (*Stathmopoda melanochra*)
Foodplants: Living gum tree scales, *Eriococcus* spp., including *E. coriaceus*

Yellow stathmopoda moth (*Stathmopoda crocophanes*)
Foodplants: leaf litter

OECOPHORIDAE
Philobota moth or **pasture tunnel moth** (*Philobota productella*)
Foodplants: grasses including lawn grasses

Impletella moth (*Philobota impletella*)

Common eupselia moth (*Eupselia carpocapsella*)
Foodplants: *Eucalyptus odorata, E. obliqua*, probably other *Eucalyptus* spp. too

Spotted kunzea moth (*Tanyzancla argutella*)
Foodplants: *Kunzea* spp..

Golden leaf moth (*Wingia aurata*)
Foodplants: *Eucalyptus* spp. including *Eucalyptus odorata*

Barea moth (*Barea banausa*)

Hemisema moth (*Machaeritis hemisema*)

Large winter leptocroca moth (*Leptocroca sanguinolenta*)

XYLORYCTIADE
Fruit tree borer (*Cryptophasa melanostigma*)
Foodplants: *Acacia* spp., **Prunus* spp..

STENOMIDAE
Grey agriophara moth (*Agriophara cinerosa*)
Foodplants: *Eucalyptus* spp.

GELECHIIDAE
Common protolechia moth (*Protolechia aversella*)
Foodplants: likely to be *Eucalyptus* spp.

Striped protolechia moth (*Protolechia straifera*)
Foodplants: *Eucalyptus* spp..

✱**Potato tuber moth** (*Phthorimaea operculella*)
Foodplants: Solanaceae, especially *Solanum tuberosum*; also *Lycopersicon esculentum*

CASTNIIDAE
Orange-spotted castniid (*Synemon sophia*)
Foodplants: *Lepidosperma carphoides*

ZYGAENIDAE
Satin-green forester (*Pollanisus viridipulverulentis*)
Foodplants: *Hibbertia stricta, H. sericea*

LIMACODIDAE
Painted cup moth (*Doratifera oxleyi*)
Foodplants: *Eucalyptus* spp., including *E. odorata, *E. cladocalyx, E. camaldulensis, E. leucoxylon*

Orange cup moth (*Pseudanapaea trigona*)
Foodplants: *Eucalyptus odorata*

PYRALIDAE
Australian water moth (*Nymphula nitens*)
Foodplants: unspecified aquatic plants

Pasture webworm (*Hednota longipalpella*)
Foodplants: various native and introduced grasses (eg **Hordeum* spp., **Bromus* sp., **Triticum aestivum, *Secale cereale*

Pasture webworm (*Hednota panteucha*)
Foodplants: a variety of plants

Pasture webworm (*Hednota pedionoma*)
Foodplants: various grasses

Pasture webworm (*Hednota relatalis*)
Foodplants: grasses

Weed web moth (*Loxostege affinitalis*)
Foodplants: a wide variety of low dicotyledons eg *Atriplex* spp., **Echium plantagineum, *Medicago sativa, Solanum tuberosum*

Cabbage-centre moth (*Hellula hydralis*)
Foodplants: **Brassica oleracea*

Tree lucerne moth (*Uresiphita ornithopteralis*)
Foodplants: **Sophora microphylla, *Cytisus proliferus, *Teline stenopetala*

Beet webworm (*Hymenia recurvalis*)
Foodplants: **Amaranthus* spp., *Atriplex* spp., **Beta vulgaris, Chenopodium* spp., *Portulaca* sp.

Golden metallarcha moth (*Metallarcha diplochrysa*)
Foodplants: unrecorded, but possibly associated with *Beyeria leschenaultii*

✱**Meal moth** (*Pyralis farinalis*)
Food: damp, decaying vegetable matter, especially moist grain and straw

Pyrastis moth (*Epipaschia pyrastis*)
Foodplants: *Eucalyptus leucoxylon, E. odorata*

Etiella moth (*Etiella behrii*)
Foodplants: **Lupinus* sp., immature seeds and seed pods of **Medicago* spp., **Medicago sativa, *Trifolium subterraneum*

***Indian meal moth** (*Plodia interpunctella*)
Foodplants: wide variety of stored food products (eg desiccated coconut, biscuits, flour, dried fruit)

PTEROPHORIDAE
Xerodes plume moth (*Stangeia xerodes*)

GEOMETRIDAE
White-margined eois (*Eois albicosta*)
Foodplants: **Polygonum aviculare;* native hosts unknown

Plantain moth (*Scopula rubraria*)
Foodplants: **Plantago lanceolata;* native hosts unknown

Lucas' emerald (*Chlorocoma assimilis*)
Foodplants: *Acacia myrtifolia, A. pycnantha, *A. saligna*

Common gum emerald (*Gelasma semicrocea*)
Foodplants: *Eucalyptus* spp., including *E. odorata*

Red-lined geometrid (*Crypsiphona ocultaria*)
Foodplants: *Eucalyptus odorata, E. camaldulensis, E. leucoxylon*

Hakea moth (*Oenochroma vinaria*)
Foodplants: *Grevillea* spp., including **G. robusta, G. ilicifolia* and *Hakea* spp., including *H. rostrata*

Common heath moth (*Dichromodes ainaria*)
Foodplants: not recorded, but probably includes myrtaceous shrubs such as *Leptospermum* or *Baeckea*.

Filata moth (*Chloroclystis filata*)

Apple looper (*Chloroclystis laticostata*)
Foodplants: *Acacia* spp., **Malus domestica*

Dark grey flat (*Microdes squamulata*)
Foodplants: **Acacia mearnsii, *A. baileyana.*

Subidaria moth (*Xanthorhoe subidaria*)
Foodplants: **Medicago* spp., including **M. polymorpha; *Beta vulgaris*

Native cranberry moth (*Asthena pulchraria*)
Foodplants: *Astroloma humifusum.* Probably other Epacridaceae too.

Penthearia moth (*Boarmia penthearia*)
Foodplant: *Acacia pycnantha*

Dodonaea moth (*Parosteodes procurata*)
Foodplant: *Dodonaea viscosa*

Twig looper (*Ectropis excursaria*)
Foodplants: *Acacia ligulata, A. pycnantha, *A. saligna, Bursaria spinosa, Senna artemisioides, *Eucalyptus cladocalyx, Exocarpus cupressiformis, Hardenbergia violacea, *Hedera helix, Pelargonium* sp., *Polygonum aviculare, Pultenaea largiflorens, *Ribes nigrum, *Schinus molle, *Thuja* sp.

Gastrinodes moth (*Gastrinodes bitaeniaria*)
Foodplant: *Eucalyptus odorata*

Chlenias moths (*Chlenias* spp.)
Foodplants: ver diverse, Including species from the genera *Acacia, Beyeria, Bursaria, Calytrix, *Camellia, Cassytha, *Chrysanthemoides* (see p.109), *Cryptandra, Dillwynia, Dodonaea, *Eriobotrya, Eucalyptus, *Genista, Grevillea, Hakea, Olearia, *Pinus, *Prunus, Pultenaea* and *Rhagodia*

Lucerne hopper (*Zermizinga indocilisaria*)
Foodplants: **Cupressus* sp., *Leptospermum* sp.

Bracken moth (*Idiodes apicata*)
Foodplant: *Pteridium esculentum*

Pasture looper moth (*Ciampa arietaria*)
Foodplants: **Arctotheca calendula, *Erodium* sp., *Medicago sativa*; native food plants not known

Fucata gum moth (*Plesanemma fucata*)
Foodplant: *Eucalyptus odorata*

Autumn gum moth (*Mnesampela privata*)
Foodplants: *Eucalyptus camaldulensis, *E. globulus, E. leucoxylon, E. obliqua, E. odorata*

Angled satin moth (*Thalaina angulosa*)
Acacia pycnantha, A. brachybotrya, Senna artemisioides

Crested teatree moth (*Lophothalaina habrocosma*)
Foodplant: *Leptospermum myrsinoides*

Macrocosma moth (*Niceteria macrocosma*)
Foodplant: *Eucalyptus odorata*

Milvaria moth (*Amelora milvaria*)
Foodplants: *Acacia myrtifolia, A. pycnantha, Calytrix tetragona, Chrysanthemoides monilifera* (see p.109), *Exocarpus cupressiformis, *Eucalyptus ficifolia, Hakea rugosa, Leptospermum myrsinoides, Olearia ramulosa, Pultenaea largiflorens*

Leucaniata moth (*Xantholepidote leucaniata*)
Foodplant: **Polygonum aviculare;* native foodplants unknown

LASIOCAMPIDAE
Wattle snout moth (*Digglesia australasiae*)
Foodplants: *Acacia pycnantha, *A. saligna, Exocarpus cupressiformis*

Gum snout moth (*Entometa fervens*)
Foodplants: **Eucalyptus erythrocorys, E. leucoxylon, E. odorata*

ANTHELIDAE
Toothed anthelid (*Anthela basigera*)
Foodplants: grasses

Eyespot anthelid (*Anthelid ocellata*)
Foodplant: native and introduced grasses (eg **Lolium perenne*)
SATURNIIDAE
Helena gum moth (*Opodiphthera helena*)
Foodplants: *Eucalyptus odorata, E. fasciculosa, E. baxteri, *Betula* sp.

SPHINGIDAE
Vine hawk moth (*Hippotion celerio*)
**Emex* spp., **Impatiens* spp., **Vitis vinifera, *Zantedeschia aethiopica*

Coprosma hawk moth (*Hippotion scrofa*)
Foodplants: **Coprosma repens, Epilobium* sp., **Fuchsia* sp., **Impatiens* spp., *Ipomoea* sp.

Convovulus hawk moth (*Agrius convolvuli*)
Foodplants: *Convovulus* spp., *Ipomoea* sp., **Merremia dissecta*

NOTODONTIDAE
Inclyta prominent moth (*Hylaeora inclyta*)
Foodplant: *Eucalyptus obliqua*

Banksia moth (*Danima banksiae*)
Foodplants: *Banksia marginata, Hakea rostrata, H. rugosa*

THAUMETOPOEIDAE
Common epicorma moth (*Epicorma melanosticta*)
Foodplant: *Eucalyptus odorata*

Boisduval's autumn moth (*Oenosandra boisduvalii*)
Foodplant: *Eucalyptus odorata*

LYMANTRIIDAE
Painted apple moth (*Teia anartoides*)
Foodplants: *Acacia pycnantha, *A. saligna, *Betula* sp., *Exocarpus cupressiformis, Hardenbergia Violetta, *Lantana camara, *Malus domestica, Pelargonium* sp., **Prunus* spp., **Rosa* sp.

Tussock moth (*Acyphas leucomelas*)
**Acacia armata, A. pycnantha, *A. saligna, Dodonaea viscosa, Eucalyptus odorata, Exocarpus cupressiformis, Myoporum viscosum, *Pinus radiata*

Mistletoe browntail moth (*Euproctis edwardsii*)
Amyema spp., mostly growing on *Eucalyptus leucoxylon* and *E. odorata; Exocarpus cupressiformis*

ARCTIIDAE
Magpie moth (*Nyctemera amica*)
Foodplants: *Senecio* spp..

Glatigny's tiger moth (*Spilosoma glatignyi*)
Foodplants: **Acanthus mollis, Arctotheca calendula, *Chaenomeles speciosa, *Chrysanthemum frutescens, *Chrysanthemoides monilifera, *Echium plantagineum, *Genista maderensis, Olearia ramulosa, *Oxalis pes-caprae, Pelargonium* sp., **Plantago lanceolata, Pultenaea largiflorens, *Taraxacum officinale, *Vitis vinifera*

Heliotrope moth (*Utetheisa pulchelloides*)
Foodplants: **Echium plantagineum, *Heliotropium europaeum, Myosotis arvensis*

Red footman moth (*Scoliacma bicolora*)
Foodplants: primarily *Pottia* sp. (moss) on bare patches of ground in thickets of *Acacia pycnantha* or in *Eucalyptus* forest. Also liverworts and some lichens on rocks or on the ground in open forest.

Clouded footman (*Xanthodule ombrophanes*)
Foodplants: algae and lichens

NOLIDAE
Gum-leaf skeletonizer (*Uraba lugens*)
Foodplants: *Eucalyptus camaldulensis, E. leucoxylon, *Tristania conferta*

NOCTUIDAE
Green-blotched moth (*Cosmodes elegans*)
Foodplant: *Lobelia* sp.

Bogong moth (*Agrotis infusa*)
Foodplant: **Brassica* spp., **Daucus carota* and other vegetables.

Brown cutworm (*Agrotis munda*)
Foodplants: **Beta vulgaris, *Brassica* spp., *Lycopersicon esculentum, *Medicago* spp., *Mentha* sp., *Solanum tuberosum.*

Tobacco looper (*Chrysodeixis argetifera*)
Foodplants: **Brassica oleracea, *Lycopersicon esculentum, Pelargonium* sp., *Solanum tuberosum, *Vicia* sp.

Granny moth or **large brown house moth** (*Dasypodia selenophora*)
Foodplant: *Acacia* spp.

Rough bollworm (*Earias perhuegeli*)
Foodplant: Malvaceae, including *Alygone* sp., **Abutilon* sp., *Hibiscus trionum, Hibiscus* sp., *Sida* spp..

Native budworm (*Heliothis punctiger*)
Foodplant: **Antirrhinum* sp., **Dianthus caryophyllus, *Lycopersicon esculentum, *Medicago sativa, *Papaver* sp., **Pisum sativum*

Black winter noctuid (*Corrha pandesma*)
Foodplant: *Acacia pycnantha*

Southern armyworm or **barley-grub** (*Persectania ewingii*)
Foodplants: **Hordeum leporinum, *H. vulgare, *Lolium perenne, *Triticum aestivum*

Streaked rictonis moth (*Rictonis tortisigna*)
Foodplants: native and introduced grasses

Pasture day moth (*Apina callisto*)
Foodplants: **Arctotheca calendula, *Malva* sp., *Rumex* sp., *Plantago lanceolata*

Grapevine moth (*Phalaenoides glycina*)
Foodplants: *Epilobium* sp., **Fuchsia* sp., *Hibbertia stricta, *Oenothera hookeri, *Vitis quinquefolia, *V. vinifera*

Water Beetles

The following list was compiled following discussions with Chris Watts of the SA Museum.

Family **DYTISCIDAE**
Subfamily **Laccophilinae**
Tribe **Hyphydrini**
Hyphydrus elegans

Tribe **Bidessini**
Allodessus bistrigatus
Liodessus amabilis
Liodessus praelargus
Liodessus schuckhardi
Gibbidessus chipi

Tribe **Hydroporini**
Paroster sharpi
Chostonectes gigas
Chostonectes nebulosus
Antiporus bakewelli
Antiporus blakei
Antiporus femoralis
Antiporus gilberti
Sternopriscus hansardi
Sternopriscus maedfooti
Sternopriscus multimaculatus
Sternopriscus tasmanicus
Sternopriscus tarsalis
Sternopriscus wehnckei
Necterosoma dispar
Necterosoma penicillatum
Necterosoma undecimlinaeatus
Megaporus gardeneri
Megaporus hammatus
Megaporus howitti
Paroster gibbi
Paroster insculptis
Paroster nigroadumbratus

Subfamily **Colymbetinae**
Tribe Agabini
Platynectes decempunctatus
Platynectes aenrscens
Platynectes bakewell
Platynectes reticulosus

Tribe **Colymbetini**
Rhantus suturalis
Lancetes lanceolatus

Tribe **Copelatini**
Copelatus australiae
Copelatus elongatulus
Copelatus ferrugineus Sharp
Copelatus punctipennis
Copelatus simplex Clark

Subfamily **Dytiscinae**
Tribe **Dytiscini**
Hyderodes schuckardi (disappeared from the Hills, possibly was on the Adelaide Plains, remains in Victoria)

Tribe **Eretini**
Eretes australis

Tribe **Cybistrini**
Onychohydrus scutellaris

Family **HYDROPHILIDAE**
Subfamily **Hydrophilinae**
Tribe **Berosini**
Berosus australiae
Berosus duplopunctatus
Berosus majusculus
Berosus nutans
Berosus veronicae
Berosus discolor
Berosus duplopunctatus
Berosus queenslandicus

Tribe **Anacaenini**
Paracymus pygmaeus
Paranacaena horni

Tribe **Oocyclini**
Subtribe **Acidocerina**
Helochares tristis
Enochrus deserticola
Enochrus elongatus
Enochrus maculiceps
Enochrus eyrensis
Enochrus samae

Subtribe **Hydrobiina**
Limnoxenus zealandicus

Subtribe **Hydrophilina**
Hydrophilus albipes
Hydrophilus brevispina
Hydrophilus latipalpus (has not been observed in the region in recent years)

Spiders

The following table contains 190 species of spiders that are known to occur on the Adelaide Plains (nine of which are introduced and marked ✱). However, the total number of species is expected to be more than 450-500, as many spiders currently found in the region are either undiscovered for the region or undescribed. The list and associated habitat preference was compiled by David Hirst of the SA Museum. Little information is available regarding the ecology of spiders in the survey area; consequently, habitat preferences are non-specific and information regarding conservation status and threatening processes is poor. A general discussion of threats within the Adelaide region follows.

Many of the spiders within the Adelaide region are ground dwellers, and are dependant on a 'natural' soil surface. Consequently, leaf litter, fallen wood and undisturbed soil are fundamental components in providing suitable habitat. Parks with extensive areas of introduced lawn and little leaf litter (eg most suburban parks, Torrens Linear Park) are likely to provide poor habitat for our native spiders.

Spiders like most animal species have some natural predators. For example, some native birds and wasps are known to eat spiders as a component of their diet. However, the introduced Eurasian Blackbird (*Turdus merula*) is now the main predator of native spiders. Apart from a few soft fruits, blackbirds feed on worms, insects and spiders found at the soil surface or just below it. They systematically cover a large area of ground, removing leaves and twigs to gain access to invertebrates underneath.

An additional introduced predator is slowly becoming recognised as a threat to native invertebrates, including spiders. The **European Wasp** (*Vespula germanica*), usually considered a pest because of its nuisance to humans is increasingly proving itself as a fierce predator of native invertebrates.

It is believed that a reduction of numbers of blackbirds and European wasps would lead to a reduction of overall predation on native spiders, thus ameliorating the overall effects of excessive predation.

Taxon	Habitat
MYGALOMORPHAE	
TUBERCULOTAE	
Barychelidae	
Idiommata scintillans (**brush-footed trapdoor**)	coastal scrub
Nemesiidae	
Aname diversiclor (**black wishbone**)	undisturbed mallee
Aname (*Chenistonia*) *tepperi*	hills, woodland, well drained situations
Stanwellia nebulosa (**southern pebble spider**)	undisturbed areas, ie creek banks
Stanwellia sp.	Aldinga
Teyloids bakeri	high rainfall areas, hills
Hexathelidae	
Hadronyche adelaidensis (**Adelaide funnel web**)	undisturbed areas, ie creek banks
FORNICEPHALAE	
Actinopodidea	
Missulena insignis (**mouse spider**)	foothills
Idiopidae	
Aganippe modesta (**4-spot trapdoor**)	foothills
Aganippe pelochroa (**4-spot trapdoor**)	foothills
Aganippe smeatoni (**4-spot trapdoor**)	foothills and south coast
Aganippe subtristis (**4-spot trapdoor**)	undisturbed soil

Blakistonia aurea (**Adelaide trapdoor**)	undisturbed soil
Misgolas andrewsi	hills, woodland, damp situations
Misgolas sp.	Mount Crawford Forest
	–

ARANEOMORPHAE

HAPLOGYNES

Filistatidae	
Wandella murrayensis	under bark, occasionally in buildings
Dysderidae	
✸*Dysdera crocata* (**slater-eater**)	gardens, under objects
Segestriidae	
Segestria sp.	under bark, tunnels in rock faces
Loxoscelidae	
✸*Loxosceles rufescens* (**fiddle back**)	locally common in old houses
Oonopidae	
Gamasomorpha banksi (**6-eyed spiders**)	small, rare, leaf litter
Gamasomorpha clarki (**6-eyed spiders**)	small, rare, leaf litter
Pholcidae	
✸*Pholcus phalangioides* (**daddy long-legs**)	common in buildings
Physocyclus sp. (**native daddy long-legs**)	mainly in foothills
Scytodidae	
✸*Scytodes perfecta* (**spitting spider**)	uncommon, old buildings

ENTELOGYNES

Amphinectidae	
Penaoola madida	unknown-described from single specimen
Anyphaenidae	
Amaurobioides isolatus (**littoral spider**)	rocky coastlines at high tide mark
Cyclotenidae	
Taxopsiella sp.	small, rare, leaf litter
Oecobiidae	
Oecobius annulipes (**money spider**)	house walls etc.
Agelenidae	
✸*Tegenaria domestica*	rare, old buildings
Desidae	
Badumna insignis (**black house spider**)	under bark, crevices, buildings
Badumna longinquus	webs in foliage of shrubs, trees
Forsterina sp.	sparse web under rocks, logs in hills
Phryganoporus candidus	nest and web in foliage of shrubs
Desis kenyonae (**marine spider**)	marine, on reefs exposed at high tide
Hahniidae	
Alistra spp.	under bark, Eucalypts, litter
Scotospilus bicolor	under bark, Eucalypts
Miturgidae	
Miturga spp. (**lined spider**)	near ground, under objects
Uliodon velox (**lined spider**)	leaf litter
Pisauridae	
Dolomedes habilis (**water spider**)	rivers, creeks, ponds
Stiphidiidae	
Baiami loftiensis	damp areas, foothills, sheltered situations
Corosoides australis (**platform spider**)	
Stiphidium facetum (**hammock spider**)	rock overhangs, tree hollows, uncommon

Zoridae	
Argoctenus sp. (**ground spider**)	litter
Hestimodema sp. (**ground spider**)	leaf litter
CLUBIONIDES	
Clubionidae	
Cheiracanthium gracile (**pale-sac spider**)	foliage of shrubs, trees
Cheiracanthium mordax (**pale-sac spider**)	shrubs, houses
Cheiracanthium spp. (**pale-sac spider**)	foliage of shrubs, trees
Clubiona cycladata (**sac spider**)	under bark
Clubiona robusta (**sac spider**)	under bark
Clubiona spp. (**sac spider**)	under bark
Supunna picta	ant-mimic, fast moving, ground or trees
Supunna spp.	ant-mimic, fast moving, ground or trees
Corinnidae	
Corinnomma sp.	ant-mimic, fast moving, ground or trees
Gnaphosidae	
Anzacia mustecula (**ground spider**)	buildings, tree trunks
Anzacia sarrita (**ground spider**)	buildings, tree trunks
Ceryerda sp. (**ground spider**)	sheltered places on ground
Hemicloea spp. (**flat spider**)	under bark or in narrow crevices
Molycria or *Myandria* sp.	under rocks, bark etc.
Rebilus sp. (**flat-rock spider**)	narrow crevices, sheet rock, foothills
Hersiliidae	
Tamopsis eucalypti (**two-tailed spider**)	tree trunks
Tamopsis fickerti (**two-tailed spider**)	tree trunks
Tamopsis raveni (**two-tailed spider**)	tree trunks
Tamopsis reevesbyana (**two-tailed spider**)	tree trunks
Heteropodidae	
Delena cancerides (**communal huntsman**)	base of tree trunks, under slabs of bark
Eodelena loftiensis (**huntsman**)	rolled bark, Loftia Park, ?rare
Holconia murrayensis (**huntsman**)	under bark of large *Eucalyptus camaldulensis*
Isopeda leishmanni (**huntsman**)	under bark, in buildings, southern foothills
Isopedella cerussata (**huntsman**)	under bark, northern areas
Isopedella leai (**huntsman**)	under bark, common in buildings
Isopedella woodwardi (**huntsman**)	high rainfall areas
Keilira sparsomaculata (**huntsman**)	Aldinga and south of
Neosparassus calligaster (**badge huntsman**)	rare in South Australia, southern, shrubs
Neosparassus diana (**badge huntsman**)	uncommon, in shrubs of southern areas
Neosparassus spp. (**badge huntsman**)	uncommon, in low shrubs
Lamponidae	
Lampona cylindrata (**white-tailed spider**)	under bark, in houses
Lycosidae	
Lycosa egena (**wolf spider**)	coastal, high tide mark on sandy beaches
Lycosa gilberta (**wolf spider**)	uncommon in urban areas, lives in burrows
Lycosa ?godeffroyi (**wolf spider**)	uncommon, southern areas only, burrows
Lycosa leuckartii (**wolf spider**)	uncommon in urban areas, lives in burrows
Lycosa senilis (**wolf spider**)	common in gardens, shallow burrows
Lycosa speciosa (**wolf spider**)	common in gardens, shallow burrows
Lycosa stirlingae (**wolf spider**)	uncommon, northern rural areas
Trabaela spp. (**wolf spider**)	common in gardens, shallow burrows
Trachosa expolita impedita (**wolf spider**)	common in gardens, shallow burrows
Trachosa martensii (**wolf spider**)	creeks, swamps, hills
Trachosa tristicula phegeia (**wolf spider**)	common in gardens, shallow burrows

Venonia sp. (**wolf spider**)	
Oxyopidae	
Oxyopes dingo (**lynx spider**)	low herbaceous plants, uncommon in south
Oxyopes mundulus (**lynx spider**)	common in gardens, foliage of low plants
Oxyopes rubicundus (**lynx spider**)	low herbaceous plants, uncommon in North
Phiodromidae	
?Philodromus sp.	Rarely collected, shrubs
Salticidae	
Abracadabrella lewistoni (**jumping spider**)	under bark, small, flat
Breda jovialis (**jumping spider**)	under bark of eucalypts, houses
Clynotis viduus (**jumping spider**)	under bark of eucalypts, houses
Damoetus sp. (**jumping spider**)	ant mimic
Helpis minitabunda (**jumping spider**)	under bark of eucalypts, houses
Helpis occidentalis (**jumping spider**)	under bark of eucalypts, houses
Helpis sp. (**jumping spider**)	under bark of eucalypts, houses
Holoplatys fusca (**jumping spider**)	under bark of eucalypts
Holoplatys planissima (**jumping spider**)	under bark of eucalypts
Hypoblemum sp. (**jumping spider**)	near ground or on low herbs etc
Jotus sp. (**jumping spider**)	near ground or on low herbs
Ligonipes sp. (**jumping spider**)	ant mimic, on eucalypts etc.
Lycidas spp. (**jumping spider**)	near ground or on low herbs
Maratus spp. (**jumping spider**)	near ground or on low herbs
Margaromma sp. (**jumping spider**)	on ground, leaf litter
Myrmararchne cuperea (**jumping spider**)	ant mimic, on eucalypts
Ocrisiona leucocomis (**jumping spider**)	under bark of eucalypts, houses
Ocrisiona melancholica (**jumping spider**)	under bark of eucalypts, houses
Opisthoncus ?alborufescens (**jumping spider**)	foliage of shrubs
Prostheclina sp. (**jumping spider**)	shrubs, uncommon
Rhombonotus sp. (**jumping spider**)	ant mimic, on eucalypts
Saitis taeniatus (**jumping spider**)	near ground or on low herbs
Saitis volans (**jumping spider**)	near ground or on low herbs
Servea vestita (**jumping spider**)	under bark, *Eucalyptus camaldulensis*
Simaetha sp. (**jumping spider**)	uncommon, often on Euc. Foliage, hills
Simaethula sp. (**jumping spider**)	uncommon, often on Euc. Foliage, hills
Sondra sp. (**jumping spider**)	leaf litter
Thomisidae	
Bomis larvata (**crab spider**)	uncommon, often on Euc. Foliage, hills
Cymbacha festiva (**crab spider**)	uncommon, often on Euc. Foliage, hills
Cymbacha sp. (**crab spider**)	frequently on foliage of Eucalypts
Diaea cruentata (**flower spider**)	flowering shrubs
Diaea pilula (**flower spider**)	flowering shrubs
Hedana valida (**crab spider**)	frequently on foliage of Eucalypts
Sidymella sp. (**flower spider**)	common, near ground or on low herbs etc.
Sidymella trapezia (**flower spider**)	common near ground or on low herbs
Stephanopis cambridgei (**crab spider**)	under bark of eucalypts
Tharpyna campestrata (**crab spider**)	under bark of eucalypts
Tharpyna diademata (**crab spider**)	under bark, Eucalypts, uncommon
Zodariidae	
Cyrioctea sp. (**ground spider**)	rare, Aldinga
Habronestes bradleyi (**ground spider**)	ant mimic
Habronestes spp. (**ground spider**)	leaf litter
Storena cyanea (**ground spider**)	base of tree trunks or under objects

SYMPHYTOGNATHOIDEA	
Hadrotarsidae	
?genus	minute, leaf litter, or under rocks etc.
Uloboridae	
Philoponella congregabilis	communal, moist shady areas of garden
Nicodamidae	
Ambicodamus leei (**red & black spider**)	foothills, coastal cliffs
Nicodamus peregrinus (**red & black spider**)	uncommon, relatively undisturbed areas
ULOBOROIDEA	
Deinopidae	
Deinopis schomburgki (**net-casting spider**)	low shrubs
ARANEOIDEA	
Araneidae	
Arachnura higginsi (**orb-weaver**)	foothills, sheltered shrubs
Araneus eburnus (**orb-weaver**)	low vegetation
Araneus psittacinus (**orb-weaver**)	web is usually in contact with evergreen trees
Araneus bradleyi (**orb-weaver**)	enamelled spider, uncommon
Araneus eburnus (**orb-weaver**)	low vegetation
Araneus psittacinus (**orb-weaver**)	web is usually on evergreen trees, citrus
Araneus spp (**orb-weaver**)	low vegetation
Araneus viridipes (**orb-weaver**)	evergreen trees, especially eucalypts
Argiope protensa (**orb-weaver**)	low vegetation
Argiope trifasciata (**orb-weaver**)	sedges etc, are favoured sites
Carepalxis sp. (**orb-weaver**)	on branches, at rest resemble nodes
Celaenia atkinsoni (**orb-weaver**)	few records, on silk lines, shrubs
Celaenia calotoides (**orb-weaver**)	only one record from Windsor Gardens
Celaenia kinbergi (**orb-weaver**)	frequently found on citrus trees
Cylosa trilobata (**orb-weaver**)	webs in low vegetation
Dolophones spp. (**orb-weaver**)	on thin branches, at rest resemble nodes
Eriophora biapicata (**common garden orb-weaver**)	trees, shrubs, clotheslines
Eriophora heroine (**orb-weaver**)	open grassy areas, low shrubs
Eriophora pustulosus (**orb-weaver**)	high rainfall or moist areas, foothills
Gasteracantha minax (**spiny or christmas spider**)	swamps, wet areas, foothills
Larinia tabida (**orb-weaver**)	nocturnal webs, grasses etc. hills, coastal
Paraplectanoides crassipes (**orb-weaver**)	rare, Aldinga (also on Kangaroo Island)
Linyphiidae	
✱*Diplocephalus cristatus* (**midget spider**)	introduced (Cox Scrub only record)
Eperigone fradeorum (**midget spider**)	introduced, uncommon
Eperigone prominens (**midget spider**)	introduced, common
Laperousea ?quindecimpunctata (**midget spider**)	small sheet webs in shrubs, hills
Laperousea cupidinea (**midget spider**)	small sheet webs in shrubs
Microctenonyx subitaneus (**midget spider**)	introduced, a few records
Ostearius melanopygius (**midget spider**)	cosmopolitan, damp places, under rocks
Tetragnathidae	
Nephila edulis (**golden orb-weaver**)	often high in mallee or other trees
Phonognatha graeffei (**leaf-curling spider**)	in low vegetation
Tetragnatha sp. (**long-jawed spider**)	usually over or near water
Theridiidae	
Achaearanea properum (**tangle-web spider**)	often on tree trunks
Achaearanea spp. (**tangle-web spider**)	foliage or buildings

✸*Achaearanea tepidariorum*	in buildings
Achaearanea veruculata (**tangle-web spider**)	bushes, fences etc.
Argyrodes antipodianus (**dew-drop spider**)	kleptoparsitic in webs of larger spiders
Argyrodes flagellum (**whip spider**)	undergrowth
Dipoena sp.	minute, moist areas
Euryopis sp.	eucalyptus, prey on ants
Latrodectus hasseltii (**red-back**)	web in contact with ground
Phoroncidia sextuberculata	uncommon, ?tree trunks, branches
Phoroncidia trituberculata	uncommon, ?tree trunks, branches
✸*Steatoda capensis*	mostly in gardens
✸*Steatoda grossa* (**cupboard spider**)	mostly indoors
Steatoda spp.	close to ground, uncommon
PALPIMANOIDEA	
Micropholcommatidae	
Micropholcomma longissima	minute, moist areas, leaf litter, hills
Micropholcomma sp.	minute, moist areas, leaf litter, hills
Textricella luteola	minute, moist areas, leaf litter, hills
Mimetidae	
Arcys simsoni (**triangular spider**)	foliage of Eucalypts, hills
Australomimetus aurioculatus (**private spider**)	invades webs of other small spiders, hills
Pararchaeidae	
Pararchaea sp.	rare, minute, high rainfall, hills

4.5 Nationally Significant Species of the Adelaide Metropolitan Area

Extensive habitat loss from urbanisation and agriculture, and other threatening processes have caused the extinction of many plants and animals of the Adelaide Metropolitan Area. The following is a list of nationally significant species found in the Adelaide Metropolitan Area. Detailed descriptions are given for all of those that are nationally threatened (ie endangered or vulnerable). For a full list of native plants and their conservation ratings at each level see Appendix 2 (p.139). Definitions to the codes used for conservation ratings are explained in Appendix 3 (p.154).

Taxa	Status			see page...
	AUS	SA	SL	
PLANTS				
Caladenia behrii **pink-lip spider-orchid**	E	E	E	100
Caladenia gladiolata **bayonet spider-orchid**	E	E	E	100
Caladenia rigida **stiff white spider-orchid**	E	E	E	100
Cullen parvum **small scurf-pea**	E	E	E	100
Euphrasia collina ssp. *osbornii* **Osborn's eyebright**	E	E	E	101
Glycine latrobeana **clover glycine**	V	V	V	101
Halosarcia flabelliformis **bead samphire**	V	V	V	101
Olearia pannosa ssp. *pannosa* **silver daisy-bush**	V	V	V	101
Prasophyllum pallidum **pale leek-orchid**	V	V	V	102
Pterostylis arenicola **sandhill greenhood**	V	V	E	102
Pterostylis cucullata **leafy greenhood**	V	V	V	102
BIRDS				
Acanthiza iredalei ssp. *iredalei* **Slender-billed Thornbill**	V	V	V	103
Halobaena caerulea **Blue Petrel**	V	V	V	103
Neophema chrysogaster **Orange-bellied Parrot**	E	E	E	103

Descriptions of Nationally Threatened Species

pink-lip spider-orchid *Caladenia behrii*	AUS	E
	SA	E
	SL	E

Briggs & Leigh (1995) indicate this species is endemic to the Southern Mount Lofty Ranges. However, Lang & Kraehenbuehl (1998) indicate this species once occurred in the Northern Lofty Ranges, but has since become extinct.

The following information on habitat requirements and threats is based on information found in Bickerton (1999). *Caladenia behrii* occurs on loamy soils (Bates (1994) cited in Bickerton 1999) in *Eucalyptus goniocalyx/ E. obliqua/ E. fasciculosa* or *E. obliqua/ E. microcarpa/ E. fasciculosa* Woodland, and usually on moderate slopes.

Although once widespread and relatively common, this species is now known to comprise of only 2000 mature individuals in two small and disjunct areas, more than 25km apart. It is found in several NPWSA Parks in the metropolitan area- Para Wirra Conservation Park, Scott Creek Conservation Park and Belair National Park. Two individuals occur on private property in Belair.

The species is very sensitive to grazing by native and introduced herbivores. Herbivory by kangaroos and "woolly bear" caterpillars accounts for most of the grazing pressure. It is also sensitive to competition from weeds, in particular boneseed, bridal creeper and blackberry. Habitat fragmentation resulting from vegetation clearance for housing and agriculture has resulted in extinctions of some populations and a decline in others. Other threats include road works, vehicular activity, illegal collection and trampling by mountain bike riders, horses and bushwalkers. Due to current threatening processes, of the 20 populations in existence, only four are presently viable. The specific primary threats to the population at Belair National Park are caterpillars, snails and boneseed.

bayonet spider-orchid *Caladenia gladiolata*	AUS	E
	SA	E
	SL	E

Caladenia gladiolata is a South Australian endemic species (Briggs & Leigh 1995), confined to the Mount Lofty Ranges and Southern Flinders Ranges (Davies 1995).
Lang & Kraehenbuehl (1998) list the species as endangered throughout its range.

This species is found in only two conservation reserves- Mount Remarkable National Park and Scott Creek Conservation Park. A population of this species became extinct in the Tothill Ranges in the 1970s, and now is found at only one other locality outside of NPWSA areas.

In 1997, following advice from the Endangered Species Scientific Subcommittee the conservation rating of *Caladenia gladiolata* was upgraded from Vulnerable to Endangered.

This species is known to be threatened by grazing from feral rabbits (Biodiversity Group 1999a).

stiff white spider-orchid *Caladenia rigida*	AUS	E
	SA	E
	SL	E

An endemic species to the Southern Mount Lofty Ranges, that is generally found in higher rainfall regions under *Eucalyptus obliqua* Open Forest, *E. obliqua – E. goniocalyx* Open Forest, and *E. leucoxylon* Open Forest, Low Open Forest, and Low Woodland (Long 1999).

This species is found in three NPWSA areas- Para Wirra Conservation Park, Belair National Park and Scott Creek Conservation Park. The strongest populations are around the Para Wirra, Chain of Ponds area; the populations around Belair and Scott Creek are poor and at risk of extinction (Doug Bickerton *pers. comm.*).

Flowers are pollinated by small native bees (*Exoneura* spp.).

Caladenia rigida has suffered decline in numbers primarily because of clearance of habitat, grazing and weed invasion. Rabbits are a perceived threat to this species (Environment Australia 2000). Other threats include reduction in native bee populations due to competition from introduced honeybees, (*Apis mellifera*) collection by orchid enthusiasts, expansion of reservoirs and use of fertilisers and herbicides (Bates 1995).

small scurf pea *Cullen parvum*	AUS	E
	SA	E
	SL	E

At the time of European settlement this species occurred on the western slopes and plains of the Mount Lofty Ranges, approximately between Spalding and Willunga. This species was also found in central and eastern Victoria, and near Wagga

Wagga in New South Wales (Davies 1986). It has since become extinct in New South Wales (Briggs & Leigh 1995).

Aside from the Southern Lofty region, several other regions in South Australia also support populations of *Cullen parvum*. Eastern SA, Flinders Ranges, Northern Lofty all have populations of this species. This small pea-flowered herb is endangered throughout its range in South Australia (Lang & Kraehenbuehl 1998).

Cullen parvum has been observed to grow with several plant associations. Davies (1986) lists the South Australian populations of *Cullen parvum* growing in *Callitris gracilis* (syn. *C. preissii*) Woodland and amongst exotic species. It is also known to grow in the Adelaide region in *Eucalyptus microcarpa* Woodland.

This species has recently been afforded protection following the gazetting of Mokota Conservation Park, in the mid-north (Graham 2000). However, it is not afforded protection in any NPWSA areas in metropolitan Adelaide. It is found in three locations in the metropolitan area- two are owned by local council, the other is owned by SA Water

This species is threatened by competition from introduced weeds. As it occurs on deep fertile soils (Davies 1986), it has suffered extensive habitat destruction through land clearing.

Osborn's eyebright *Euphrasia collina* ssp. *osbornii*	AUS	E
	SA	E
	SL	E

Euphrasia collina ssp. *osbornii* is a South Australian endemic species. It is still found in the Northern Mt Lofty Ranges, Yorke Peninsula, Kangaroo Island and the South East, and it is considered to be endangered in all these regions. It is extinct on Eyre Peninsula. Within the Southern Lofty region this species is found in Eric Bonython Conservation Park, Montacute Conservation Park and one heritage agreement site (Briggs & Leigh 1995). The population at Montacute Conservation Park is the only population in the metropolitan area that is afforded protection in a NPWSA reserve. It is found on private property in one other locality in the metropolitan area. No recovery plan to date.

clover glycine *Glycine latrobeana*	AUS	V
	SA	V
	SL	V

In South Australia *Glycine latrobeana* is found in the Southern Mount Lofty Ranges, the South-east (Vulnerable in these regions) and the Northern Mount Lofty Ranges (Endangered in this region). It is also found in Victoria and Tasmania (Briggs & Leigh 1995). In the Southern Mount Lofty Region, this species is found in association with *Eucalyptus viminalis* Woodland and Open Woodland, *Eucalyptus goniocalyx* grassy Woodland, and *Eucalyptus fasciculosa* Low Open Forest. It is found at 11 locations in the Mount Lofty Ranges (Long 1999). Within the metropolitan area, this species is found at three locations- Belair National Park, Scott Creek Conservation Park and Mount George Conservation Park. No recovery plan has been prepared for this species.

bead samphire *Halosarcia flabelliformis*	AUS	V
	SA	V
	SL	V

In South Australia, this species is found on Eyre Peninsula (Vulnerable); Northern Lofty Ranges (Threatened); Yorke Peninsula (Threatened) and in the Southern Lofty Ranges (Vulnerable) (Lang & Kraehenbuehl 1998). It is also found in northwest Victoria.

Halosarcia flabelliformis is found on coastal saltmarshes (Graham 2000) and inland in the mallee region (DEST 1996).

The main threats to this species have been identified as recreational activities, rubbish dumping, and the community perception that tidal saltmarsh communities are simply "wasteland" (Graham 2000).

silver daisy-bush *Olearia pannosa* ssp. *pannosa*	AUS	V
	SA	V
	SL	V

In South Australia this species is found on Eyre Peninsula (Threatened), Flinders Ranges (Vulnerable), Murray (Vulnerable), Northern Lofty (Vulnerable), South-east (Threatened), Southern Lofty (Vulnerable) and Yorke Peninsula (Vulnerable) (Lang & Kraehenbuehl 1998). It is also found in central Victoria (Briggs & Leigh 1995). In the Southern Lofty region, *Olearia pannosa* ssp. *pannosa* is offered protection in Spring Gully Conservation Park, Black Hill Conservation Park and two heritage agreements. Of these Southern Lofty populations, only the population at Black Hill Conservation Park falls inside the

metropolitan area. No recovery plan has been prepared.

The population of *Olearia pannosa* ssp. *pannosa* growing at Black Hill Conservation Park is found under *Eucalyptus odorata* Woodland. The population is dwindling due to poor recruitment and until recently there has been little success in propagation (Kieran Brewer *pers. comm.*).

pale leek-orchid *Prasophyllum pallidum*	AUS	V
	SA	V
	SL	V

In South Australia *Prasophyllum pallidum* is found in the Flinders Ranges, Northern Lofty Region and in the Southern Lofty Region; it is Vulnerable in all of these regions (Lang & Kraehenbuehl 1998). It is endemic to these regions (Davies 1986).

In the Mount Lofty Ranges *Prasophyllum pallidum* can be found in a variety of habitats- *Eucalyptus leucoxylon* Open Forest, Low Open Forest, and Low Woodland; *Eucalyptus goniocalyx* Woodland, *Eucalyptus fasciculosa* Low Woodland, and Low Open Woodland; *Eucalyptus microcarpa* Woodland; and *Callitris gracilis* (*syn. C. preissii*)- *Eucalyptus fasciculosa* Low Open Forest (Davies 1986).

Briggs & Leigh (1995) indicate that the species is conserved in nine NPWSA Conservation Reserves in the Southern Lofty region, five of which fall in the Adelaide Metropolitan Area- Anstey Hill Recreation Park, Belair National Park, Ferguson Conservation Park, Onkaparinga River National Park and Scott Creek Conservation Park. The NPWSA Reserves database also lists this species as being found in Black Hill Conservation Park. In addition, this species is also found at a local council reserve in the metropolitan area.

The flowers of *Prasophyllum pallidum* are pollinated by native wasps, which puncture the labellum to obtain secretions produced by the flower (Davies 1986). The species occurs at higher densities in regenerating vegetation that has recently been burnt (Davies 1986).

The population in Belair National Park is threatened by rabbit grazing, invasion by weeds, illegal removal (Davies 1986) and recreational pressures (Davies 1995). The main weed threats to this population are **boneseed** (*Chrysanthemoides monilifera*), **harlequin flower** (*Sparaxis bulbifera*) and **bridal creeper** (*Asparagus asparagoides*) (Davies 1995).

Actions (from Davies 1986)

- research into the habitat requirements of the native wasp species which pollinate *Prasophyllum pallidum*
- Research into the desired fire regime of *Prasophyllum pallidum.*

sandhill green-hood orchid *Pterostylis arenicola*	AUS	V
	SA	V
	SL	E

Pterostylis arenicola is endemic to South Australia. Herbarium records indicate this species is found near Tailem Bend in the Murray Mallee, south-east of Langhorne Creek and at the Grange Golf Course on the Adelaide Plains (Davies 1992). It is offered protection in the Coorong National Park (Briggs & Leigh 1995; Jusaitis & Smith 1999).

In the Adelaide Metropolitan Area, *Pterostylis arenicola* is found only at the Grange Golf Course, on the red sand dunes and under *Callitris gracilis* (*syn. C. preissii*) Low Woodland. Davies (1992) indicated that at the Grange Golf Course it is threatened by trampling, collectors and reserve maintenance activities. Jusaitis & Smith (1999) list competition from *Pennisetum macrourum* (African feather grass), *Oxalis pes-caprae* (soursob), *Ehrharta calycina* (Perennial veldt grass), *Lagurus ovatus* (Hare's tail grass) and *Arctotheca calendula* (cape weed), as well as grazing from hares and rabbits as the main threats to the population at the Grange Golf Course.

Annual weed removal and monitoring occurs at the Grange Golf Course by volunteers from the Native Orchid Society of South Australia and the Adelaide Plains Flora Association. These activities are assisted by DEH staff.

- Recovery plan commenced in 1991 (Jusaitis 1991)

leafy greenhood orchid *Pterostylis cucullata*	AUS	V
	SA	V
	SL	V

In South Australia *Pterostylis cucullata* can only be found in the Mount Lofty Ranges; it was once found in the South-east, but is now considered extinct in that region. Populations remain in New South Wales, Victoria and Tasmania (Briggs & Leigh 1995). In South Australia, the only substantial population is found in Belair National Park. Outside of Belair National Park, this species is found in six small, threatened populations (Davies 1995). One of

these is protected in Scott Creek Conservation Park. The species has been observed in *Eucalyptus obliqua* Open Forest and *Eucalyptus leucoxylon, E. viminalis* Open Forest (Davies 1986).

The primary threat to these populations is weed invasion (Davies 1995), with the main species of concern being *Chrysanthemoides monilifera* (boneseed), *Genista monspessulana* (Montpellier broom), *Hedera helix* (ivy), *Asparagus asparagoides* (bridal creeper), *Olea europaea* (Olive), *Phalaris aquatica* (phalaris), *Rubus fruticosis* L. agg. (blackberry), *Ulex europaeus* (Gorse) and the non-indigenous native *Pittosporum undulatum* (Sweet pittosporum). Davies (1995) also lists horse-riding as a threat to this species.

Actions (from Davies 1995)

- Divert horse- trail through more suitable area
- Continue with weeds control measures

Slender-billed Thornbill *Acanthiza iredalei* ssp. *rosinae*	AUS	V
	SA	V
	SL	V

Acanthiza iredalei ssp. *rosinae* is endemic to the northern shores of the Gulf of St Vincent in South Australia (SAOA 1977 in Garnett & Crowley 2000).

There are two other subspecies of this Thornbill; each has part of its distribution in South Australia. *Acanthiza iredalei* ssp. *iredalei* is found in the southern arid zone of Australia, from Shark Bay in Western Australia across the Nullarbor Plain to Spencer Gulf in South Australia (Garnett & Crowley 2000). *Acanthiza iredalei* ssp. *hedleyi* is found in a fragmented distribution across Big and Little Deserts, Victoria and Ninety Mile Plain, SA and some isolated occurrences in south-eastern South Australia (Garnett & Crowley 2000).

The local subspecies of the Slender-billed Thornbill inhabits samphire shrublands along coastal saline mudflats. It is threatened by loss of habitat caused by reclamation of salt flats for recreational and industrial purposes. Other threats include marina development and seawater inundation of habitat resulting from a rise in sea level (Garnett & Crowley 2000).

Blue petrel *Halobaena caerulea*	AUS	V
	SA	V
	SL	V

Oceanic species, which breeds on offshore stacks around Macquarie Island and possibly Heard Island. Also breeds on subantarctic islands in the Indian and Atlantic Islands (outside of Australian territory). Forages around breeding sites, but found throughout the Southern Ocean.

Nests in colonies, rock crevices and burrows dug among rocks or tussock grass *Poa foliosa*. Forages in subantarctic waters for pelagic crustacea, fish, cephalopods and insects. Threatened by predation from **Subantarctic Skuas** (*Catharacta antarctica*), Black Rats (*Rattus rattus*) and Feral Cats (*Felis catus*).

As this species is likely to come to land anywhere in South Australia only if injured or exhausted there are really no on ground conservation activities that can be implemented in South Australia to aid this species.

Garnett & Crowley (2000) list the Australian breeding population of this animal as **CRITICALLY ENDANGERED.**

Orange-bellied Parrot *Neophema chrysogaster*	AUS	E
	SA	E
	SL	E

Prior to the 1920s this animal was reported to be common and locally abundant throughout its range. Today, with only 180 mature individuals alive, in just one sub-population, the Orange-bellied Parrot is one of Australia's most threatened birds (Garnett & Crowley 2000).

This animal breeds in the south-west of Tasmania, migrating to the mainland in mid-march, where individuals disperse east to coastal Gippsland and west as far as Lake Alexandrina (OBPRT 1999). Its habitat includes saltmarshes, coastal dunes, pastures, shrublands, estuaries, islands, beaches and moorlands where the animal feeds on the seeds and fruits of grasses, chenopods, sedges and herbs (OBPRT 1998). In Victoria, the main sources of food come from shrublands dominated by **Beaded Glasswort** (*Sarcocornia quinqueflora*) and **Shrubby Glasswort** (*Sclerostegia arbuscula*). In the Adelaide area, this habitat type is found at a variety of locations including Torrens Island Conservation Park, Onkaparinga Estuary Recreation Park, Little Para Estuary and Port Gawler Conservation Park.
During the SAOA Atlas this animal was sighted once in the survey area at Nappyalla on the edge of Lake Alexandrina. There were no sightings in the metropolitan area during this survey. Despite sightings west of the Murray mouth being very rare, one bird was seen in the Noarlunga region in July

1999 (Jon Starkes *pers. comm.*). Several other sightings have previously occurred in the Adelaide area.

In the metropolitan area suitable habitat (although highly fragmented) for this nationally significant bird is found at Onkaparinga Estuary Recreation Park, Little Para Estuary, Torrens Island, Buckland Park, Port Gawler Conservation Park and small areas in the Golf Courses on the old Reedbeds.

It is believed that the reason for population decline are primarily due to fragmentation of wintering habitat. Specifically, destruction of saltmarsh feeding grounds has been due to urbanisation, industrial development, agricultural development and recreational activities (OBPRT 1998). Other threats to this animal include trapping for aviculture, predation by cats and foxes and competition for food by introduced finches such as the **European Goldfinch** (*Carduelis chloris*) and **European Greenfinch** (*Carduelis carduelis*), **Rabbits** (*Oryctolagus cuniculus*) and **Starlings** (*Sturnus vulgaris*) (OBPRT 1999).

The protection, management and creation of winter habitats are key management actions that are required for the conservation of this species (Garnett & Crowley 2000).

5 Threats and Management

Many different land uses occur in the physical area considered in this plan (see p.13), and with each different land use comes a suite of threats to biodiversity. However, the primary threat to biodiversity in the Adelaide Metropolitan Area is common to all the different land uses. Habitat fragmentation in the Adelaide region due to clearing of native vegetation for residential development and farming has resulted in a few small islands of remnant vegetation in a sea of suburbia and agriculture. Indeed, the clearance of native vegetation poses the greatest threat to terrestrial biodiversity (SOEAC 1996).

Other threats to biodiversity in the Adelaide Metropolitan Area include:

- excessive **herbivory** of native plants from introduced and native animals;
- excessive competition from **introduced plants**;
- direct competition for food and shelter from **introduced animal pests** such as rabbits, European carp, feral honey bees, and starlings;
- introduced **predators** such as dogs, cats, foxes and trout;
- **introduced diseases**;
- **collection of firewood** from remnant vegetation;
- altered **fire regimes**;
- **inappropriate management** activities;
- **water extraction/pollution.**

The process of fragmentation has the immediate and obvious effect of species loss and associated habitat loss, with the consequent death of plants and animals. Other impacts of fragmentation include fluxes of radiation, wind, water and nutrients (Hobbs & Saunders 1993); restricted ability to recover following disturbance (Hobbs *et al.* 1993); increased susceptibility to invasions by exotic flora and fauna; disruption of ecosystem processes (Saunders *et al.* 1991); and inbreeding depression (Lunney & Recher 1986). Many patches of remnant vegetation are too small to ensure long-term viability of plant and animal populations.

5.1 Herbivory

Rabbits, goats, donkeys, horses, sheep and cattle are the main introduced vertebrate herbivores in Australia. Sheep and cattle are of course managed to meet the needs of humans, but their impact on the environment is often negative and substantial. Rabbits have adapted well to the Australian environment and have existed in the wild with self-sustaining populations.

Rabbits (*Oryctolagus cuniculus*)

Competition and land degradation by feral rabbits is listed in Schedule 3 of the Endangered Species Protection Act 1992 as being a key threatening process (Environment Australia 2000). Furthermore, rabbits eat crops and pastures and compete with herbivores used in primary production. Rabbits have adapted to a wide range of habitats and now inhabit approximately 60% of the country (Biodiversity Group 1999a). It has been shown that rabbits inhibit regeneration of native vegetation, compete with native fauna for food and shelter, support populations of introduced canids and felids, and cause soil erosion. Rabbits are a known and perceived threat to many plants and animals listed under Schedule 1 of the *Endangered Species Protection Act 1992*. Species that once occurred or still occur naturally in the Adelaide area, are on Schedule 1 of the above Act and are threatened by rabbits include:

- **Greater Bilby** (*Macrotis lagotis*) (known threat)
- **Burrowing Bettong** (*Bettongia lesueur*) (perceived threat)
- **bayonet spider-orchid** (*Caladenia gladiolata*) (known threat)
- **Stiff white spider-orchid** (*Caladenia rigida*) (perceived threat;)

For more than a century, attempts to control rabbits have been implemented, with varying degrees of success.

While eradication is not possible, there are ways of reducing their impact on the environment. The National Threat Abatement Plan (Biodiversity Group 1999a) aims to reduce the impact of rabbits on the Australian environment by:

- implementing rabbit control programs in specific areas of high conservation priority;
- encouraging the development and use of innovative humane rabbit control methods;

- educating land managers and relevant organisations to improve their knowledge of rabbit impacts and ensure skilled and effective participation in control activities; and
- collecting and disseminating information to improve understanding of the ecology of rabbits in Australia, their impacts and methods to control them.

These broad objectives are expected to filter through to individual landholders. However, the basic methods of controlling rabbits have not changed. The recently released Rabbit calicivirus disease (RCD) has proven to be successful in reducing rabbit numbers, but its effects are more dramatic in some areas compared with others. Biological control agents such as RCD and myxomatosis are not intended to control rabbits on their own. Traditional control methods such as fumigation, ripping, fencing, and baiting will continue to be a fundamental component of rabbit control. Consequently, "...[R]abbit control will have to continue for the foreseeable future and the costs of control will be significant" (Biodiversity Group 1999a).

Domestic Stock

The grazing of domestic stock, in particular sheep, goats and cattle, on native vegetation is more widespread in other regions, but still occurs in the Adelaide Metropolitan Area. Horses are particularly common in and east of the Hills Face Zone. Damage to native vegetation from grazing by domestic stock occurs through:

- stock selectively grazing palatable native species
- destruction of soil surface crust and compaction from the hard hooves of domestic stock
- favouring weed species through changes in soil nutrients resulting from faecal deposition
- preventing regeneration through selectively grazing seedlings
- facilitating the spread of weeds into remnant vegetation through stock fur and dung
- ringbarking of plants.

It must be recognised that biodiversity conservation is not in direct conflict with stock grazing. Indeed primary production is dependant on functioning ecosystems, of which biodiversity is a fundamental component (see section 1.2). Furthermore, retention of remnant vegetation benefits primary producers through more obvious and tangible ways such as prevention of increasing salinity, erosion control, provision of shelter to stock etc.

Managers of primary production land have a significant opportunity to contribute to biodiversity conservation at the same time as enhancing their long-term viability. Fencing of remnant vegetation, management of stocking levels and strategic placement of watering points can all benefit their long-term viability as well as biodiversity conservation.

5.2 Environmental Weeds

Weeds have a wide range of impacts on remnant vegetation. They compete with native plants for light, space, soil moisture, pollinators and nutrients. Weeds can form a dense cover and smother emerging native plant seedlings. They can change habitats through extra shade and alterations to the soil (Robertson 1994).

Following a survey of 15 people with expertise in our local biodiversity a list of key weed species posing threats to biodiversity has been compiled. The five weeds constituting the most serious threats to biodiversity across the Adelaide Metropolitan Area are:

- **olive** (*Olea europaea*)
- **bridal creeper** (*Asparagus asparagoides*)
- **boneseed** (*Chrysanthemoides monilifera*)
- **phalaris** (*Phalaris aquatica*)
- **blackberries** (*Rubus fruticosis* L.agg.)

A non-exhaustive list of other plant species posing a threat to Adelaide's biodiversity are provided on page 107.

Other weeds posing a threat to Adelaide's biodiversity include:

- **three cornered garlic** (*Allium triquetrum*)
- **alligator weed** (*Alternanthera philoxeroides*) WONS
- **cabomba** (*Cabomba caroliniana*) **WONS**
- **tagasaste** (*Chamaecytisus palmensis*)
- **hawthorn** (*Crataegus* spp.)
- **couch** (*Cynodon* spp.)
- **English broom** (*Cytisus scoparius*)
- **salvation jane** (*Echium plantagineum*)
- **perennial veldt grass** (*Ehrharta calycina*)
- **tree heath** (*Erica* spp.)
- **fennel** (*Foeniculum vulgare*)
- **desert ash** (*Fraxinus rotundifolia*)
- **galenia** (*Galenia* spp.)
- **Montpellier broom** (*Genista monspessulana*)
- **cape tulip** (*Homeria* spp.)
- **coolatai grass** (*Hyparrhenia hirta*)
- **box thorn** (*Lycium ferocissimum*)
- **monadenia orchid** (*Monadenia bracteata*)
- **African furze** (*Muraltia heisteria*)
- **Chilean needle grass** (*Nassella neesiana*) **WONS**
- **soursob** (*Oxalis pes-caprae*)
- **kikuyu** (*Pennisetum clandestinum*)
- **radiata pine** (*Pinus radiata*)
- **rice millet** (*Piptatherum miliaceum*)
- **sweet pittosporum** (*Pittosporum undulatum*)
- **buckthorn** (*Rhamnus alaternus*)
- **castor oil plant** (*Ricinus communis*)
- **salvinia** (*Salvinia molesta*) **WONS**
- **South African daisy** (*Senecio pterophorus* var. *pterophorus*)
- **sparaxis** (*Sparaxis* spp.)
- **gorse** (*Ulex europaeus*) **WONS**
- **bulbil watsonia** (*Watsonia meriana* cv. *Bulbillifera*)
- **pasture grasses** Many different species

WONS= Weed of National Significance. These weeds have been identified as having significant impact on biodiversity, farming, cultural and other values. They have been identified by analysing each weeds:

- invasiveness and impact characteristics,
- potential and current area of spread, and
- current primary industry, environmental and socioeconomic impacts.

Weeds as with native plants, have particular preferences for habitat types. Consequently, weeds found at one locality may not be found at another.

Clearly, this list does not represent all of the plants that have naturalised and pose a problem to remnant vegetation in the Adelaide area. A comprehensive species list database of all NPWSA reserves, council reserves and other remnant areas in the Adelaide Metropolitan Area compiled for this study, shows that within the Adelaide area, more than a third of all plants found in NPWSA reserves and council reserves are exotic. Many of these plants do not currently pose a threat to biodiversity. However, they may pose a threat to biodiversity in the future. Species which appear benign for many years and then spread rapidly following certain natural events such as flood, fire, drought or climate change, or a change in land or water management are termed 'sleepers.' The National Weeds Strategy indicates "...[T]here is a need to recognise and eliminate sleepers during their benign phase or at least identify the events that could turn them into major weeds" (ARMCANZ, ANZECC & FM 1999). Many of these sleepers are found in suburban gardens, botanic gardens, and at the local nursery. If we are to prevent further invasions of weeds into our remnant vegetation, then commitment from all levels of government, land managers and the wider community is required.

This approach is also cost effective, as eradication of plants that are not widespread, is a relatively easy and cheap exercise. Yet, if we wait until these plants are widespread and invading bushland fast, the costs of control will be significant. Furthermore, the costs to the environment will also be great. The difficulty is identifying which species are likely to become a problem in the future. Systematic monitoring of weed spread in an area can be critical in this regard.

Unless otherwise indicated control methods for the following weeds are from Robertson (1994).

European Olive (*Olea europaea* ssp. *europaea*)

The **olive** (*Olea europaea*) was an intentional introduction for horticultural purposes. Indeed, widespread plantings throughout the Adelaide Metropolitan Area have recently occurred following a revival in the olive oil industry. It is unfortunate that a plant that contributes significantly to the state economy is also extremely invasive.

Olives have the capacity to invade a variety of plant communities, and most notably grassy woodlands.

Feral olives are increasing in number in the Hills Face Zone. This is cause for concern, as the Hills Face Zone constitutes more than 30% of the total area of remnant vegetation in the Adelaide area (see section 3.5).

Seedlings and small plants can be removed by either hand-pulling or grubbing. However, it is critical to remove the underground lignotuber as well. This is best done in the winter when the soil is moist and friable. Larger plants must have their stem(s) cut close to the ground, the edges frilled and swabbed with a systemic herbicide. Recent success has also been had by drilling into the truck and injecting with herbicide. Both of these methods do not require the removal of the whole tree, consequently the dead tree will provide perching areas for birds and minimise total disturbance. When using herbicide to control feral olives, best results are obtained in the summer/autumn period.

A strategic approach to where olives groves can and cannot be planted, that considers proximity to remnant vegetation and likelihood of escape will reduce the risk of infestations, contribute to biodiversity conservation and limit the costs associated with control of olive infestations.

Bridal Creeper (*Asparagus asparagoides*)

Bridal creeper has been described as South Australia's "...worst threat to biodiversity..." with "...about half of all terrestrial orchid species found in South Australia...potentially threatened by bridal creeper" (Anon 1999). It is one of 20 weeds of national significance (NWSEC 2000b) and is the most threatening environmental weed in the south-east of South Australia (Croft *et al.* 1999).

Bridal creeper grows rapidly between autumn and spring. Leaves and stems die in the summer, but underground roots persist throughout the year. It invades undisturbed sites and competes with native plants by smothering and displacing them; it also prevents regeneration (Virtue & Jupp 2000).

Bridal creeper is a major threat to understorey species, in particular herbs, lilies and orchids in mallee, dry sclerophyll forest, coastal and heath vegetation (Virtue & Jupp 2000).

While sandy, alkaline soils are particularly favoured, bridal creeper can grow in a variety of soil types. Roadsides are often heavily infested as they receive extra moisture from road run-off, additional nutrients from adjacent paddocks and are not subject to grazing pressure from stock (Virtue & Jupp 2000).

Introduced into Australia as a garden ornamental plant, dispersal is primarily via introduced and native fruit eating birds, that eat the berries and excrete seeds. Rabbits and foxes are also known to eat and disperse the seeds (Willis 2000).

Control of this species is difficult and time consuming. Priority must be given to preventing the establishment of bridal creeper in unaffected areas (Willis 2000). While the general principle of working in least affected areas first applies to virtually all weeds, in areas where infestation is still only in the early stages emphasis must be placed on controlling areas of high berry production.

Isolated plants can be physically removed through hand-pulling or grubbing, preferably before they have seeded. When hand-pulling or grubbing, it is important to remove the underground tubers. Small infestations should be controlled through herbicide application (Willis 2000).

Larger infestations are best controlled by using herbicides and fire. In the absence of fire herbicides alone can still be effective (Wallis 2000). However, in these instances it is important that a strategic staged approach is implemented, so that treated areas are not reinfested (Wallis 2000).

Two biological control agents have recently been released. The leafhopper (*Zygina* sp.) was released in June 1999, and a rust fungus (*Puccinia myrsiphylli*) was approved for release in June 2000. Results of these biological control agents are still being assessed. Other agents are currently being studied in South Africa and in quarantine in Australia (Virtue & Jupp 2000). However, biological control is not a magic bullet, but rather one more weapon that can be used in the fight against this most invasive plant.

Boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*)

Boneseed is a bushy perennial shrub up to 3m high. Originally introduced into Australia as a garden plant in the 1850s, boneseed has also been used in the eastern states to control soil erosion in denuded areas such as sand dunes. Setting seed prolifically in the summer months, the seeds remain viable for at least five years.

Posing a significant threat to biodiversity, boneseed infestations reduce the abundance and diversity of native species and adversely affect the structure and function of natural ecosystems (Thomas 2000). It is for this reason that this plant is considered one of 20 weeds of national significance. Studies in Tasmania show that dense stands of boneseed can significantly effect the availability of food sources and habitat for native birds and animals while favouring introduced animals such as blackbirds and sparrows (DPIW&E 2000).

The capacity of boneseed to proliferate in natural ecosystems results from its rapid growth rate, enormous seed production, long viability of seeds, dispersal mechanisms, lack of predators/pathogens and its adaptability to different environments. Natural ecosystems most susceptible to boneseed infestation include dune heath, grasslands, headlands with heath, mallee and a variety of forests and woodlands (Thomas 2000).

In recognition of its capacity as a highly invasive weed, a national strategy for control of boneseed has recently been released (Thomas 2000).

The primary means of dispersal is via animals such as birds and foxes that eat the seeds and spread them, sometimes up to several kilometres away in their faeces. The seedbank stored in the soil consists of about 800-2500 seeds per square metre, with some seeds remaining viable for more than 10 years (Adair & Ainsworth 2000).

Small boneseed plants are relatively easy to pull up or dig out. Larger ones can be controlled by cutting at the base and swabbing with Glyphosate. The use of fire is also an effective method of control. However, because boneseed has large and persistent seed banks in the soil follow up work for several years is required (Adair & Ainsworth 2000).

Several biological control agents have been released; a couple have returned promising early results (Thomas 2000). Successful biological control agents will not eliminate the need to employ traditional methods of control such as hand pulling, herbicide application and the use of fire.

Phalaris (*Phalaris* spp. especially *P. aquatica*)

Several species of phalaris are capable of reproducing naturally in the environment; however, *Phalaris aquatica* is by far the most serious.

Phalaris is a tall tussocky perennial grass. Typically, it forms dense clumps along creeks and road verges, smothering understorey plants and preventing seedlings from growing.

Phalaris was initially planted as a pasture grass species, however more recently it has been scrutinised for the deaths of stock such as sheep and cattle (Bourke 2000).

Management of this particular weed is best achieved by pulling or grubbing young plants before development of the underground rhizomes and the setting of seeds. In more dense infestations, spraying of the leaves when green will achieve best results.

Blackberry (*Rubus fruticosis* L. agg.)

There are several species of blackberry grouped into the above aggregate, including the most common blackberry weed found in the Adelaide area *Rubus ulmifolius* var. *ulmifolius* (David Cooke *pers. comm.*).

In 1842, blackberry was deliberately introduced to Adelaide for its fruit. It was recognised as being an invasive weed by the 1880s (Pigott & Keel 2000).

Blackberries are a perennial plant, able to invade abandoned waste areas, land managed for pasture, bushland and particularly riparian areas. Blackberries occupy or grow over remnant vegetation thus preventing regeneration (Pigott & Keel 2000).

Dispersal is achieved via a variety of vectors, most frequently foxes and birds. Berries contain about 80 seeds each and are eaten by birds and foxes, who excrete the seeds in their faeces. Seed stored in the soil can be as high as 13,000 per square metre (Bruzzese *et al.* 2000).

Blackberries pose a significant threat to a priority SA plant community- *Leptospermum lanigerum, L. continentale* Swamp Heath (see section 4.2, p.17). The Silky Tea-tree swamp heath occurs predominantly adjacent to permanent water in the high rainfall areas of the Mount Lofty Ranges. It is the habitat for several conservation significant plants and animals. These areas are also frequently invaded by Blackberries.

The plant provides shelter and food for introduced animals such as foxes, starlings and blackbirds. The increased abundance of these animals further impacts native flora and fauna (Pigott & Keel 2000). However, blackberry also provides habitat for some native animals including the **Southern Brown Bandicoot** (*Isoodon obesulus*). In areas where blackberry is providing shelter to native animals, its removal should be a gradual process, so that not all habitat is removed at once. In these instances, assistance to regenerating natives (eg follow-up weed removal) should also occur.

Blackberry is easiest to control in the earliest stages of infestations, as access remains relatively easy. Larger thickets must be treated in stages by spraying with Triclopyr at the edges of infestations. Follow up work is required.

Blackberry has a capacity to invade non-bushland areas also. Control of blackberries in these areas is not a high priority for biodiversity conservation, but is important to reduce re-infestation elsewhere.

5.3 Predation

Cats (*Felis catus*)

Predation by Feral Cats is listed in Schedule 3 of the Endangered Species Protection Act 1992 as a key threatening process (Environment Australia 2000).

The problem associated with Feral Cat predation must not be confused with predation by domestic and stray cats. Several threatened animals are known to be susceptible to Feral Cat predation and Feral Cats are known to have caused the extinction of native animals on some islands (Biodiversity Group 1999b). However, domestic Cats are found generally in the built-up areas where native species that are present are generally common or adaptable species (Biodiversity Group 1999b). Nevertheless, predation by domestic cats is known to impact heavily on urban wildlife, primarily birds.

Species that once occurred naturally in the Adelaide area, are on Schedule 1 of the above Act and are threatened by Feral Cats include:

- **Greater Bilby**
  (*Macrotis lagotis*)
  (known threat)

- **Numbat**
  (*Myrmecobius fasciatus*)
  (known threat)
- **Orange-bellied Parrot**
  Neophema chrysogaster
  (perceived threat)
- **Burrowing Bettong**
  (*Bettongia lesueur*)
  (perceived threat)

Predation by the Feral Cat is not restricted to the above listed species. Therefore, management of Feral Cat predation must involve action to reduce the threat to targeted threatened species ***and*** other native species (Biodiversity Group 1999b).

Cat owners can however, take some actions to reduce the likelihood of their pet killing native wildlife. Measures such as: keeping cats inside at night to prevent the cat from hunting at this time; placing two bells on their collar to alert other animals of their presence; and desexing male and female cats to avoid unwanted kittens, will reduce the adverse impact domestic Cats have on native wildlife.

European Red Fox (*Vulpes vulpes*)

Predation by the European Red Fox is listed in Schedule 3 of the Endangered Species Protection Act 1992 as being a key threatening process (Environment Australia 2000).

Species that once occurred naturally in the Adelaide area, are on Schedule 1 of the above Act and are threatened by the European Red Fox include:

- **Greater Bilby**
  (*Macrotis lagotis*)
  (known threat)
- **Numbat**
  (*Myrmecobius fasciatus*)
  (known threat)
- **Orange-bellied Parrot**
  Neophema chrysogaster
  (perceived threat)

Predation by the European Red Fox is not restricted to the above listed species. Therefore, management of fox predation must involve action to reduce the threat to targeted threatened species ***and*** other native species (Biodiversity Group 1999c).

Some might be surprised to hear that foxes are known to inhabit urban areas. However, reliable anecdotal evidence suggests that the European Red Fox can be found throughout the metropolitan area, not just on the urban fringe. Foxes utilise the main riparian corridors such as Dry Creek, Little Para River and River Torrens. They are known to occur at the Adelaide Airport, on the golf courses, South Parklands and West Terrace Cemetery. They have even been sighted in the central business district (Phil Stott *pers. comm.*).

Programs addressing the threat of the European Red Fox need to recognise:

> ... that foxes cannot be eradicated over most of their Australian range using current techniques and financial resources. Abatement of the threat they pose must initially be undertaken in discrete manageable areas...Fox control will have to be ongoing for the foreseeable future and therefore must make the best use of available resources.
>
> (Biodiversity Group 1999c)

5.4 Inappropriate Management

The inappropriate management of remnant vegetation and the biodiversity contained within it is proving to be a serious threat to the overall biodiversity of the region.

Inappropriate management is a broad threat that includes management of land for a particular incompatible type of landuse (eg managing remnant vegetation for mountain bike riding), specific management practices (eg slashing grass for fire prevention), and can also include the absence of any type of management (eg failing to manage weeds in an undeveloped reserve). While legislation such as the *Native Vegetation Act 1991* and parts of the *Development Act 1993* offer remnant vegetation some protection from clearance, there is no legislative support that protects remnant vegetation from inappropriate management.

Intensive Recreation Perhaps the most common form of inappropriate management is allowing excessive and/or intensive recreation in sensitive remnant vegetation areas. This threat to biodiversity is a uniquely urban threat, simply due to the close proximity of large numbers of people to remnant vegetation. While the public is entitled to well-planned quality open space, some areas are inappropriate for most recreational activities. On the surface, someone walking his or her dog through a local council park does not appear to be a threat to biodiversity. However, walkers can carry plant diseases and weed seeds; the dog may defecate, encouraging weeds and polluting a local creek, and the mere presence of an animal such as a dog can

affect the feeding of native animals. Moreover, when one considers the possibility of this happening many times in one day, the diversity and severity of threats become significant.

Mountain bike riding and horse riding are also worthy of particular attention. Each of these recreational activities can have detrimental impacts on remnant vegetation.

While people from each of these groups are entitled to good quality, safe and enjoyable areas of open space to undertake their chosen form of recreational activity, just where this should occur requires careful planning on behalf of decision-makers. Given that only 12.5% of native vegetation remains:

- we need to conserve and actively manage what remains, and
- there is almost 90% of the Adelaide region that does not have remnant vegetation on it- much of this is open space and can be used for more intensive or active types of recreation.

In those areas where particular types of recreation are incompatible with the conservation of biodiversity, measures should be taken to educate the public on why these areas are unsuitable for certain activities. For example, when part of a local park is fenced off from the public for management purposes, this should be accompanied with signage that addresses the importance of remnant vegetation, why the area is fenced off and how the public can further contribute to conservation of local patches of remnant vegetation. These initiatives need to be accompanied with the development of suitable recreation facilities for the activities in non-sensitive areas.

Management Practices Some areas of remnant vegetation are subject to specific, albeit, well intentioned detrimental management practices. For example, many local parks that contain remnant vegetation are slashed for fire prevention measures. However, the timing and method of slashing can quite easily be altered with little impact on the need to protect lives and property.

The threat of inadequate management is compounded by lack of information dissemination. Where the information and adequate understanding on how remnant vegetation should be managed exists in the minds of those making the management decisions, it needs also to be disseminated to those staff actually doing the field work (see section "Field Operators" p.117).

The work at popular Beaumont Common is a good example of how a local government can provide residents with open space that meets local recreational needs, conserves biodiversity through appropriate management and educates the public on the importance of local patches of remnant vegetation.

5.5 Introduced Diseases

Disease is an integral component of functioning ecosystems. However, exotic diseases can threaten remnant vegetation; in particular scattered trees and degraded areas.

Root-rot fungus (*Phytophthora* spp.)

There are more than 50 known species of *Phytophthora*, but *Phytophthora cinnamomi* is the most common form of this parasitic fungus. It is a soil-borne pathogen that kills a range of native plants by attacking their root system. It can be found in all Australian states and in many climatic zones. It is believed that *P. cinnamomi* first entered Australia on the roots of cultivated plants, shortly after European settlement. Species at most risk are from the families Proteaceae, Epacridaceae, Leguminosae and Myrtaceae; however, not all genera from these families are susceptible (Croft *et al.* 1999). In the Adelaide Metropolitan Area, it is most abundant in Cleland Conservation Park.

In undisturbed vegetation, *Phytophthora cinnamomi* generally occurs in locations receiving more than 600mm of annual rainfall. It is believed that in South Australia alone, tens of thousands of hectares are affected by *P. cinnamomi* (Commonwealth of Australia 1999a).

P. cinnamomi is capable of dispersing naturally in very moist, well aerated soils. Water travelling downslope can increase the boundaries of infection by a few hundred metres per year. *P. cinnamomi* is most likely to occur in moist sites such as gullies, creeks, drains and culverts. If established on ridges and upper slopes, then areas downslope will become infected over time. There remain however, other vectors most commonly associated with human activities. Road building and maintenance, timber harvesting, mineral exploration, the nursery trade and recreational activities such as bushwalking, mountain bike riding and horse riding are the most important (Commonwealth of Australia 1999a).

Establishment success is influenced by population levels in the soil from an infected area and total amount of soil transferred. At the point of delivery survival, establishment and further spread is dependant on sufficient moisture and the presence of living host tissue (Commonwealth of Australia 1999a).

Several methods are available to reduce the spread of this species. The "Draft Threat Abatement Plan for Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)" (Commonwealth of Australia 1999a) describes the following in detail:

- preventing invasion,
- reducing the pathogen's spread by vectors, and
- reducing the pathogen's activity.

There is no cure for *P. cinnamomi*. The most tangible means of reducing the spread of this disease is by washing down vehicles, equipment and shoes that have been working in and adjacent infected areas, and restricting access to infected areas (particularly when soil is very moist).

Other measures to control the spread of *Phytophthora cinnamomi* include:

- coordination of works in infested areas when soils are dry;
- ensuring all imported materials have been subject to hygiene procedures; and
- education of field staff and general public (Velzeboer *et al.* 2000).

Mundulla Yellows

The disease Mundulla Yellows affects a range of Australian plants, but primarily eucalypts. Early symptoms include an uneven yellowing affecting the outer part of a limb or a segment of the crown. This is followed by dieback of affected shoots with a progression of yellowing inwards towards the centre of the crown; the yellow leaves may develop red-brown spots and may become distorted. Later stages include "panic growth" where the affected plant produces many new shoots below the infected area and the plant eventually dies (University of Adelaide 1999). While it may take more than 10 years, observations so far indicate that eventual death is inevitable (Paton & Cutten 1999)

Little is known of this recently discovered disease. However, it represents a serious potential threat to remnant vegetation as well as forestry and revegetation projects (Commonwealth of Australia 2000b).

It was first noticed by a local apiarist working in and around the upper South East town of Mundulla in the late 1970s (Cotton 1999). In South Australia alone it can be found in an area greater than 25,000 km^2. There are unconfirmed reports indicating that this disease may also be present in other Australian states (Commonwealth of Australia 2000b).

Current research indicates that this disease is both biotic and contagious. Possible causes that are currently being investigated include endo-parasitic pathogens such as viruses and phytoplasmas (John Randles *pers. comm.*). It is suggested that the wide and scattered distribution of this disease indicate that it is spread through aerial transmission (University of Adelaide 1999). There are also suggestions that this disease has other non-biotic causes such as herbicide use and vehicular diesel fumes (Peter Bennett *pers. comm.*). Results from seedlings that have been grafted with infected tissue support the hypothesis that a pathogen is involved (John Randles *pers. comm.*).

While in South Australia, the disease appears most prolific in and around the South East, trees at several localities throughout the Adelaide Metropolitan Area also show symptoms of this disease (John Randles *pers. comm.*). These include the Adelaide city parklands, the foothills, Waite Arboretum, roadsides in the southern region and Cobbler Creek Recreation Park.

Given that this disease represents such a significant potential threat to biodiversity and that its origins are unknown; the obvious action at this stage is a significant input of resources into researching the disease, its causes, means of spread and management.

6 Recommendations and Implementation

The Regional Biodiversity Plan for the metropolitan area seeks to guide community and Government agencies. For implementation to be successful, specific and concerted efforts by all land managers are required. The following actions are of particular importance:

- retention of remnant vegetation
- restoration and regeneration of remnant vegetation
- revegetation with appropriate species and genotypes in high priority areas
- construction and management of wildlife corridors.

6.1 Native Vegetation Conservation

Retention

With little more than 12% of the total native vegetation remaining in the Adelaide Metropolitan Area, all remnant vegetation is considered important. Intact remnant vegetation has many types of plants, from grasses and shrubs to trees, which in turn support many native animal species. Intact remnant vegetation is self-sustaining and therefore requires less input in the form of active management. Consequently, retention of remnant vegetation is cheaper and must be considered as cost effective. The loss of remnant vegetation from land clearing cannot be offset and compensated by replanting in other "more appropriate" areas (Croft *et al.* 1999).

Retention of remnant vegetation in the Adelaide Metropolitan Area is achieved in a number of ways. The *Native Vegetation Act 1991* is intended to "...control the clearance of native vegetation." The *Native Vegetation Act 1991* however, does not provide protection to native vegetation over a large portion of the metropolitan area. The recent amendment to the *Development Act 1993* will offer some protection to 'significant trees' in the metropolitan area. The legislation declares any tree (except proclaimed plants) significant if the circumference at one metre from the ground is greater than 2.5 metres. Further to this, council may in their Development Plan, declare a tree as significant if:

1. it makes an important contribution to the character or amenity of the local area; or
2. it is indigenous to the local area and its species is listed under the *National Parks and Wildlife Act 1972* as a rare or endangered native species; or
3. it represents an important habitat for native fauna; or
4. it is part of a wildlife corridor or a remnant area of native vegetation; or
5. it is important to the maintenance of biodiversity in the local environment; or
6. it is a notable visual element to the landscape of a local area.

It is unlikely that this legislation will offer protection to other native plants aside from trees.

Retention of remnant vegetation requires some input in the form of fencing, destocking, fire management and problem species control (Willoughby 2000).

There are also other non-legislative means of retaining remnant vegetation. For example, the UFBP has:

- encouraged the integration of priorities into local government decision-making and land management practices
- commented on a number of Planning Amendment Reports and Development Plans
- fed priorities into the 1998 Metropolitan Planning Strategy
- worked closely with industry to identify, conserve and manage priority sites (eg SA Water, United Water, Penrice).

Restoration and Regeneration

Because of past and present management practices, much of the remnant vegetation in the metropolitan area is in a degraded condition. These inappropriate management practices have resulted in thinning of the tree canopy and a reduced diversity of understorey plants. These areas are likely to have a substantial portion of their seed bank stored in the soil. If fenced from herbivores (rabbits in most cases, but also kangaroos in some areas) and managed to reduce the competition from weeds, these areas will regenerate with minimal further input. The removal of herbivores and weeds (using minimum disturbance techniques) to facilitate natural regeneration is a higher priority than replanting with native species.

Successful restoration and regeneration cannot be achieved in the short term. Instead, such projects must assess results over several years. The ultimate aim of restoration and regeneration is to reinstate the processes of natural regeneration (Croft *et al.* 1999).

Priority for restoration and regeneration should firstly be directed towards threatened plant communities (these were outlined in section 4.2, p.17) and secondly to regionally threatened communities such as the Reedbed communities and *Callitris gracilis* Low Woodland. However, local remnancy must also be considered. In areas that have suffered widespread clearance, a small degraded patch of native vegetation is important simply because of its local remnancy. This is especially pertinent to suburban areas close to the city. These areas were cleared for agriculture very early following European settlement, and since then they have been developed for residential use. The result being that very little in the way of remnant vegetation remains.

The work undertaken by The National Trust of South Australia at Watiparinga Reserve is a fine example of successful restoration and regeneration. Using minimum disturbance techniques, control of rabbits and weeds received highest priority; consequently, the number of native plants found in the reserve has risen significantly- all a result of natural regeneration (Robertson 1999).

A general rule suggests that restoration of existing native vegetation should be a higher priority than revegetation of cleared areas. Biodiversity continues to decline in existing areas, while it is already lost in cleared areas. Resources need to be directed to sites where the **rate of decline** is greatest. As cleared areas have little or no current biodiversity value, their rate of decline is minimal. Most existing native vegetation is currently being degraded at a much greater rate and therefore demands urgent conservation efforts.

Revegetation

Revegetation is the re-establishment of perennial vegetation in an area that has been completely or partially cleared. Revegetation within the context of biodiversity conservation has a narrower definition than in other contexts. For example, revegetation for biodiversity conservation must plant only species that were originally found in that location, and use seed from plants that are as near as possible to the planting site.

The use of indigenous plants of suitable provenance is important for a variety of reasons, not least because planting provenance species maintains the genetic integrity of a particular area. Revegetation projects using plants from a local seed source are adapted to local weather conditions and can cope with extreme events such as drought and flooding. Locally indigenous species have the best capacity to provide habitat, food and other resources for wildlife. Furthermore, local plants are a part of natural and cultural heritage and their continued existence is fundamental to maintaining these heritage values.

Successful revegetation for biodiversity takes careful planning. Ideally, revegetation projects should be completed over several stages. Establishment of grasses and other pioneer species should be done first to avoid competition with larger trees and shrubs.

Revegetation may involve the planting of tubestock, but it is far more economical and successful to use direct seeding with many species (Croft *et al.* 1999). However, the suitability of direct seeding must be considered within the context of availability of locally sourced seed, ease of germination and low rainfall conditions. It is estimated that direct seeding uses as much as 5-10 times the amount of seed when compared with planting of seedlings (Mortlock 2000). Furthermore some species are best grown from cuttings and therefore require the use of tubestock. Using a combination of both direct seeding and tubestock is likely to achieve optimum results.

Stock and pest species management is an integral component of any revegetation project (Dalton 1998). Stock will damage native plants through grazing, trampling and ringbarking. They also damage the soils through compaction and can bring in the seeds of certain invasive weeds. Weeds compete with native plants for space, moisture, nutrients and light (see section 5.2, p.106). Animal pests such as rabbits and hares eat native natives and if left unmanaged can destroy revegetation efforts (Dalton 1998).

Within the context of revegetation for biodiversity conservation, the State Revegetation Strategy (SRC 1996) defines revegetation broadly to include regeneration, and active management of remnant vegetation. The Strategy, offers some useful guidelines when revegetating for biodiversity, including:

- the use of indigenous plants from local seed sources;
- establishing and maintaining understorey species, with the aim of enhancing the value of vegetation for wildlife habitat and to establish stable ecosystems;
- actively managing remnant vegetation, which includes controlling pest plants and animals;
- establishing vegetation corridors linking areas of remnant vegetation, with particular attention given to ridge tops, streamlines and roadsides;
- fencing off areas of remnant vegetation areas near isolated trees to prevent stock grazing and to encourage natural regeneration of remaining native species;
- use of buffer zones around remnant vegetation to assist in the protection of these areas from invasion by weeds;
- a recognition of the importance of dead and fallen trees and rocky outcrops in providing habitat for flora and fauna.

Priorities (from Willoughby 2000) for revegetation projects should be given to:

- buffers to existing stands or remnant trees or blocks of remnant vegetation;
- providing feeding or breeding habitat for nationally threatened species;
- re-establishing regionally important plant communities;
- establishing linear vegetation or 'stepping stones' which link blocks of remnant vegetation;
- establishing 'bulges' along linear remnants which link blocks of remnant vegetation.

Wildlife Corridors and Other Links

The remnant vegetation of the Adelaide region is highly fragmented; it is found as small islands in a sea of suburbia and agriculture. The establishment of links between these fragmented remnants will allow the movement of fauna between these patches, thus maintaining genetic diversity and allowing escape and re-colonisation following catastrophic events such as wildfire (Croft *et al.* 1999). To be effective wildlife corridors should:

- have a short distance between remnants (<1km) and be as wide as possible (>50m);
- be replanted with suitable species to the area and landform, from locally collected seed (<5km);
- include understorey species; and
- be protected from grazing (Croft et al. 1999).

Road, railway or watercourses with remnant vegetation may already provide a link between remnants. These existing linkages however, frequently suffer from excessive weed competition and herbivory. Additional fencing, strategic management of weeds and in some cases revegetation would enhance the design and performance of these existing corridors.

In Adelaide, watercourses in particular lend themselves as suitable wildlife corridors. Although highly degraded, they frequently have some canopy species remaining, are usually situated away from roads and are natural linkages between remnant vegetation.

6.2 Strategic Management of Conservation Threats

Adaptive management

Natural resource management is full of uncertainties and precise outcomes of our management actions are rarely known. Adaptive natural resource management is a means of addressing these uncertainties while still implementing on ground actions. It is a process of implementing management actions in a way that generates information to improve future management, while at the same time attempting to achieve other management objectives (Petterman 1998). Adaptive management forces us to acknowledge uncertainty, and to follow a plan by which decisions are modified as we learn by doing (Parma *et al.* 1998).

The framework for adaptive management is essentially a five-step process (Forest Practices Branch 1999):

1) **assess the problem**- here the scope of the management problem and measurable objectives are defined.
2) **design a management plan and monitoring program** that is both informative and provides reliable feedback.
3) **implement and monitor the plan**, documenting any deviations from the plan.

4) **evaluate the plan** by comparing anticipated outcomes with actual outcomes.
5) **adjust the plan** according to the results obtained in step 4.

6.3 Target Groups

Land managers of remnant vegetation in the metropolitan area are faced with a tremendous opportunity to halt the loss of biodiversity for the benefit of our own and future generations.

The UFBP has identified six main target groups who can make a practical contribution to the conservation of biodiversity in the Metropolitan Adelaide Region. The groups are:

- **Property owners**- owners of urban fringe land, commercial horticulturists and industry
- **Field operators**- council and government agency field operators, horticultural landscapers
- **Members of Parliament** and **Councillors**
- **Teachers**
- **Community** - individuals and groups
- **Planners** and **Developers**

The importance of biodiversity conservation and what these groups can do to assist is covered in a series of six brochures produced by the UFBP, the main text of which is reproduced here (UFBP 2000). In addition, other groups and organisations have an essential role to play in the conservation of biodiversity. Some of these are community-based organisations working in bushcare projects and others are owners of large tracts of bushland in the region.

Property Owners/Managers

Owners of bushland within the region include private individuals and companies, local government, National Parks and Wildlife South Australia, Forestry SA, SA Water and the National Trust of South Australia. Many areas owned by these agencies now have 'friends' groups associated with them.

Landowners are in an ideal position to determine the future management of remnant vegetation on their land and many are already participating in bushcare programs.

The preparation and implementation of a management plan is a fundamental component of the management of remnant vegetation. Those involved in management of remnant vegetation should have the skills associated with bushland management. Important skills include native plant and weed recognition, weed control (in particular minimum disturbance methods), seed collection and propagation.

Landholders will ideally work together to address issues that require an integrated approach. In particular, weeds and feral animals require a regionally integrated approach to their management.

Landholders living adjacent to remnant vegetation have a greater responsibility to control domestic animals (section 5.3, p.110) and plant appropriate plants (section 5.2, p.106) on their land.

Field Operators

Field operators, whether working with local government, government agencies, golf courses, schools, or as professional horticulturists and landscapers, are in a leading position to help protect our natural biodiversity.

Field operators who are aware of the loss of native flora and fauna and are committed to redressing the balance when the opportunity arises, are vital in restoring Adelaide's regional biodiversity.

Field operators, like property owners are frequently the ones who implement, and sometimes develop management plans for areas containing remnant vegetation. Knowledge of native plant/weed identification, and seed collection/propagation are important in the field operator's role of remnant vegetation management.

Field operators can also encourage their organisation to use local native species in any plantings that may occur in their area. Species chosen for planting should:

- come from a seed source as close as possible to the area being planted, and
- include all levels of vegetation structure (grasses, groundcovers, shrubs, and trees).

Before slashing activities, but in particular major works activities, a site assessment pertaining to the presence of native plants should be carried out. The dissemination of information regarding the presence of native plants to those persons actually doing the work is critical.

Teachers

Teachers are in a position to impart knowledge about what biodiversity is and how it is important (see section 1.2 "Values of biodiversity", p.1). Teachers can inform students on what they as individuals can do to aid biodiversity conservation.

Teaching and learning about biodiversity and its importance is essential if we as a community will effectively conserve biodiversity. At the Earth Summit in 1992, 150 nations including Australia endorsed Agenda 21. In it, world leaders asserted that:

> '... education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues.... It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making.'

The most appropriate focus for the study and protection of biodiversity is a bioregion. This term combines life (bios) and territory (region or area of understanding). Bioregional strategies refer to the restoration of the earth's natural plant and animal diversity with a regional framework and of the necessary cultural adaptations to achieve it in specific bioregions. Ecology, language studies, poetry, Aboriginal studies, art in all its forms, Society and Environment, environmental education and cultural history are all tools to be used in bioregional studies.

All teachers, class teachers or subject teachers, can therefore help develop in students a "sense of place" in relation to their bioregion, where they live, go to school and play. This means appreciating what Adelaide was originally like, understanding what it is like now, and then developing in students a "sense of place" so that they want to protect and restore Adelaide's diverse natural areas. If students understand and take on environmental responsibilities and projects, our environment will benefit.

Community Groups

Community groups involved in local bushland conservation include Friends of Parks, Friends of National Trust Reserves, Friends of the Forests, Landcare, Coastcare, Bushcare, Adelaide Plains Flora Association, school and service groups. Projects are currently underway in bushland owned or managed by private individuals and companies, local government, National Parks and Wildlife South Australia, Adelaide University, Forestry SA, SA Water and the National Trust of South Australia.

These projects rely extensively on volunteer workers, although many are supported financially by the Natural Heritage Trust, UFBP, Catchment Water Management Boards, local government, other organisations and agencies.

Community groups, often have people in them who are well versed in the threats and management of remnant vegetation. These groups are an extremely valuable resource, often coordinating and implementing tasks frequently undertaken by government bodies such as NPWSA.

Community groups like property owners and field workers as discussed above, are frequently involved in the on-ground management of remnant vegetation. Community groups need to have an understanding of similar issues such as native plant and weed recognition, minimum disturbance weed removal, and other management issues.

Planners and Developers

Planners, builders and developers can support the community and government in enhancing the biodiversity of the Adelaide region, in our backyards, open spaces, roadside verges and recreational areas, by familiarising themselves with the *National Strategy for Ecologically Sustainable Development.* This strategy aims for 'Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends'.

Decisions by local authorities on development applications should take ecologically sustainable development (ESD) goals, including biodiversity, into account. The extent to which this is possible will depend upon:

- councils being proactive and strategic about promoting good development practices, and
- the policies and controls in the relevant Development Plan(s) for the area.

Councils are required to prepare strategic plans for their area (*Local Government Act 1999*) and to regularly review the effectiveness of their Development Plan (*Development Act 1993*). These processes provide a sound basis for determining the

extent to which local planning decisions reflect ESD goals as set out in the Government's Planning Strategy and other policy documents.

Councils have a significant opportunity to guide development that embraces ESD and biodiversity conservation principles. Ideally, councils will have a comprehensive resource inventory on the biodiversity of the council area.

Does the Council Development Plan:

- Use zoning to protect sensitive areas (eg coastal areas, remnant vegetation, watercourses, floodplains) from inappropriate development?
- Support Council-wide objectives and principles with more detailed zoning provisions - including performance measures to promote environmental compliance and give greater certainty?
- Contain policies to ensure that new development supports catchment-wide strategies for managing stormwater?
- Promote energy efficiency in subdivision and building design?
- Seek to ensure that open spaces in newly developing areas are linked in ways that accommodate the movement of wildlife and/or enhance the viability of biological communities?

A range of resources are available to assist Councils in preparing Development Plan amendments that will provide clearer policies regarding ESD and biodiversity principles. For example, the Planning SA website (www.planning.sa.gov.au) contains information on performance-based policies for development in industrial, residential and rural areas. Planning SA is also working jointly with the Torrens and Patawalonga Water Catchment Management Boards to release a package of policy information and design guidelines dealing with planning and managing urban stormwater.

Assessment practices also have an important role to play:

- Is pre-lodgment consultation encouraged as a means of improving the design quality and compliance of applications?
- Are applicants asked for site assessments so that impacts on adjacent properties and key site features are considered in the design process?
- Is there a register of significant trees or remnant bushland areas to assist applicants?
- Are Land Management Agreements (or Heritage Agreements) used to provide a framework for improved environmental management on key development sites?

Builders and developers can contribute to biodiversity conservation:

Conserve what is already there

- Seek professional advice to identify remnant native species on the land being developed.
- Retain native vegetation and plan development as far away as possible from remnant vegetation.
- Protect native grasses and shrubs by the use of boardwalks in ecologically sensitive areas rather than cement paths.
- Protect and conserve biodiversity from pollution, eg water run-off from roads, by directing road run-off water into culverts and not natural creeklines.
- Site access paths to housing areas outside and around, but not through, bushland areas.
- Include the regeneration of remnant areas (open space) to extend natural areas within new housing developments.
- Use indigenous species when landscaping the subdivision and encourage residents or other property owners to do the same in order to bring native wildlife into the area.
- Maximise the use of recycled materials in developments to resist increasing the use of new materials from natural areas.

Plan for environmental quality

- Create developments that are in harmony with the natural surroundings; for example choice of building materials, style of building and use of colours.
- Minimise pollution of air, water and soil by planning for energy and water efficient homes.

Protect the natural environment

- Conserve remnant vegetation, bushland corridors and open space in urban subdivisions.
- Restore natural ecosystems as part of subdivision developments.
- Voluntarily move towards a 10% standard of maintaining the local biodiversity, eg on any large scale housing development of 40 ha or more,

- establish and maintain wildlife corridors alongside watercourses.
- Plan for 'cluster-housing' in new areas to minimise encroaching on remnant vegetation, bushland and wildlife habitats.
- Plan for community open spaces, eg linking individual backyards with community open spaces.
- Maximise the use of local native plant species in cleared areas not required for development to encourage native wildlife by increasing the area available to them and by establishing corridors.
- Use cleared land for community purposes and avoid areas with remnant vegetation.

Plan movement and access

- Encourage the use of linear parks and multi-purpose trails for cyclists and walkers that avoid remnant bushland.
- Use boardwalks to pass over sensitive areas rather than establish walkways going through them.
- Plan suburbs so that residents are not dependant on cars. For example walkways that are placed to connect streets and siting commercial areas in a central location.

Educate self and others

Become familiar with the aims of biodiversity conservation and bushland restoration.

Increase expertise of customer service staff and housing consultants in giving advice on local species, biodiversity conservation and restoration principles, and actions so that they can pass this on to homebuyers.

Styles of planning need to be innovative and involve best practice to encourage sustainable use and development of natural resources – the protection of the atmosphere, the seas, the land and their biological diversity are challenges to be embraced by all planners and developers.

State Government Agencies

National Parks and Wildlife SA

As little as 5% of the metropolitan area is afforded protection under the NPWSA Act. However, almost 25% of the remnant vegetation in the Adelaide area is afforded protection. These areas house many rare and threatened species and plant communities. Consequently, they are the foundation of biodiversity conservation in the metropolitan area. However, the biodiversity in these areas remains under threat from weeds, introduced animals and inappropriate recreation. The resource information in this document and its priorities provide a regional context for reserve management plans. The numbers of rare and threatened plants and animals in these areas combined with clear threatening processes requires a long-term financial commitment that values biodiversity and is serious about addressing biodiversity decline.

SA Water & Forestry SA

Large areas of remnant vegetation exist on both of these state government owned lands. Some of these habitats house nationally significant species and vegetation communities. In these instances, their potential inclusion in the national system of reserves should be addressed. The resource information in this document and its priorities provide a regional context for management of these areas.

6.4 Information Gaps

Detailed information on species, ecosystems, populations, threats and other ecological processes is the cornerstone of the biodiversity planning process. In many areas, this information is sparse, especially for invertebrates and other life forms such as fungi, lichen and algae. Even plants and vertebrates are poorly understood within the context of ecological interactions. Research into these areas will further consolidate the required information base for allocating limited resources to priority conservation activities.

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Appendix 1 Summary of Remnant Vegetation Sites

(See end of this table for explanation of *condition rating*; see Appendix 3 for definitions of *conservation categories*)

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
First Creek Tusmore Park *Eucalyptus camaldulensis* **Woodland**	3.4	1	5																					
Second Creek Reserve	3.7																							
Third Creek, University of SA *Eucalyptus camaldulensis, E. leucoxylon* **Woodland**	9.9	1.5	5																					
Fifth Creek (Lorenz Crt)	1.4																							
Fifth Creek (Stonybrook Dve)	0.5																							
Fifth Creek Riparian Walking Trail *Eucalyptus camaldulensis, E. leucoxylon* **Woodland**	8.3	1	4																					
Abercrombie Reserve *Eucalyptus leucoxylon* over *Callitris gracilis, Allocasuarina verticillata, Bursaria spinosa, Acacia paradoxa* & native grasses **Open Forest**	2.8	2.33	3	58									1	3	2	6					3	7	1	11
Adelaide Airport **Sedgeland**				72					2				1	1	1	5	1	4	1	5	5	5		9
Alan E. Cousins Reserve *Eucalyptus microcarpa, E. leucoxylon* over native and exotic grasses **Woodland**	1.1		5																					
Aldinga Beach	25.5	10		79									1	1	1	3		2		1	10	8		21
Alison Ave Reserve	0.7																							
Archery Park	18	15																						
Archibald Park	5.1	1		58										1	1	2						4		4
Ashby Reserve	29.2																							
Athelstone Riparian Reserve	0.5	0.8																						
Auldana Reserve	9.7	1																						
Bailey Reserve	0.4																							
Barracks Reserve	1.7																							
Beach rd Scrub	2.7	0.7																						
Beaumont Common *Eucalyptus microcarpa E. leucoxylon* over native and exotic grasses **Woodland**	4.9	1	4																					
Beckman Ave Reserve	2.4																							
Bell Yett Reserve *Eucalyptus camaldulensis, E. leucoxylon* over *Acacia pycnantha, Acacia paradoxa* and native and exotic grasses **Woodland**	3.7	0.5	4																					
Berri rd Reserve	2.3																							
Black rd Roundabout				51									1	3	1	5				1	4			5
Blacks rd scrub (ETSA substation, Flagstaff Hill)	22.4	6		35									2		1	3		1		1		2		4
Blacktop rd	16.4	6.57	5																					
Blackwood Hill Reserve	82	78		61					1					2	2	5			1		2	5		8

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Blewitt Springs	5.3	4.5																						
Boral Plaster Boards	1.3																							
Breakout Creek	35.5																							
Breakout Creek / Apex Park	6.1																							
Bull 'n' Mouth Reserve	1.5																							
Byron Ave Reserve	0.5																							
Callitris Reserve *Eucalyptus leucoxylon, E. camaldulensis over Acacia pycnantha, Callitris gracilis Allocasuarina verticillata, Acacia paradoxa,* exotic grasses **Open Forest;** *Eucalyptus leucoxylon,* over *Callitris gracilis, Acacia paradoxa, Allocasuarina verticillata,* exotic grasses **Open Forest**	3	2.36	4	103									3			3	1	1			4	4		10
Camel Reserve	5.6																							
Carclew	4	2.3																						
Carclew Church	0.4																							
Carlson Reserve *Acacia ligulata, A. pycnantha, Adriana klotzschii* **Tall Shrubland**	3.8	0.3	4	14																1	1	2		4
Carrick Hill	36.6	21	4	84			1	1			1	2	2	1		6				1	5	12		18
Castieau Reserve *Eucalyptus porosa* over *Acacia paradoxa, Maireana brevifolia, *Hyparrhenia hirta* **Open Forest**	24.2	6	4	78							1		1	2		4	2	4	1	3	9	8		27
Cedric Reserve	4.3	0.4																						
Chambers Gully *Eucalyptus camaldulensis, E. leucoxylon* **Woodland;** *Eucalyptus leucoxylon, Allocasuarina verticillata* over *Xanthorrhoea quadrangulata* and native grasses **Woodland**	45.4	21.5	4																					
Cherry Gardens Cemetery	7	4		96					1			2	3	1		7		2			2	5	1	10
Chimney Reserve	1.9	1																						
Christie Creek Riparian Zone	77.6																							
Christine Reserve *Eremophila longifolia* over *Acacia ligulata* and native grasses **Tall Shrubland;** *Eucalyptus porosa* over **Olea europaea* and *Austrostipa* sp. **Low Woodland**	1.9	0.2		15											1	1		1		1	4	2		8
Clonlea Park *Eucalyptus camaldulensis* over **Olea europaea, *Fraxinus rotundifolia* and **Schinus areira* **Open Forest**	25.5	3.95	4	67			1	1				3	1	2		6	1	4	2	3	10	6		26
Cobbler Creek, Salisbury East *Eucalyptus camaldulensis* over *Acacia salicina* and *A. paradoxa* **Open Forest**	8.6	2.43		8														2				1		3
Coomurra Gully *Eucalyptus porosa* over *Acacia salicina* and **Olea europaea* **Open Forest**	5	1.3		19													1	1			2	2		6
Coulls Rd Reserve *Eucalyptus camaldulensis, E. leucoxylon* over *Callitris gracilis,* & *Acacia paradoxa* **Opeh Forest**	8.8	1.8		21																		2		2
Creighton Reserve	4.3			17									1	1		2					1	2		3

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
CSIRO, Glenthorne	229																							
Danthonia Reserve *Eucalyptus camaldulensis, E. leucoxylon, E. microcarpa, Acacia melanoxylon, A. pycnantha Allocasuarina verticillata* **Woodland**	9.2	2	4	34									1	1		2					2	5	1	8
Dead Man's Pass *Eucalyptus camaldulensis* over **Olea europaea* and *Phragmites australis* **Woodland**; *Eucalyptus porosa* over **Olea europaea* and native grasses **Woodland**	23.4	2.37	4	76			1	1			1	2	2	4		9	1	5	2	3	8	9		28
Demeter / Roy Reserve	0.5	0.25		29																				
Douglas Scrub *Eucalyptus fasciculosa* over *Acacia pycnantha* and heathy understorey **Low Open Woodland**; *Eucalyptus camaldulensis, E. leucoxylon* over *Leptospermum continetale, Bursaria spinosa, Acacia rupicola* and *A. acinacea* **Open Woodland**	21.3			149									4	4		8		1			7	8		16
Dry Creek Linear Reserve *Eucalyptus camaldulensis, E. leucoxylon* **Woodland** (highly modified, with many exotics)																								
Ellerslie Dve Reserve	1.4	0.7		25					1				1	1	1	4			1		1	4		6
Field River Estuary	4.5																							
Field River				73									2	3		5	1	2		8			12	23
Fifth Creek Walking Trail	2.5			12										2		2					1	1		2
Flinders University- ILKARI Inc.	177			47						1			1	1	2	5	1				5	5		11
Folland Park *Eucalyptus porosa E. socialis* **Low Woodland**; *Eucalyptus dumosa, E. porosa* **Open Scrub**	4.1	3.5	3	50			1	1	1				1		1	3	3	1	1	1	6	5		17
Fourth Creek Rostrevor *Eucalyptus camaldulensis, E. leucoxylon* **Woodland**	1.1	0.5		11																		1		1
Fox Ave Reserve *Eucalyptus leucoxylon* **Woodland**	1.2			27									1	2		3					1	2		3
Frank Smith Park	13.2																							
Fraser Reserve	0.65																							
Nurrutti Reserve	3.6																							
Gilles Rd Drainage Reserve	0.23																							
Glen Osmond Creek *Eucalyptus camaldulensis, E. leucoxylon, E. microcarpa, Acacia dodonaeifolia* over exotic grasses **Open Woodland**	0.78																							
Glenelg Golf Course	49.4	8		38					1					2		3	1	1			3	8		13
Grand Junction Rd	0.28		4																					
Grange Golf Course	102			66			1	1		1		1		1		3	1	1	1	4	3	8		18
Greenbank Rd Reserve	0.72																							
Greenfields Wetlands	42.3																							
Greenglade Dve	17.8			19										1	1	2	1				3	3		7
Grenfell Rd Reserve	0.43																							

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Grevillea Ave Reserve *Euclayptus fasciculosa* **Open Woodland**	0.1			37																	1	1		2
Gully Reserve *Eucalyptus leucoxylon, E. microcarpa* **Woodland**	11.7		3																					
Gunda Flora Reserve *Eucalyptus leucoxylon, E. fasciculosa* over *Acacia paradoxa, A. pycnantha* **Open Forest**	5.4	0.8	4	75									1	4		5	1				2	5		8
Happy Valley Dve	53	24																						
Happy Valley Primary School	2.4	2																						
Happy Valley Reservoir	557	90																						
Harry Bowey & Carisbrooke Reserves *Eucalyptus camaldulensis, E. leucoxylon* over *Acacia salicina* **Woodland**	72.3			14													1					1		2
Hazelwood Park *Eucalyptus camaldulensis, E. leucoxylon* **Open Woodland**	12.5			9																		1		1
Headland Reserve	4.6	3.5		87									1	3	1	5	1	4			19	9		34
Henley Beach Primary School	3.7																							
Heywood Park *Eucalyptus microcarpa, E. leucoxylon* **Low Woodland**	3.2		5																					
Hillcrest Reserve	1.7	1.5																						
Hilltop Dve / Upper Sturt Reserve	5.3	5.3		113									1	2	2	5				1	2	4		7
Hockley Riparian Reserve	0.4			10									1	1		2					1	2		3
Hope Valley Reservoir	90.9																							
Ilfould Reserve *Eucalyptus leucoxylon, E. microcarpa* over *Danthonia* sp., *Austrostipa* sp. and *Themeda triandra* **Woodland**	0.68	0.25	4																					
Jo Gapper Reserve	78.8																							
Joann St Reserve	0.1			4																				
Kangarilla Dump	11.5	1.8		49										1		1					1	3		4
Kaplan Reserve *Eucalyptus leucoxylon, E. camaldulensis* **Open Forest**; *Eucalyptus camaldulensis, E. leucoxylon* over *Bursaria spinosa, Acacia pycnantha, Allocasuarina verticillata* **Open Forest**; *Eucalyptus camaldulensis, E. leucoxylon* over *Bursaria spinosa* and *Acacia paradoxa* **Open Forest**	3.1	2	3	15										1		1						3		3
Karinya Reserve	14.7	9.5		81										2	2	4		1			1	5		7
Ken Patterson Reserve	2.6																							
Kensington Gdns (Piles Paddock) *Eucalyptus camaldulensis, E. leucoxylon* over *Danthonia racemosa* and *Cotula australis* **Open Woodland**	16.2		5	38									1	1	2	4		1			2	4		7
Kensington Park Reserve	6.5																							
Kesters Rd Reserve *Eucalyptus porosa, E. odorata* over *Acacia paradoxa* and *Senna artemisioides* **Open Forest**	7.8	3		29											1	1		1		1	6	1		9

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
King Reserve	11																							
Kingston Park	3.2	2.6		64								1	1	2	2	6	1	3	1	2	11	9		27
Kooyonga Golf Course	58.5			44														1	1	1	3	4		10
Langman Reserve *Eucalyptus microcarpa* **Woodland**	2.9		4																					
Little Para Estuary Chenopod (inc. *Sarcocornia quinqueflora*) **Low Closed Shrubland**	12.6		3	24											1	1					1	1	2	4
Little Para Linear Park				11														1						
Lockleys Reserve	1.6																							
Lotus Drive Reserve	1.4																							
Magill Stone Mine Reserve *Eucalyptus porosa* over *Olearia ramulosa, Pimelea glauca* **Low Open Woodland**	4.3		3																					
Mandilla Reserve	1.6	1																						
Marryatville High School *Eucalyptus camaldulensis* **Woodland** (canopy)	7.8	1.2	5																					
Maslin Beach	43.3																							
McLaren Vale Swamp	24.4																							
Milne Reserve																								
Minda Dunes	4.5																							
Mistletoe Reserve	0.82																							
Mumford Reserve	2.9	2	4																					
Nightingale Reserve *Eucalyptus camaldulensis, E. leucoxylon* **Open Woodland**	0.3		5																					
Oaklands Park Wetlands	11.1																							
Ochre Point	57.5		3	81									1	1	1	3		2		2	12	11		27
Olive Parklands mixed understory species only	3.5			13									1		1	2						2		2
One Tree Hill Rd Reserve	7.5																							
Park 6 - Adelaide Parklands Mixed understorey species only	37.4		5	16									1			1			1			2		3
Patawalonga Creek Wetland *Melaleuca halmaturorum* over *Maireana decalvans, Maireana brevifolia, Danthonia* sp. **Low Open Forest**	49.9		4																					
Pelican Point *Myoporum insulare, Lawrencia squamata, Adriana klotzschii, Olearia axillaris* **Shrubland**	321		5	36														1		1	1	5		8
Penno Parade (north)	1	0.8																						
Penrice Mangroves	89.1	28																						
Peppermint Gum Gully *Eucalyptus odorata, E. camaldulensis* over *Acacia paradoxa, Dodonaea viscosa* **Open Forest**	16.2	4.5	3	47										2	1	3		4		2	5	6		17
Piggott Range	21.3			38																	1			1

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Piggott Range Rd, Onkaparinga Hills	33.6																					2		2
Pimpala Reserve	14.7	6		32			1	1					1			1					1	2		3
Pine Dve Reserve	9.5	1.3																						
Pine Park	1.3	0.8																						
Player Reserve *Eucalyptus camaldulensis, E. leucoxylon* over *Dodonaea viscosa*, heath, sedges and exotic grasses **Open Forest**	2.8	2.55	3	42																	2			2
Playford Reserve *Eucalyptus camaldulensis* over **Lycium ferocissimum, *Piptatherum miliaceum* and *Cyperus gymnocaulos* **Closed Forest**	16.6	7												2		2	1				1	1	2	5
Port Noarlunga Dunes	20.7			23										1	1		1				1	1	2	5
Port Stanvac Scrub	229	24	2	156	1			1	1				3	6	3	13	3	5	2	4	23	18		55
Prosperity Way Reserve	0.6			18									1	1		2					2	2		4
Quandong Avenue Reserve *Eucalyptus fasciculosa* **Open Woodland**	0.3			32										1		1					1	2		3
Radar Reserve	0.7																							
Ragless Reserve	1.3	0.5																						
Randall Park	48.6	36		59										1	2	3					1	5		6
R.B. Connolly Reserve *Acacia ligulata, A. pycnantha, Adriana klotzschii* **Tall Shrubland**	2.3	1.15	4	19																		3		3
Ridge Park *Eucalyptus camaldulensis, E. leucoxylon, E. microcarpa, Acacia dodonaeifolia* over exotic grasses **Open Woodland**	5.1	1.9	4																					
Riverside Golf Course	33.2																							
Rokewood Scrub	1.5																							
Romalo Reserve	0.4																							
Romalo Walk *Callitris gracilis* over grasses	0.1		4																					
Roy Martin Reserve	5.4																							
Royal Adelaide Golf Course	66.9			63					1			1		1		3	1	2	1	4	1	7		16
Saddle Hill Reserve *Eucalyptus microcarpa* (with grassy understory) **Woodland**	16.4	5		87	1			1	2	1			1	2	2	8	2	1			6	10		19
Sandalwood Reserve *Eucalyptus camaldulensis, E. leucoxylon, *Fraxinus rotundifolia, *Populus* spp., *Dodonaea viscosa* ssp. *spatulata, *Olea europaea, Callitris gracilis, Bursaria spinosa* and exotic grasses **Open Forest**	0.7	0.5																				1		1
Sauerbier Creek Reserve	10.2			60										4		4						8		8
Scroop Creek	2.52																							
Settlement Rd	45.1	15.3		25																	1	3		4

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Shannon Rd Reserve *Eucalyptus camaldulensis, E. leucoxylon* over *Allocasuarina verticillata, Bursaria spinosa, Dodonaea viscosa, Acacia paradoxa* and **Pennisetum clandestinum* **Open Forest**	1.6	1.5											1			1						3		3
Shepherdson Rd Reserve	1.1	0.8																						
Sleeps Hill Reserve *Eucalyptus microcarpa* (with grassy understory) **Woodland**	99.5			120							1		3	4	2	10	1	1			12	11		25
Smart Rd Reserve (south) *Eucalyptus camaldulensis* over *Bursaria spinosa, Acacia paradoxa, *Lycium ferocissimum, Cyperus vaginatus, *Pennisetum clandestinum* **Open Forest;** *Eucalyptus leucoxylon* over *Bursaria spinosa, Acacia paradoxa, Acacia salicina, Acacia pycnantha, *Olea europaea, Callitris gracilis, Dodonaea viscosa* ssp. *spatulata* and exotic grasses **Open Forest;** *Eucalyptus camaldulensis, E. leucoxylon* over *Callitris gracilis, Bursaria spinosa, *Olea europaea, Dodonaea viscosa* ssp. *spatulata* and exotic grasses	5	4	3	30																				
Smart Rd Reserve	16.2	2.2		19														1				1		2
Smith Creek	5.7																							
Snake Gully	46.6																							
South Parklands	29																							
Spriggs Rd Reserve	7.1																							
St Peters Billabong	8.8																							
St Vincent Rd	0.94			53								1	1	2		4				1	7	6		17
Steelmains	23.1																							
Sturt River (Laffers Triangle)	46.1																							
Sturt River Riparian Reserve	77.7	25																						
Tangari Reserve	132	67	3	115	1			1	1			2	6	3		12	1	2		1	5	12		21
Tarnanngga Reserve	6.1			14																				
Tasman Reserve	1.22																							
Taworri Flora & Fauna Reserve *Eucalyptus fasciculosa, E. leucoxylon, E goniocalyx* over *Acacia paradoxa, A. pycnantha* and *Hibbertia australis* **Open Forest**			3	108								2	6			8				1	3	3		7
Tea Tree Gully Golf Course	38.8																							
Tennyson Dunes	19.9	10	3	49										1		1	1			2	3	9		15
The Aqueduct	37.6																							
The Gums Reserve *Eucalyptus camaldulensis, E. leucoxylon* **Woodland**	8			7																				
"The Monastery"	5.2																							
Themeda Slopes	7.1																							

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia				South Australia								Southern Lofty							
					E	V	R	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Third Creek Reserve	2.6	1.6																						
Thompson's Creek Reserve *Melaleuca halmaturorum* over *Maireana aphylla* & *Muehlenbeckia florulenta* **Tall Open Shrubland**	1.5			29											1	1		3			2	2	1	8
Tingira Dve Reserve *Eucalyptus porosa* **Low Open Woodland**	3	1		87									2	1	1	4	1	3			2	12	14	32
Torrens Island	793			61		1		1	1				1	1		3		3			2	1	7	13
Torrens Linear Park, Campbelltown	100			59										4	1	5		1				5	5	11
Tea Tree Gully Hill Reserve	5.9	5.5																						
Turramurra Reserve *Eucalyptus leucoxylon* **Woodland**	2.6	1.2		13																			1	1
Upper Little Para Reserve *Eucalyptus camaldulensis* over **Salix* sp., *Acacia salicina, Typha domingensis* and exotic grasses **Open Woodland**; *Eucalyptus porosa* over **Olea europaea* and *Acacia salicina* **Open Woodland**	23.7	7	4	77					1					2	3	6	1	3	1	3	7	9		24
Valour Crt *Eucalyptus porosa* over *Acacia paradoxa, Pittosporum phylliraeoides* and **Olea europaea* **Woodland**	10	2		21											1	1					2	1	6	9
Wadmore Park *Eucalyptus camaldulensis* **Woodland**; *Eucalyptus camaldulensis, E. leucoxylon* **Woodland**; *Eucalyptus leucoxylon, Eucalyptus fasciculosa, Allocasuarina* verticillata **Open Woodland**; *Calytrix tetragona* **Open Heath**	29.1	17	2	181		1		1	1	2			3	6	3	15		4	1	2	10	12		29
Waite Reserve	105			174			1	1	1	2			3	13	7	26	1	3	1	1	9	23	1	39
Walkley Heights *Eucalyptus camaldulensis* over *Schinus areira, Acacia salicina, *Olea europaea* **Open Woodland**; *Eucalyptus porosa, E. odorata,* over *Acacia paradoxa, *Olea europaea, Acacia ligulata, Piptatherum miliaceum, Themeda triandra, Austrostipa* sp. **Open Woodland**	32.7	11	4	68			1	1					1	1	3	5		3	1	3	8	8		23
Washpool Wetland	22.6			63										2	1	3		1			3	9	7	20
Waste Water Treatment Plant (O'Sullivan Beach)	32																							
Watiparinga Reserve *Eucalyptus microcarpa* **Woodland**	32		3	141		1	1	2		1	1	1	4	7	3	17	1	2	2	2	11	20		38
Wattle Park Reserve	1.9																							
West Beach Dunes	5	3.8																						
Wheal Gawler Reserve *Acacia melanoxylon, Acacia pycnantha, Allocasuarina verticillata, Eucalyptus leucoxylon* over grasses **Grassy Woodland**	1.8		4																					
White Reserve	0.75																							
Whitelaw Creek *Eucalyptus camaldulensis* over **Olea europaea, Eremophila longifolia, Myoporum viscosum* **Open Forest**	1.6	1	4	52			1	1					2	1	2	5		4	1	1	6	6		18
Wilfred Taylor Reserve	66.4	13																						
Willaston Cemetery *Eucalyptus porosa, E. socialis over Myoporum platycarpum, Eremophila deserti* **Woodland**	10	3	4	54					1			1		1		3	3	3	1	3	4	7		21

	Reserve Area (ha)	Area of Remnant Vegetation (ha)	Condition	Total species	Australia		South Australia		Southern Lofty	
					E V R	Total	E V T K R U Q	Total	E V T K R U Q	Total
Willunga Courthouse Reserve *Eucalyptus microcarpa* **Woodland**	1.9	0.5		18					1	1
Willunga Creek	12.4	1.8								
Willunga St	1.2									
Wirranendi (Park 23) West Parklands Formerly *Eucalyptus porosa* **Woodland**	17.3		6							
Woodland Ridge	5.1	2.5								
West Terrace Cemetery *Eucalyptus porosa* **Woodland** (degraded remains)	27.9		5							
Wyfield Reserve	2.1									
Wynn Vale Gullies	11.6									
Xavier St Reserve *Eucalyptus leucoxylon* over *Allocasuarina verticillata, Bursaria spinosa, *Olea europaea* and grasses **Open Forest**	0.7	0.2		12					2	2
Yaningan Rd	9.9	8.5								
York Dve	4.9	1.7								
Zig-zag Reserve *Eucalyptus camaldulensis* over *Acacia melanoxylon* **Woodland**	1.3		3							

Vegetation Condition Scales (after State of Western Australia 2000).

Condition Scale	Description
Pristine (1)	Pristine. Or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non- aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance eg. disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it eg. disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management eg. disturbance to vegetation structure by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weeds or crop species with isolated native trees or shrubs

Table 3 Summary of NPWSA Parks

NPWSA Reserve	Area of NPWSA Park	Area of remnant vegetation (approx. ha)	Total number of indigenous species	Numbers of Conservation Significant Plants																			
				Australia					South Australia								Southern Lofty							
				E	V	R	Q	Total	E	V	T	K	R	U	Q	Total	E	V	T	K	R	U	Q	Total
Aldinga Scrub Conservation Park	265	212	292							1		1	3	12	4	21	3	11	1	4	30	27	1	77
Angove Conservation Park	5.19	4.7	152							1			1	5	2	9		1			4	8		13
Anstey Hill Recreation Park	307	154	298		1	1	1	3		1			5	17	5	28		1			17	33	1	52
Belair National Park	816	775	348	2	3			5	4	6		2	15	32	7	56	4	11	1	4	26	46	1	93
Black Hill Conservation Park	701	554	309		2	5	1	8		4		1	15	22	2	44	13			4	30	35		82
Brownhill Creek Recreation Park	51		75			1							5	7	3	15		1			5	12		18
Cleland Conservation Park	993	963	373			4		4	2	2			30	42	4	80	6	5		1	41	52		105
Cobbler Creek Recreation Park	288	144	89										1	4	2	7	1	9	1	7	6	12		36
Eurilla Conservation Park	7.5	7.5	62										3	8		11					3	10		13
Ferguson Conservation Park	8	8	146		1	1		2		2			3	9	2	16		2			7	14		23
Greenhill Recreation Park	27	14	23											2	1	3					1	5		6
Hallett Cove Conservation Park	50.2	10	220			1		1				1	2	7	3	13	3	11	2	3	32	25		76
Horsnell Gully Conservation Park	245	230	264			2		2	1				6	21	6	34	1			2	13	31	1	48
Marino Conservation Park	30	15	143			1		1				1	2	3	1	7		9	2	2	18	16		47
Mark Oliphant Conservation Park	181		193			1							5	15	1	21					8	20		28
Moana Sands Conservation Park	21.4		30												2	2								2
Montacute Conservation Park	201		232	1				1	1			1	6	11	5	24	1	1		1	12	25	1	41
Morialta Conservation Park	540	519	339			3	1	4		1			22	31	7	61		5	1	1	34	54	1	96
Mount George Conservation Park	66.7		204		1			1		2		2	9	16	1	30		2		3	12	17	1	35
Mylor Conservation Park	45.7		160							1			4	9	1	15		1			5	10	1	17
O'Halloran Hill Recreation Park	289		32									1	1			2				1	5	4		10
Onkaparinga River National Park	1490	520	448	1	1	1	1	4	2			2	13	32	10	59	3	9	1	8	47	62	2	132
Onkaparinga Estuary Recreation Park	290		52						1				2			3	1	1		3	8	3		16
Para Wirra Recreation Park	1426		276	2	2	1		5	2	3			4	16	2	27	2	4	1		17	30		54
Port Gawler Conservation Park	433	433	56											1	1	2		2		3	4	7		16
Scott Creek Conservation Park	706	619	465	3	1	6	1	11	8	4		3	42	57	6	120	10	8	2	14	61	59	2	156
Shepherds Hill Recreation Park	88	44																						
Sturt Gorge Recreation Park	178	93	158		1			1	1		1		4	6	4	16	1	1	2	2	14	18		38
The Knoll Conservation Park	1.7	1.7	57										1	2		3					2	2		4
Torrens Island Conservation Park	79	79																						
Totals	7204		876	4	6	15	1	26	13	17	1	10	90	87	21	239	26	56	12	38	169	109	3	413
Totals for NPWSA and non NPWSA			1001	5	6	15	1	27	16	17	1	14	94	93	25	260	36	62	17	49	181	114	3	462

Appendix 2 List of Native Plants Recorded for the Adelaide Metropolitan Area

(see Appendix 3 for explanation of codes)

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Acacia acinacea	wreath wattle	LEGUMINOSAE				
Acacia anceps x *nematophylla*	hybrid wattle	LEGUMINOSAE				
Acacia argyrophylla	silver mulga-bush	LEGUMINOSAE			U	E
Acacia continua	thorn wattle	LEGUMINOSAE				U
Acacia cupularis	cup wattle	LEGUMINOSAE				R
Acacia cupularis/ligulata		LEGUMINOSAE				
Acacia cyclops	western coastal wattle	LEGUMINOSAE				
Acacia dodonaeifolia	hop-bush wattle	LEGUMINOSAE		3RCa	R	R
Acacia gunnii	ploughshare wattle	LEGUMINOSAE			R	R
Acacia hakeoides	hakea wattle	LEGUMINOSAE				K
Acacia leiophylla	coast golden wattle	LEGUMINOSAE				
Acacia ligulata	umbrella bush	LEGUMINOSAE				K
Acacia longifolia	sallow wattle	LEGUMINOSAE				
Acacia longifolia var. *sophorae*	coastal wattle	LEGUMINOSAE				U
Acacia mearnsii	black wattle	LEGUMINOSAE				
Acacia melanoxylon	blackwood	LEGUMINOSAE				
Acacia myrtifolia var. *myrtifolia*	myrtle wattle	LEGUMINOSAE				
Acacia notabilis	notable wattle	LEGUMINOSAE				K
Acacia paradoxa	kangaroo thorn	LEGUMINOSAE				
Acacia paradoxa hybrid	kangaroo thorn hybrid	LEGUMINOSAE				
Acacia pycnantha	golden wattle	LEGUMINOSAE				
Acacia retinodes	silver wattle	LEGUMINOSAE				
Acacia retinodes var. *retinodes* (hill form)	wirilda	LEGUMINOSAE				
Acacia retinodes var. *retinodes* (swamp form)	swamp wattle	LEGUMINOSAE				
Acacia retinodes var. *uncifolia*	coast silver wattle	LEGUMINOSAE			U	R
Acacia rupicola	rock wattle	LEGUMINOSAE				U
Acacia salicina	willow wattle	LEGUMINOSAE				V
Acacia sclerophylla	hard-leaf wattle	LEGUMINOSAE				V
Acacia spinescens	spiny wattle	LEGUMINOSAE				
Acacia verniciflua	varnish wattle	LEGUMINOSAE			U	U
Acacia verticillata	prickly Moses	LEGUMINOSAE				
Acacia victoriae ssp. *victoriae*	elegant wattle	LEGUMINOSAE				V
Acaena agnipila var. *aequispina*	downy sheep's burr	ROSACEAE				
Acaena agnipila var. *agnipila*	downy sheep's burr	ROSACEAE				
Acaena echinata var. *echinata*	sheep's burr	ROSACEAE				
Acaena echinata var. *retrorsumpilosa*	sheep's burr	ROSACEAE				
Acaena novae-zelandiae	biddy-biddy	ROSACEAE				
Acaena x *anserovina*	hybrid burr	ROSACEAE				
Acianthus caudatus var. *caudatus*	mayfly orchid	ORCHIDACEAE				
Acianthus caudatus var. *pallidus*	green mayfly orchid	ORCHIDACEAE				
Acianthus pusillus	mosquito orchid	ORCHIDACEAE				
Acrotriche affinis	ridged ground-berry	EPACRIDACEAE				R
Acrotriche depressa	native currant	EPACRIDACEAE			U	R
Acrotriche fasciculiflora	Mount Lofty ground-berry	EPACRIDACEAE			U	U
Acrotriche patula	prickly ground-berry	EPACRIDACEAE				R
Acrotriche serrulata	cushion ground-berry	EPACRIDACEAE				
Actinobole uliginosum	flannel cudweed	COMPOSITAE				U
Adenanthos terminalis	yellow gland-flower	PROTEACEAE				U
Adiantum aethiopicum	common maiden-hair	ADIANTACEAE				
Adiantum capillus-veneris	dainty maiden-hair	ADIANTACEAE			R	V
Adriana klotzschii	coast bitter-bush	EUPHORBIACEAE				U
Agrostis aemula var. *aemula*	blown-grass	GRAMINEAE				
Agrostis avenacea var. *avenacea*	common blown-grass	GRAMINEAE				
Agrostis avenacea var. *perennis*	perennial blown-grass	GRAMINEAE				
Agrostis billardieri var. *billardieri*	coast blown-grass	GRAMINEAE				
Ajuga australis form A	Australian bugle	LABIATAE				V
Ajuga australis form B	lesser bugle	LABIATAE				R
Allocasuarina muelleriana ssp. *muelleriana*	common oak-bush	CASUARINACEAE				
Allocasuarina striata	stalked oak-bush	CASUARINACEAE				
Allocasuarina verticillata	drooping sheoak	CASUARINACEAE				
Alternanthera denticulata	lesser joyweed	AMARANTHACEAE				U

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Alyxia buxifolia	sea box	APOCYNACEAE				R
Amphibromus archeri	pointed swamp wallaby-grass	GRAMINEAE			R	R
Amphibromus nervosus	veined swamp wallaby-grass	GRAMINEAE			U	Q
Amphipogon caricinus var. *caricinus*	long grey-beard grass	GRAMINEAE				U
Amphipogon strictus var. *setifer*	spreading grey-beard grass	GRAMINEAE				
Amyema miquelii	box mistletoe	LORANTHACEAE				
Amyema pendulum ssp. *pendulum*	drooping mistletoe	LORANTHACEAE				U
Amyema preissii	wire-leaf mistletoe	LORANTHACEAE				
Angianthus preissianus	salt angianthus	COMPOSITAE				R
Anogramma leptophylla	annual fern	ADIANTACEAE			R	U
Anthocercis angustifolia	narrow-leaf ray-flower	SOLANACEAE		3RCa	R	R
Apalochlamys spectabilis	showy firebush	COMPOSITAE			U	V
Aphanes australiana	Australian piert	ROSACEAE				R
Aphelia gracilis	slender aphelia	CENTROLEPIDACEAE			Q	R
Aphelia pumilio	dwarf aphelia	CENTROLEPIDACEAE				
Apium annuum	annual celery	UMBELLIFERAE				R
Apium prostratum ssp. *prostratum* var. *filiforme*	native celery	UMBELLIFERAE				
Apium prostratum ssp. *prostratum* var. *prostratum*	native celery	UMBELLIFERAE				
Aristida behriana	brush wire-grass	GRAMINEAE				U
Aristida personata (syn. *A. australis*)	purple wire-grass	GRAMINEAE			K	K
Arthropodium fimbriatum	nodding vanilla-lily	LILIACEAE				
Arthropodium minus	small vanilla-lily	LILIACEAE				
Arthropodium strictum	common vanilla-lily	LILIACEAE				
Asperula conferta	common woodruff	RUBIACEAE				
Asplenium flabellifolium	necklace fern	ASPLENIACEAE				
Asteridea athrixioides forma *athrixioides*	wirewort	COMPOSITAE				K
Astroloma conostephioides	flame heath	EPACRIDACEAE				
Astroloma humifusum	cranberry heath	EPACRIDACEAE				
Atriplex cinerea	coast saltbush	CHENOPODIACEAE				
Atriplex paludosa ssp. *cordata*	marsh saltbush	CHENOPODIACEAE				
Atriplex paludosa ssp. *paludosa*	marsh saltbush	CHENOPODIACEAE			Q	K
Atriplex semibaccata	berry saltbush	CHENOPODIACEAE				
Atriplex suberecta	lagoon saltbush	CHENOPODIACEAE				
Austrofestuca littoralis	coast fescue	GRAMINEAE				R
Austrostipa (syn. *Stipa*) *acrociliata*	graceful spear-grass	GRAMINEAE				R
Austrostipa acrociliata group	branched spear-grass	GRAMINEAE				
Austrostipa blackii	crested spear-grass	GRAMINEAE				
Austrostipa breviglumis	cane spear-grass	GRAMINEAE		3RC-	R	R
Austrostipa curticoma	short-crest spear-grass	GRAMINEAE			Q	U
Austrostipa densiflora	foxtail spear-grass	GRAMINEAE			R	R
Austrostipa drummondii	cottony spear-grass	GRAMINEAE				
Austrostipa elegantissima	feather spear-grass	GRAMINEAE				U
Austrostipa eremophila	rusty spear-grass	GRAMINEAE				U
Austrostipa exilis	heath spear-grass	GRAMINEAE				T
Austrostipa flavescens	coast spear-grass	GRAMINEAE				
Austrostipa gibbosa	fat spear-grass	GRAMINEAE			R	R
Austrostipa hemipogon	half-beard spear-grass	GRAMINEAE				U
Austrostipa mollis	soft spear-grass	GRAMINEAE				
Austrostipa muelleri	tangled spear-grass	GRAMINEAE			R	R
Austrostipa multispiculis	small-seed spear-grass	GRAMINEAE		3RC-	R	R
Austrostipa nitida	Balcarra spear-grass	GRAMINEAE				
Austrostipa nodosa	tall spear-grass	GRAMINEAE				
Austrostipa pilata	prickly spear-grass	GRAMINEAE			K	T
Austrostipa platychaeta	flat-awn spear-grass	GRAMINEAE				T
Austrostipa puberula	small rusty spear-grass	GRAMINEAE			R	
Austrostipa pubinodis	long-shaft spear-grass	GRAMINEAE			U	U
Austrostipa scabra ssp. *falcata*	slender spear-grass	GRAMINEAE				
Austrostipa scabra ssp. *scabra*	rough spear-grass	GRAMINEAE				
Austrostipa semibarbata	fibrous spear-grass	GRAMINEAE				
Austrostipa setacea	corkscrew spear-grass	GRAMINEAE			U	U
Austrostipa stipoides	coast spear-grass	GRAMINEAE				R
Austrostipa stuposa	spear-grass	GRAMINEAE			K	K
Austrostipa tenuifolia	spear-grass	GRAMINEAE			R	V
Austrostipa trichophylla	spear-grass	GRAMINEAE				K
Avicennia marina var. *resinifera*	grey mangrove	AVICENNIACEAE				
Azolla filiculoides	Pacific azolla	AZOLLACEAE				
Baeckea behrii	silver broom-bush	MYRTACEAE				T

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Baeckea ramosissima ssp. *ramosissima*	rosy baeckea	MYRTACEAE				
Banksia marginata	silver banksia	PROTEACEAE				
Banksia ornata	desert banksia	PROTEACEAE				
Baumea acuta	pale twig-rush	CYPERACEAE			R	R
Baumea arthrophylla	swamp twig-rush	CYPERACEAE				R
Baumea gunnii	slender twig-rush	CYPERACEAE			R	R
Baumea juncea	bare twig-rush	CYPERACEAE				
Baumea laxa	lax twig-rush	CYPERACEAE			R	R
Baumea rubiginosa	soft twig-rush	CYPERACEAE			U	U
Baumea tetragona	square twig-rush	CYPERACEAE			U	U
Beyeria lechenaultii	pale turpentine bush	EUPHORBIACEAE				
Billardiera bignoniacea	orange bell-climber	PITTOSPORACEAE			U	U
Billardiera cymosa	sweet apple-berry	PITTOSPORACEAE				
Billardiera sericophora	silky apple-berry	PITTOSPORACEAE				
Billardiera uniflora	one-flower apple-berry	PITTOSPORACEAE				R
Billardiera versicolor	yellow-flower apple-berry	PITTOSPORACEAE			U	R
Blechnum minus	soft water-fern	BLECHNACEAE			U	U
Blechnum nudum	fishbone water-fern	BLECHNACEAE			R	R
Blechnum wattsii	hard water-fern	BLECHNACEAE			R	R
Blennospora drummondii	dwarf button-flower	COMPOSITAE				
Boerhavia dominii	tar-vine	NYCTAGINACEAE				
Bolboschoenus caldwellii	salt club-rush	CYPERACEAE				
Bolboschoenus medianus	marsh club-rush	CYPERACEAE			U	U
Boronia coerulescens ssp. *coerulescens*	blue boronia	RUTACEAE				
Boronia edwardsii	Edwards' boronia	RUTACEAE				V
Boronia nana	dwarf boronia	RUTACEAE			U	V
Bossiaea prostrata	creeping bossiaea	LEGUMINOSAE				
Bothriochloa macra	red-leg grass	GRAMINEAE			E	T
Brachycome cuneifolia	wedge-leaf daisy	COMPOSITAE			U	K
Brachycome debilis	weak daisy	COMPOSITAE			R	E
Brachycome diversifolia var. *diversifolia*	tall daisy	COMPOSITAE			E	E
Brachycome exilis	slender daisy	COMPOSITAE				E
Brachycome lineariloba	hard-head daisy	COMPOSITAE				V
Brachycome perpusilla	tiny daisy	COMPOSITAE				
Brachyloma ericoides ssp. *ericoides*	brush heath	EPACRIDACEAE				
Bracteantha bracteata	golden everlasting	COMPOSITAE				R
Brunonia australis	blue pincushion	GOODENIACEAE				
Bulbine bulbosa	bulbine-lily	LILIACEAE				
Bulbine semibarbata	small leek-lily	LILIACEAE				R
Burchardia umbellata	milkmaids	LILIACEAE				
Bursaria spinosa	sweet bursaria	PITTOSPORACEAE				
Caesia calliantha	blue grass-lily	LILIACEAE				
Caladenia behrii	pink-lip spider-orchid	ORCHIDACEAE	E	2ECi	E	E
Caladenia cardiochila	heart-lip spider-orchid	ORCHIDACEAE				V
Caladenia carnea complex	pink fingers caladenia	ORCHIDACEAE				
Caladenia carnea var. *carnea*	pink fingers	ORCHIDACEAE				
Caladenia dilatata complex	green-comb spider-orchid	ORCHIDACEAE				
Caladenia gladiolata	bayonet spider-orchid	ORCHIDACEAE	E	3ECa	E	E
Caladenia latifolia	pink caladenia	ORCHIDACEAE				U
Caladenia leptochila	narrow-lip spider-orchid	ORCHIDACEAE				
Caladenia minor	pigmy caladenia	ORCHIDACEAE			R	R
Caladenia patersonii complex	white spider-orchid	ORCHIDACEAE				
Caladenia prolata	shy caladenia	ORCHIDACEAE				R
Caladenia reticulata	veined spider-orchid	ORCHIDACEAE			U	U
Caladenia rigida	stiff white spider-orchid	ORCHIDACEAE	E	3ECa	E	E
Caladenia tentaculata	King spider-orchid	ORCHIDACEAE				
Calandrinia calyptrata	pink purslane	PORTULACACEAE				U
Calandrinia eremaea	dryland purslane	PORTULACACEAE				U
Calandrinia granulifera	pigmy purslane	PORTULACACEAE				U
Calandrinia volubilis	twining purslane	PORTULACACEAE			U	T
Caleana major	large duck-orchid	ORCHIDACEAE			V	V
Callistemon rugulosus var. *rugulosus*	scarlet bottlebrush	MYRTACEAE				
Callistemon sieberi	river bottlebrush	MYRTACEAE			U	U
Callitris gracilis (syn. *Callitris preissii*)	southern cypress pine	CUPRESSACEAE				U
Callitris rhomboidea	Oyster Bay pine	CUPRESSACEAE			U	R
Calocephalus citreus	lemon beauty-heads	COMPOSITAE			U	R
Calochilus campestris	plains beard-orchid	ORCHIDACEAE			R	E

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Calochilus robertsonii	purplish beard-orchid	ORCHIDACEAE				
Calostemma purpureum	pink garland-lily	AMARYLLIDACEAE				
Calotis hispidula	hairy burr-daisy	COMPOSITAE				V
Calystegia sepium	large bindweed	CONVOLVULACEAE			Q	R
Calytrix tetragona	common fringe-myrtle	MYRTACEAE				
Cardamine paucijuga	annual bitter-cress	CRUCIFERAE			R	V
Carex appressa	tall sedge	CYPERACEAE				
Carex bichenoviana	notched sedge	CYPERACEAE			U	U
Carex breviculmis	short-stem sedge	CYPERACEAE				
Carex fascicularis	tassel sedge	CYPERACEAE			U	U
Carex gaudichaudiana	fen sedge	CYPERACEAE			U	U
Carex gunniana	mountain sedge	CYPERACEAE			R	R
Carex inversa var. *inversa*	knob sedge	CYPERACEAE			R	R
Carex inversa var. *major*	knob sedge	CYPERACEAE			R	K
Carex tereticaulis	rush sedge	CYPERACEAE				
Carpobrotus rossii	native pigface	AIZOACEAE				
Cassinia arcuata	drooping cassinia	COMPOSITAE			U	V
Cassinia laevis	curry bush	COMPOSITAE				
Cassinia uncata	sticky cassinia	COMPOSITAE				
Cassytha glabella forma *dispar*	slender dodder-laurel	LAURACEAE				
Cassytha melantha	coarse dodder-laurel	LAURACEAE				
Cassytha pubescens	downy dodder-laurel	LAURACEAE				
Casuarina pauper	black oak	CASUARINACEAE				
Centella asiatica	Asian centella	UMBELLIFERAE			Q	U
Centella cordifolia s.str.	native centella	UMBELLIFERAE			U	R
Centipeda cunninghamii	common sneezeweed	COMPOSITAE				
Centrolepis aristata	pointed centrolepis	CENTROLEPIDACEAE				
Centrolepis cephaloformis ssp. *cephaloformis*	cushion centrolepis	CENTROLEPIDACEAE			R	K
Centrolepis fascicularis	tufted centrolepis	CENTROLEPIDACEAE			U	U
Centrolepis polygyna	wiry centrolepis	CENTROLEPIDACEAE				
Centrolepis strigosa	hairy centrolepis	CENTROLEPIDACEAE				
Chamaescilla corymbosa var. *corymbosa*	blue squill	LILIACEAE				
Cheilanthes austrotenuifolia	annual rock-fern	ADIANTACEAE				
Cheilanthes distans	bristly cloak-fern	ADIANTACEAE				R
Cheilanthes lasiophylla	woolly cloak-fern	ADIANTACEAE				E
Cheilanthes sieberi ssp. *sieberi*	narrow rock-fern	ADIANTACEAE				R
Cheiranthera alternifolia	finger-flower	PITTOSPORACEAE				
Chenopodium pumilio	clammy goosefoot	CHENOPODIACEAE				
Chloris truncata	windmill grass	GRAMINEAE				
Choretrum glomeratum	sour-bush	SANTALACEAE				
Chorizandra enodis	black bristle-rush	CYPERACEAE				
Chrysocephalum apiculatum	common everlasting	COMPOSITAE				
Chrysocephalum baxteri	white everlasting	COMPOSITAE				
Chrysocephalum semipapposum	clustered everlasting	COMPOSITAE				R
Cladium procerum	leafy twig-rush	CYPERACEAE			R	R
Clematis microphylla	old man's beard	RANUNCULACEAE				
Comesperma calymega	blue-spike milkwort	POLYGALACEAE				
Comesperma volubile	love creeper	POLYGALACEAE				
Conospermum patens	slender smoke-bush	PROTEACEAE				U
Convolvulus erubescens	Australian bindweed	CONVOLVULACEAE				
Convolvulus remotus	grassy bindweed	CONVOLVULACEAE				
Correa alba var. *pannosa*	white correa	RUTACEAE			R	R
Correa decumbens	spreading correa	RUTACEAE			U	R
Correa glabra	rock correa	RUTACEAE				R
Correa reflexa var. *reflexa*	common correa	RUTACEAE				
Corybas despectans	coast helmet-orchid	ORCHIDACEAE				R
Corybas diemenicus	veined helmet-orchid	ORCHIDACEAE				
Corybas dilatatus	common helmet-orchid	ORCHIDACEAE				
Corybas expansus	dune helmet-orchid	ORCHIDACEAE			U	E
Corybas incurvus	slaty helmet-orchid	ORCHIDACEAE			U	U
Corybas unguiculatus	small helmet-orchid	ORCHIDACEAE			R	E
Cotula australis	common cotula	COMPOSITAE				
Cotula vulgaris var. *australasica*	slender cotula	COMPOSITAE				K
Craspedia glauca	billy-buttons	COMPOSITAE				
Crassula closiana	stalked crassula	CRASSULACEAE				
Crassula colorata var. *acuminata*	dense crassula	CRASSULACEAE				
Crassula colorata var. *colorata*	dense crassula	CRASSULACEAE				

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Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Crassula decumbens var. *decumbens*	spreading crassula	CRASSULACEAE				
Crassula helmsii	swamp crassula	CRASSULACEAE				R
Crassula peduncularis	purple crassula	CRASSULACEAE			Q	R
Crassula sieberiana ssp. *sieberiana*	Sieber's crassula	CRASSULACEAE			E	E
Crassula sieberiana ssp. *tetramera*	Australian stonecrop	CRASSULACEAE				
Cryptandra hispidula	rough cryptandra	RHAMNACEAE			U	U
Cryptandra tomentosa	heath cryptandra	RHAMNACEAE				
Cullen australasicum	tall scurf-pea	LEGUMINOSAE				
Cullen cinereum	annual scurf-pea	LEGUMINOSAE				
Cullen parvum	small scurf-pea	LEGUMINOSAE	E	3ECi	E	E
Cyanicula deformis	bluebeard orchid	ORCHIDACEAE				
Cymbonotus preissianus	austral bear's-ear	COMPOSITAE			U	U
Cymbopogon ambiguus	lemon-grass	GRAMINEAE				V
Cymbopogon obtectus	silky-head lemon-grass	GRAMINEAE				R
Cynoglossum australe	Australian hound's-tongue	BORAGINACEAE				R
Cynoglossum suaveolens	sweet hound's-tongue	BORAGINACEAE			Q	U
Cyperus gunnii ssp. *gunnii*	flecked flat-sedge	CYPERACEAE			U	U
Cyperus gymnocaulos	spiny flat-sedge	CYPERACEAE				
Cyperus involucratus		CYPERACEAE				
Cyperus tenellus	tiny flat-sedge	CYPERACEAE				
Cyperus vaginatus	stiff flat-sedge	CYPERACEAE				
Cyrtostylis reniformis	small gnat-orchid	ORCHIDACEAE				
Cyrtostylis robusta	robust gnat-orchid	ORCHIDACEAE				
Dampiera dysantha	shrubby dampiera	GOODENIACEAE				
Dampiera lanceolata var. *intermedia*	Aldinga dampiera	GOODENIACEAE			V	V
Dampiera rosmarinifolia	rosemary dampiera	GOODENIACEAE				R
Danthonia auriculata	lobed wallaby-grass	GRAMINEAE				
Danthonia caespitosa	common wallaby-grass	GRAMINEAE				
Danthonia carphoides	short wallaby-grass	GRAMINEAE				
Danthonia carphoides var. *carphoides*	short wallaby-grass	GRAMINEAE			K	V
Danthonia clelandii	Cleland's wallaby-grass	GRAMINEAE				
Danthonia duttoniana	brown-back wallaby-grass	GRAMINEAE			R	R
Danthonia eriantha	hill wallaby-grass	GRAMINEAE			R	K
Danthonia geniculata	kneed wallaby-grass	GRAMINEAE				
Danthonia laevis	smooth wallaby-grass	GRAMINEAE			K	K
Danthonia linkii var. *fulva*	leafy wallaby-grass	GRAMINEAE			R	R
Danthonia pilosa var. *paleacea*	velvet wallaby-grass	GRAMINEAE				
Danthonia pilosa var. *pilosa*	velvet wallaby-grass	GRAMINEAE			Q	
Danthonia racemosa var. *racemosa*	slender wallaby-grass	GRAMINEAE				
Danthonia setacea var. *setacea*	small-flower wallaby-grass	GRAMINEAE				
Danthonia tenuior	short-awn wallaby-grass	GRAMINEAE			Q	Q
Daucus glochidiatus	native carrot	UMBELLIFERAE				
Daviesia benthamii ssp. *humilis*	mallee bitter-pea	LEGUMINOSAE			R	V
Daviesia brevifolia	leafless bitter-pea	LEGUMINOSAE				
Daviesia leptophylla	narrow-leaf bitter-pea	LEGUMINOSAE				
Daviesia ulicifolia	gorse bitter-pea	LEGUMINOSAE				
Derwentia derwentiana ssp. *homalodonta*	Derwent speedwell	SCROPHULARIACEAE		3KC-	E	E
Deyeuxia densa	heath bent-grass	GRAMINEAE			R	R
Deyeuxia minor	small bent-grass	GRAMINEAE			K	E
Deyeuxia quadriseta	reed bent-grass	GRAMINEAE				
Dianella brevicaulis	short-stem flax-lily	LILIACEAE				
Dianella longifolia var. *grandis*	pale flax-lily	LILIACEAE			R	V
Dianella porracea	pale flax-lily	LILIACEAE			K	K
Dianella revoluta var. *revoluta*	black-anther flax-lily	LILIACEAE				
Dichanthium sericeum ssp. *sericeum*	silky blue-grass	GRAMINEAE				V
Dichelachne crinita	long-hair plume-grass	GRAMINEAE				
Dichelachne inaequiglumis	loose plume-grass	GRAMINEAE			R	R
Dichelachne micrantha	short-hair plume-grass	GRAMINEAE			Q	Q
Dichondra repens	kidney weed	CONVOLVULACEAE				
Digitaria brownii	cotton panic-grass	GRAMINEAE				K
Dillwynia hispida	red parrot-pea	LEGUMINOSAE				
Dillwynia sericea	showy parrot-pea	LEGUMINOSAE				
Dipodium roseum	pink hyacinth orchid	ORCHIDACEAE				
Disphyma crassifolium ssp. *clavellatum*	round-leaf pigface	AIZOACEAE				
Dissocarpus biflorus var. *biflorus*	two-horn saltbush	CHENOPODIACEAE				V
Distichlis distichophylla	emu-grass	GRAMINEAE				
Diuris aff. *corymbosa*	wallflower donkey-orchid	ORCHIDACEAE				

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Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Diuris aff. *corymbosa* x *pardina*		ORCHIDACEAE				
Diuris behrii	Behr's cowslip orchid	ORCHIDACEAE			R	V
Diuris brevifolia	short-leaf donkey-orchid	ORCHIDACEAE		3RCa	R	R
Diuris lanceolata	cowslip orchid	ORCHIDACEAE			E	
Diuris palustris	little donkey-orchid	ORCHIDACEAE			U	V
Diuris pardina	spotted donkey-orchid	ORCHIDACEAE				
Diuris x *palachila*	broad-lip donkey-orchid	ORCHIDACEAE				
Dodonaea hexandra	horned hop-bush	SAPINDACEAE				R
Dodonaea viscosa ssp. *angustissima*	narrow-leaf hop-bush	SAPINDACEAE				
Dodonaea viscosa ssp. *cuneata*	wedge-leaf hop-bush	SAPINDACEAE			U	V
Dodonaea viscosa ssp. *spatulata*	sticky hop-bush	SAPINDACEAE				
Drosera auriculata	tall sundew	DROSERACEAE				
Drosera auriculata/peltata	sundew	DROSERACEAE				
Drosera binata	forked sundew	DROSERACEAE			R	R
Drosera glanduligera	scarlet sundew	DROSERACEAE				
Drosera macrantha ssp. *planchonii*	climbing sundew	DROSERACEAE				
Drosera peltata	pale sundew	DROSERACEAE				
Drosera praefolia	early sundew	DROSERACEAE			R	V
Drosera pygmaea	tiny sundew	DROSERACEAE				
Drosera whittakeri ssp. *aberrans*		DROSERACEAE			Q	
Drosera whittakeri ssp. *whittakeri*		DROSERACEAE				
Echinopogon ovatus var. *ovatus*	rough-beard grass	GRAMINEAE			R	T
Einadia nutans ssp. *nutans*	climbing saltbush	CHENOPODIACEAE				
Eleocharis acuta	common spike-rush	CYPERACEAE				
Eleocharis gracilis	slender spike-rush	CYPERACEAE			U	U
Elymus scaber var. *scaber (syn. E. scabrus* var. *scabrus)*	native wheat-grass	GRAMINEAE				
Empodisma minus	tangled rope-rush	RESTIONACEAE			U	U
Enchylaena tomentosa var. *tomentosa*	ruby saltbush	CHENOPODIACEAE				
Enneapogon cylindricus	jointed bottle-washers	GRAMINEAE				
Enneapogon nigricans	black-head grass	GRAMINEAE				
Enteropogon acicularis	umbrella grass	GRAMINEAE				
Epacris impressa	common heath	EPACRIDACEAE				
Epaltes australis	spreading nut-heads	COMPOSITAE				K
Epilobium billardierianum ssp. *billardierianum*	robust willow-herb	ONAGRACEAE				
Epilobium billardierianum ssp. *cinereum*	variable willow-herb	ONAGRACEAE				U
Epilobium billardierianum ssp. x *intermedium*	variable willow-herb	ONAGRACEAE				
Epilobium hirtigerum	hairy willow-herb	ONAGRACEAE				
Epilobium pallidiflorum	showy willow-herb	ONAGRACEAE			U	U
Eragrostis benthamii	Bentham's love-grass	GRAMINEAE				
Eragrostis dielsii var. *dielsii*	mulka	GRAMINEAE				K
Eremophila deserti	turkey-bush	MYOPORACEAE				E
Eremophila glabra ssp. *glabra*	tar bush	MYOPORACEAE				K
Eremophila longifolia	weeping emubush	MYOPORACEAE				V
Eriochilus cucullatus	parson's bands	ORCHIDACEAE				
Eriostemon angustifolius ssp. *angustifolius*	narrow-leaf wax-flower	RUTACEAE			R	R
Eriostemon pungens	prickly wax-flower	RUTACEAE				R
Erodium crinitum	blue heron's-bill	GERANIACEAE				R
Eryngium rostratum	blue devil	UMBELLIFERAE			V	V
Eryngium vesiculosum	prostrate blue devil	UMBELLIFERAE			R	K
Eucalyptus arenacea/baxteri	brown stringybark	MYRTACEAE				
Eucalyptus baxteri	brown stringybark	MYRTACEAE				
Eucalyptus camaldulensis var. *camaldulensis*	river red gum	MYRTACEAE				
Eucalyptus cosmophylla	cup gum	MYRTACEAE				
Eucalyptus dalrympleana ssp. *dalrympleana* (syn. *E. rubida*)	Mt Lofty Ranges candlebark	MYRTACEAE			R	R
Eucalyptus diversifolia	coastal white mallee	MYRTACEAE				R
Eucalyptus dumosa	white mallee	MYRTACEAE				V
Eucalyptus dumosa complex	white mallee	MYRTACEAE				
Eucalyptus dumosa x *odorata*	hybrid mallee	MYRTACEAE				
Eucalyptus fasciculosa	pink gum	MYRTACEAE				
Eucalyptus goniocalyx	long-leaf box	MYRTACEAE				
Eucalyptus largiflorens	river box	MYRTACEAE				V
Eucalyptus leptophylla	narrow-leaf red mallee	MYRTACEAE				R
Eucalyptus leucoxylon ssp. *leucoxylon*	South Australian blue gum	MYRTACEAE				
Eucalyptus microcarpa	grey box	MYRTACEAE				U
Eucalyptus obliqua	messmate stringybark	MYRTACEAE				
Eucalyptus odorata	peppermint box	MYRTACEAE				

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Eucalyptus porosa	mallee box	MYRTACEAE				U
Eucalyptus rugosa	coastal white mallee	MYRTACEAE				V
Eucalyptus socialis	beaked red mallee	MYRTACEAE				U
Eucalyptus viminalis ssp. *cygnetensis*	rough-bark manna gum	MYRTACEAE				
Eucalyptus viminalis ssp. *viminalis*	manna gum	MYRTACEAE			R	R
Euchiton gymnocephalus	creeping cudweed	COMPOSITAE				
Euchiton involucratus	star cudweed	COMPOSITAE				
Euchiton sphaericus	annual cudweed	COMPOSITAE				
Euphorbia drummondii	caustic weed	EUPHORBIACEAE				
Euphrasia collina ssp. *osbornii*	Osborn's eyebright	SCROPHULARIACEAE	E	3EC-	E	E
Eutaxia diffusa	large-leaf eutaxia	LEGUMINOSAE			U	V
Eutaxia microphylla var. *microphylla*	common eutaxia	LEGUMINOSAE				
Eutaxia microphylla var. *microphylla* (erect)	common eutaxia	LEGUMINOSAE				
Exocarpos aphyllus	leafless cherry	SANTALACEAE				V
Exocarpos cupressiformis	native cherry	SANTALACEAE				
Exocarpos sparteus	slender cherry	SANTALACEAE				R
Frankenia pauciflora var. *fruticulosa*	southern sea-heath	FRANKENIACEAE				
Frankenia pauciflora var. *gunnii*	southern sea-heath	FRANKENIACEAE				
Gahnia ancistrophylla	curled saw-sedge	CYPERACEAE			U	U
Gahnia deusta	limestone saw-sedge	CYPERACEAE				R
Gahnia filum	smooth cutting-grass	CYPERACEAE				R
Gahnia lanigera	black grass saw-sedge	CYPERACEAE				R
Gahnia sieberiana	red-fruit cutting-grass	CYPERACEAE			U	U
Gahnia trifida	cutting grass	CYPERACEAE				U
Galium gaudichaudii	rough bedstraw	RUBIACEAE				
Galium migrans	loose bedstraw	RUBIACEAE				
Genoplesium rufum	red midge-orchid	ORCHIDACEAE				
Geranium potentilloides var. *potentilloides*	downy geranium	GERANIACEAE				K
Geranium retrorsum	grassland geranium	GERANIACEAE				
Geranium solanderi var. *solanderi*	austral geranium	GERANIACEAE				
Gleichenia microphylla	coral fern	GLEICHENIACEAE			R	R
Glischrocaryon behrii	golden pennants	HALORAGACEAE				
Glossodia major	purple cockatoo	ORCHIDACEAE				
Glyceria australis	Australian sweet-grass	GRAMINEAE				R
Glycine clandestina var. *clandestina*	twining glycine	LEGUMINOSAE			Q	
Glycine clandestina var. *sericea*	twining glycine	LEGUMINOSAE				
Glycine latrobeana	clover glycine	LEGUMINOSAE	V	3VCa	V	V
Glycine tabacina	variable glycine	LEGUMINOSAE			T	E
Gnaphalium indutum	tiny cudweed	COMPOSITAE				R
Gompholobium ecostatum	dwarf wedge-pea	LEGUMINOSAE				
Gonocarpus elatus	hill raspwort	HALORAGACEAE				
Gonocarpus mezianus	broad-leaf raspwort	HALORAGACEAE				
Gonocarpus micranthus ssp. *micranthus*	creeping raspwort	HALORAGACEAE			R	R
Gonocarpus tetragynus	small-leaf raspwort	HALORAGACEAE				
Goodenia albiflora	white goodenia	GOODENIACEAE			U	U
Goodenia amplexans	clasping goodenia	GOODENIACEAE			U	U
Goodenia blackiana	native primrose	GOODENIACEAE				
Goodenia geniculata	bent goodenia	GOODENIACEAE				
Goodenia ovata	hop goodenia	GOODENIACEAE				
Goodenia pinnatifida	cut-leaf goodenia	GOODENIACEAE			Q	U
Goodenia pusilliflora	small-flower goodenia	GOODENIACEAE				
Goodenia willisiana	silver goodenia	GOODENIACEAE				R
Goodia lotifolia var. *lotifolia*	golden-tip	LEGUMINOSAE				U
Gratiola peruviana	austral brooklime	SCROPHULARIACEAE				
Grevillea ilicifolia var. *ilicifolia*	holly-leaf grevillea	PROTEACEAE				K
Grevillea lavandulacea var. *lavandulacea*	spider-flower	PROTEACEAE				
Grevillea lavandulacea var. *sericea*	spider-flower	PROTEACEAE			U	U
Grevillea muricata	rough spider-flower	PROTEACEAE		2RCa	R	
Hakea carinata	erect hakea	PROTEACEAE				
Hakea muelleriana	heath needlebush	PROTEACEAE				R
Hakea rostrata	beaked hakea	PROTEACEAE				
Hakea rugosa	dwarf hakea	PROTEACEAE				
Haloragis acutangula	smooth raspwort	HALORAGACEAE				
Haloragis acutangula forma *acutangula*	smooth raspwort	HALORAGACEAE				
Haloragis aspera	rough raspwort	HALORAGACEAE				R
Haloragis brownii	swamp raspwort	HALORAGACEAE			R	V
Haloragis heterophylla	variable raspwort	HALORAGACEAE			U	U

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Halosarcia indica ssp. *bidens*	brown-head samphire	CHENOPODIACEAE				
Halosarcia flabelliformis	bead samphire	CHENOPODIACEAE	V	3VC-	V	V
Halosarcia halocnemoides ssp. *halocnemoides*	grey samphire	CHENOPODIACEAE				
Halosarcia indica ssp. *bidens*	brown-head samphire	CHENOPODIACEAE				
Halosarcia indica ssp. *leiostachya*	brown-head samphire	CHENOPODIACEAE				
Halosarcia pergranulata ssp. *pergranulata*	black-seed samphire	CHENOPODIACEAE				
Halosarcia syncarpa	fused samphire	CHENOPODIACEAE			Q	
Hardenbergia violacea	native lilac	LEGUMINOSAE				
Helichrysum leucopsideum	satin everlasting	COMPOSITAE				U
Helichrysum rutidolepis	pale everlasting	COMPOSITAE			E	E
Helichrysum scorpioides	button everlasting	COMPOSITAE				
Hemichroa pentandra	trailing hemichroa	AMARANTHACEAE			U	R
Hibbertia exutiacies	prickly guinea-flower	DILLENIACEAE				
Hibbertia incana		DILLENIACEAE				
Hibbertia riparia	guinea-flower	DILLENIACEAE				
Hibbertia riparia (long-leaved aff. H. stricta)	bristly guinea-flower	DILLENIACEAE				
Hibbertia sericea var. *scabrifolia*	rough-leaf guinea-flower	DILLENIACEAE				R
Hibbertia sericea var. *sericea*	silky guinea-flower	DILLENIACEAE				
Hibbertia stricta var. *stricta*	stalked guinea-flower	DILLENIACEAE				
Hibbertia virgata	twiggy guinea-flower	DILLENIACEAE				
Hyalosperma demissum	dwarf sunray	COMPOSITAE				
Hyalosperma semisterile	orange sunray	COMPOSITAE				
Hybanthus floribundus ssp. *floribundus*	shrub violet	VIOLACEAE				
Hydrocotyle callicarpa	tiny pennywort	UMBELLIFERAE				
Hydrocotyle capillaris	thread pennywort	UMBELLIFERAE				R
Hydrocotyle comocarpa	fringe-fruit pennywort	UMBELLIFERAE		3RCi	R	K
Hydrocotyle foveolata	yellow pennywort	UMBELLIFERAE				
Hydrocotyle hirta	hairy pennywort	UMBELLIFERAE			R	R
Hydrocotyle laxiflora	stinking pennywort	UMBELLIFERAE				
Hydrocotyle plebeya		UMBELLIFERAE			U	K
Hydrocotyle verticillata	shield pennywort	UMBELLIFERAE			Q	K
Hymenanthera dentata	tree violet	VIOLACEAE			U	R
Hypericum gramineum	small St John's wort	GUTTIFERAE				
Hypericum japonicum	matted St John's wort	GUTTIFERAE			K	K
Hypolaena fastigiata	tassel rope-rush	RESTIONACEAE				
Hypolepis rugosula	ruddy ground-fern	DENNSTAEDTIACEAE			R	V
Hypoxis glabella var. *glabella*	tiny star	HYPOXIDACEAE				
Hypoxis vaginata var. *vaginata*	yellow star	HYPOXIDACEAE				
Imperata cylindrica	blady grass	GRAMINEAE				R
Indigofera australis var. *australis*	austral indigo	LEGUMINOSAE				U
Isachne globosa	swamp millet	GRAMINEAE				K
Isoetes drummondii ssp. *drummondii*	plain quillwort	ISOETACEAE			R	R
Isoetopsis graminifolia	grass cushion	COMPOSITAE				
Isolepis cernua	nodding club-rush	CYPERACEAE				
Isolepis congrua	slender club-rush	CYPERACEAE				K
Isolepis fluitans	floating club-rush	CYPERACEAE			U	U
Isolepis hookeriana	grassy club-rush	CYPERACEAE			U	R
Isolepis inundata	swamp club-rush	CYPERACEAE				
Isolepis marginata	little club-rush	CYPERACEAE				
Isolepis nodosa	knobby club-rush	CYPERACEAE				
Isolepis platycarpa	flat-fruit club-rush	CYPERACEAE				
Isopogon ceratophyllus	horny cone-bush	PROTEACEAE				
Ixiolaena leptolepis	narrow plover-daisy	COMPOSITAE				
Ixodia achillaeoides ssp. *achillaeoides*	coast ixodia	COMPOSITAE				
Ixodia achillaeoides ssp. *alata*	hills daisy	COMPOSITAE				
Juncus amabilis		JUNCACEAE			V	V
Juncus australis	austral rush	JUNCACEAE			K	K
Juncus bufonius	toad rush	JUNCACEAE				
Juncus caespiticius	grassy rush	JUNCACEAE				
Juncus continuus	pithy rush	JUNCACEAE				
Juncus flavidus	yellow rush	JUNCACEAE			R	R
Juncus holoschoenus	joint-leaf rush	JUNCACEAE				
Juncus kraussii	sea rush	JUNCACEAE				
Juncus pallidus	pale rush	JUNCACEAE				
Juncus pauciflorus	loose-flower rush	JUNCACEAE				
Juncus planifolius	broad-leaf rush	JUNCACEAE				
Juncus sarophorus		JUNCACEAE				

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Juncus subsecundus	finger rush	JUNCACEAE				
Juncus usitatus	common rush	JUNCACEAE				
Kennedia prostrata	scarlet runner	LEGUMINOSAE				
Kunzea pomifera	muntries	MYRTACEAE				U
Lagenifera gracilis	slender bottle-daisy	COMPOSITAE			V	V
Lagenifera huegelii	coarse bottle-daisy	COMPOSITAE				
Lagenifera stipitata var. *stipitata*	spreading bottle-daisy	COMPOSITAE				R
Lasiopetalum baueri	slender velvet-bush	STERCULIACEAE				U
Lasiopetalum behrii	pink velvet-bush	STERCULIACEAE				R
Lavatera plebeia	Australian hollyhock	MALVACEAE				U
Lawrencia glomerata	clustered lawrencia	MALVACEAE				K
Lawrencia spicata	salt lawrencia	MALVACEAE			U	K
Lawrencia squamata	thorny lawrencia	MALVACEAE				K
Laxmannia orientalis	dwarf wire-lily	LILIACEAE				
Lemna disperma	common duckweed	LEMNACEAE				
Lepidium hyssopifolium	small peppercress	CRUCIFERAE				
Lepidium pseudohyssopifolium		CRUCIFERAE			U	E
Lepidobolus drapetocoleus	scale shedder	RESTIONACEAE				
Lepidosperma canescens	hoary rapier-sedge	CYPERACEAE				U
Lepidosperma carphoides	black rapier-sedge	CYPERACEAE				
Lepidosperma concavum	spreading sword-sedge	CYPERACEAE				
Lepidosperma congestum	clustered sword-sedge	CYPERACEAE				
Lepidosperma curtisiae	little sword-sedge	CYPERACEAE				
Lepidosperma gladiatum	coast sword-sedge	CYPERACEAE				U
Lepidosperma laterale s.str.	tall sword-sedge	CYPERACEAE			U	U
Lepidosperma longitudinale	pithy sword-sedge	CYPERACEAE				
Lepidosperma semiteres	wire rapier-sedge	CYPERACEAE				
Lepidosperma viscidum	sticky sword-sedge	CYPERACEAE				
Leporella fimbriata	fringed hare-orchid	ORCHIDACEAE				
Leptocarpus brownii	coarse twine-rush	RESTIONACEAE				U
Leptocarpus tenax	slender twine-rush	RESTIONACEAE				U
Leptoceras menziesii	hare orchid	ORCHIDACEAE				
Leptochloa fusca ssp. *fusca* (syn. *Diplachne parviflora*)	small-flower beetle-grass	GRAMINEAE			R	K
Leptorhynchos elongatus	lanky buttons	COMPOSITAE			K	E
Leptorhynchos squamatus	scaly buttons	COMPOSITAE				
Leptospermum continentale	prickly tea-tree	MYRTACEAE				
Leptospermum lanigerum	silky tea-tree	MYRTACEAE				U
Leptospermum myrsinoides	heath tea-tree	MYRTACEAE				
Leucophyta brownii	coast cushion bush	COMPOSITAE				
Leucopogon concurvus	scrambling beard-heath	EPACRIDACEAE				
Leucopogon cordifolius	heart-leaf beard-heath	EPACRIDACEAE				R
Leucopogon lanceolatus	lance beard-heath	EPACRIDACEAE			U	R
Leucopogon parviflorus	coast beard-heath	EPACRIDACEAE				
Leucopogon rufus	ruddy beard-heath	EPACRIDACEAE			U	R
Leucopogon virgatus	common beard-heath	EPACRIDACEAE				
Levenhookia dubia	hairy stylewort	STYLIDIACEAE				
Levenhookia pusilla	tiny stylewort	STYLIDIACEAE				
Lilaeopsis polyantha	Australian lilaeopsis	UMBELLIFERAE			Q	V
Limosella australis	Australian mudwort	SCROPHULARIACEAE				U
Lindsaea linearis	screw fern	LINDSAEACEAE			U	U
Linum marginale	native flax	LINACEAE				
Lissanthe strigosa	peach heath	EPACRIDACEAE				
Lobelia alata	angled lobelia	CAMPANULACEAE				
Lobelia gibbosa	tall lobelia	CAMPANULACEAE				
Lobelia rhombifolia	tufted lobelia	CAMPANULACEAE			U	U
Logania linifolia	flax-leaf logania	LOGANIACEAE				R
Logania recurva	recurved logania	LOGANIACEAE			U	U
Logania saxatilis	rock logania	LOGANIACEAE			R	R
Lomandra collina	sand mat-rush	LILIACEAE				R
Lomandra densiflora	soft tussock mat-rush	LILIACEAE				
Lomandra effusa	scented mat-rush	LILIACEAE				R
Lomandra fibrata	Mount Lofty mat-rush	LILIACEAE				
Lomandra juncea	desert mat-rush	LILIACEAE				U
Lomandra leucocephala ssp. *robusta*	woolly mat-rush	LILIACEAE				R
Lomandra micrantha ssp. *micrantha*	small-flower mat-rush	LILIACEAE				
Lomandra micrantha ssp. *tuberculata*	small-flower mat-rush	LILIACEAE				
Lomandra multiflora ssp. *dura*	hard mat-rush	LILIACEAE				

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Lomandra nana	small mat-rush	LILIACEAE				
Lomandra sororia	sword mat-rush	LILIACEAE			U	U
Lotus australis	austral trefoil	LEGUMINOSAE				U
Luzula densiflora	dense wood-rush	JUNCACEAE			U	R
Luzula meridionalis	common wood-rush	JUNCACEAE				
Luzula ovata	clustered wood-rush	JUNCACEAE			R	R
Lycium australe	Australian boxthorn	SOLANACEAE				E
Lycopodiella lateralis	slender clubmoss	LYCOPODIACEAE			R	V
Lycopodium deterodensum	bushy clubmoss	LYCOPODIACEAE			E	E
Lycopus australis	Australian gipsywort	LABIATAE			R	R
Lysiana exocarpi ssp. *exocarpi*	harlequin mistletoe	LORANTHACEAE				
Lythrum hyssopifolia	lesser loosestrife	LYTHRACEAE				
Maireana aphylla	cotton-bush	CHENOPODIACEAE				V
Maireana brevifolia	short-leaf bluebush	CHENOPODIACEAE				
Maireana decalvans	black cotton-bush	CHENOPODIACEAE			E	E
Maireana enchylaenoides	wingless fissure-plant	CHENOPODIACEAE				U
Maireana oppositifolia	salt bluebush	CHENOPODIACEAE				
Maireana rohrlachii	Rohrlach's bluebush	CHENOPODIACEAE		3RC-	R	V
Marsilea drummondii	common nardoo	MARSILEACEAE				E
Marsilea hirsuta	short-fruit nardoo	MARSILEACEAE				R
Melaleuca brevifolia	short-leaf honey-myrtle	MYRTACEAE				R
Melaleuca decussata	totem-poles	MYRTACEAE				
Melaleuca halmaturorum ssp. *halmaturorum*	swamp paper-bark	MYRTACEAE				V
Melaleuca lanceolata ssp. *lanceolata*	dryland tea-tree	MYRTACEAE				U
Melaleuca squamea	swamp honey-myrtle	MYRTACEAE			R	V
Melaleuca uncinata	broombush	MYRTACEAE				R
Mentha diemenica	slender mint	LABIATAE			R	K
Microlaena stipoides var. *stipoides*	weeping rice-grass	GRAMINEAE				
Microseris lanceolata	yam daisy	COMPOSITAE				
Microtis arenaria	notched onion-orchid	ORCHIDACEAE				
Microtis atrata	yellow onion-orchid	ORCHIDACEAE			R	R
Microtis frutetorum		ORCHIDACEAE				
Microtis parviflora	slender onion-orchid	ORCHIDACEAE			U	U
Microtis rara	sweet onion-orchid	ORCHIDACEAE			R	R
Microtis unifolia	common onion-orchid	ORCHIDACEAE				
Microtis unifolia complex	onion-orchid	ORCHIDACEAE				
Millotia muelleri	common bow-flower	COMPOSITAE				
Millotia myosotidifolia	broad-leaf millotia	COMPOSITAE				U
Millotia tenuifolia var. *tenuifolia*	soft millotia	COMPOSITAE				
Mimulus repens	creeping monkey-flower	SCROPHULARIACEAE				R
Minuria leptophylla	minnie daisy	COMPOSITAE				
Montia fontana ssp. *chondrosperma*	waterblinks	PORTULACACEAE			V	V
Muehlenbeckia adpressa	climbing lignum	POLYGONACEAE				
Muehlenbeckia florulenta	lignum	POLYGONACEAE				R
Muehlenbeckia gunnii	coastal climbing lignum	POLYGONACEAE				
Myoporum insulare	common boobialla	MYOPORACEAE				
Myoporum montanum	native myrtle	MYOPORACEAE				K
Myoporum parvifolium	creeping boobialla	MYOPORACEAE			R	V
Myoporum platycarpum ssp. *perbellum*	mallee sandalwood	MYOPORACEAE				R
Myoporum platycarpum ssp. *platycarpum*	false sandalwood	MYOPORACEAE				K
Myoporum viscosum	sticky boobialla	MYOPORACEAE			U	U
Myosotis australis	austral forget-me-not	BORAGINACEAE				R
Myosotis australis/discolor	forget-me-not	BORAGINACEAE				
Myosurus minimus var. *australis*	mousetail	RANUNCULACEAE			Q	
Myriophyllum amphibium	broad milfoil	HALORAGACEAE			R	R
Myriophyllum integrifolium	tiny milfoil	HALORAGACEAE			R	R
Myriophyllum simulans	amphibious milfoil	HALORAGACEAE			Q	V
Neurachne alopecuroidea	fox-tail mulga-grass	GRAMINEAE				
Nicotiana maritima	coast tobacco	SOLANACEAE				R
Nitraria billardierei	nitre-bush	ZYGOPHYLLACEAE				
Olearia axillaris	coast daisy-bush	COMPOSITAE				
Olearia ciliata var. *ciliata*	fringed daisy-bush	COMPOSITAE				
Olearia floribunda var. *floribunda*	heath daisy-bush	COMPOSITAE				
Olearia grandiflora	Mount Lofty daisy-bush	COMPOSITAE			U	U
Olearia pannosa ssp. *cardiophylla*	velvet daisy-bush	COMPOSITAE		3RC-	R	K
Olearia pannosa ssp. *pannosa*	silver daisy-bush	COMPOSITAE	V	3VCa	V	V
Olearia passerinoides ssp. *glutescens*	sticky daisy-bush	COMPOSITAE			R	V

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Olearia ramulosa	twiggy daisy-bush	COMPOSITAE				
Olearia teretifolia	cypress daisy-bush	COMPOSITAE			U	U
Olearia tubuliflora	rayless daisy-bush	COMPOSITAE			U	U
Opercularia ovata	broad-leaf stinkweed	RUBIACEAE			U	U
Opercularia scabrida	stalked stinkweed	RUBIACEAE				
Opercularia turpis	twiggy stinkweed	RUBIACEAE				
Opercularia varia	variable stinkweed	RUBIACEAE				
Ophioglossum lusitanicum	austral adder's-tongue	OPHIOGLOSSACEAE				U
Orobanche cernua var. *australiana*	Australian broomrape	OROBANCHACEAE			U	E
Orthoceras strictum	horned orchid	ORCHIDACEAE			U	R
Oxalis perennans	native sorrel	OXALIDACEAE				
Oxalis radicosa	downy native sorrel	OXALIDACEAE			Q	K
Ozothamnus retusus	notched bush-everlasting	COMPOSITAE			Q	R
Panicum effusum var. *effusum*	hairy panic	GRAMINEAE			Q	K
Parietaria debilis	smooth-nettle	URTICACEAE				
Paspalidium constrictum	knotty-butt paspalidium	GRAMINEAE				R
Paspalidium jubiflorum	Warrego summer-grass	GRAMINEAE				K
Patersonia occidentalis	long purple-flag	IRIDACEAE			U	U
Pelargonium australe	australian pelargonium	GERANIACEAE				U
Pelargonium littorale	native pelargonium	GERANIACEAE				
Pentapogon quadrifidus var. *quadrifidus*	five-awn spear-grass	GRAMINEAE			R	K
Persicaria decipiens	slender knotweed	POLYGONACEAE				
Persicaria lapathifolia	pale knotweed	POLYGONACEAE			U	T
Persicaria prostrata	creeping knotweed	POLYGONACEAE			U	U
Persoonia juniperina	prickly geebung	PROTEACEAE				U
Phebalium hillebrandii	Mount Lofty phebalium	RUTACEAE		2RCa	R	R
Phragmites australis	common reed	GRAMINEAE				
Phyllangium distylis	tiny mitrewort	LOGANIACEAE			R	K
Phyllangium divergens	wiry mitrewort	LOGANIACEAE				
Phyllanthus australis	southern spurge	EUPHORBIACEAE				K
Phyllanthus saxosus	rock spurge	EUPHORBIACEAE			U	V
Phylloglossum drummondii	pigmy clubmoss	LYCOPODIACEAE			R	R
Phyllota pleurandroides	heathy phyllota	LEGUMINOSAE				U
Picris angustifolia ssp. *angustifolia*	coast picris	COMPOSITAE			Q	K
Picris squarrosa	squat picris	COMPOSITAE			Q	E
Pimelea curviflora var. *gracilis*	curved riceflower	THYMELAEACEAE				
Pimelea curviflora var. *sericea*	curved riceflower	THYMELAEACEAE				
Pimelea flava ssp. *dichotoma*	diosma riceflower	THYMELAEACEAE				
Pimelea flava ssp. *flava*	yellow riceflower	THYMELAEACEAE				K
Pimelea glauca	smooth riceflower	THYMELAEACEAE				
Pimelea humilis	low riceflower	THYMELAEACEAE				
Pimelea linifolia ssp. *linifolia*	slender riceflower	THYMELAEACEAE				
Pimelea micrantha	silky riceflower	THYMELAEACEAE				R
Pimelea octophylla	woolly riceflower	THYMELAEACEAE				
Pimelea phylicoides	heath riceflower	THYMELAEACEAE				
Pimelea serpyllifolia ssp. *serpyllifolia*	thyme riceflower	THYMELAEACEAE				
Pimelea stricta	erect riceflower	THYMELAEACEAE				
Pittosporum phylliraeoides var. *microcarpa*	native apricot	PITTOSPORACEAE				R
Plantago drummondii	dark plantain	PLANTAGINACEAE				T
Plantago gaudichaudii	narrow-leaf plantain	PLANTAGINACEAE				R
Plantago hispida	hairy plantain	PLANTAGINACEAE				
Plantago sp. B	little plantain	PLANTAGINACEAE				
Plantago varia	variable plantain	PLANTAGINACEAE				
Platylobium obtusangulum	holly flat-pea	LEGUMINOSAE				
Platysace heterophylla var. *heterophylla*	slender platysace	UMBELLIFERAE				
Pleurosorus rutifolius	blanket fern	ASPLENIACEAE				U
Poa clelandii	matted tussock-grass	GRAMINEAE				
Poa crassicaudex	thick-stem tussock-grass	GRAMINEAE				
Poa labillardieri var. *labillardieri*	common tussock-grass	GRAMINEAE				
Poa poiformis	coast tussock-grass	GRAMINEAE				
Poa tenera	slender tussock-grass	GRAMINEAE			Q	U
Poa umbricola	shady tussock-grass	GRAMINEAE		3RCa	R	R
Podolepis muelleri	button podolepis	COMPOSITAE			K	V
Podolepis rugata var. *littoralis*	coast copper-wire daisy	COMPOSITAE			U	T
Podolepis tepperi	delicate copper-wire daisy	COMPOSITAE				R
Podotheca angustifolia	sticky long-heads	COMPOSITAE				
Pogonolepis muelleriana	stiff cup-flower	COMPOSITAE				U

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Pomaderris paniculosa ssp. *paniculosa*	mallee pomaderris	RHAMNACEAE				U
Poranthera ericoides	heath poranthera	EUPHORBIACEAE				R
Poranthera microphylla	small poranthera	EUPHORBIACEAE				
Poranthera triandra	three-petal poranthera	EUPHORBIACEAE				R
Portulaca oleracea	common purslane	PORTULACACEAE				
Posidonia australis	southern tapeweed	POSIDONIACEAE				
Potamogeton tepperi	Tepper's pondweed	POTAMOGETONACEAE				E
Prasophyllum australe	austral leek-orchid	ORCHIDACEAE			R	R
Prasophyllum constrictum	tawny leek-orchid	ORCHIDACEAE			R	R
Prasophyllum elatum	tall leek-orchid	ORCHIDACEAE				
Prasophyllum fitzgeraldii	Fitzgerald's leek-orchid	ORCHIDACEAE			U	R
Prasophyllum occidentale	plains leek-orchid	ORCHIDACEAE				
Prasophyllum odoratum	scented leek-orchid	ORCHIDACEAE				
Prasophyllum pallidum	pale leek-orchid	ORCHIDACEAE	V	3VCa	V	V
Prasophyllum pruinosum	plum leek-orchid	ORCHIDACEAE			V	V
Pratia pedunculata	matted pratia	CAMPANULACEAE			U	T
Prostanthera behriana	downy mintbush	LABIATAE			U	U
Prostanthera chlorantha	green mintbush	LABIATAE		R	R	R
Prunella vulgaris	self-heal	LABIATAE				
Pseudognaphalium luteoalbum	Jersey cudweed	COMPOSITAE				
Psilotum nudum	skeleton fork-fern	PSILOTACEAE			E	E
Pteridium esculentum	bracken fern	DENNSTAEDTIACEAE				
Pteris tremula	tender brake	PTERIDACEAE			R	V
Pterostylis aff. *nana* "mallee"	mallee dwarf greenhood	ORCHIDACEAE				K
Pterostylis aff. *rufa*	rufous greenhood	ORCHIDACEAE				
Pterostylis alata	tall shell-orchid	ORCHIDACEAE			U	R
Pterostylis arenicola	sandhill greenhood	ORCHIDACEAE	V	3RCa	V	E
Pterostylis biseta	two-bristle greenhood	ORCHIDACEAE				K
Pterostylis cucullata	leafy greenhood	ORCHIDACEAE	V	3VCa	V	V
Pterostylis curta	blunt greenhood	ORCHIDACEAE			R	R
Pterostylis cycnocephala	swan-head greenhood	ORCHIDACEAE				R
Pterostylis excelsa	dryland greenhood	ORCHIDACEAE				E
Pterostylis foliata	slender greenhood	ORCHIDACEAE			R	R
Pterostylis furcata	forked greenhood	ORCHIDACEAE			E	
Pterostylis longifolia	tall greenhood	ORCHIDACEAE				
Pterostylis mutica	midget greenhood	ORCHIDACEAE				T
Pterostylis nana	dwarf greenhood	ORCHIDACEAE				
Pterostylis nutans	nodding greenhood	ORCHIDACEAE				
Pterostylis pedunculata	maroon-hood	ORCHIDACEAE				
Pterostylis plumosa	bearded greenhood	ORCHIDACEAE				
Pterostylis robusta	large shell-orchid	ORCHIDACEAE				
Pterostylis sanguinea	blood greenhood	ORCHIDACEAE				
Pterostylis x *ingens*	pointed greenhood	ORCHIDACEAE				
Ptilotus erubescens	hairy-tails	AMARANTHACEAE		Q	R	R
Ptilotus nobilis var. *nobilis*	yellow-tails	AMARANTHACEAE				V
Ptilotus polystachyus var. *polystachyus*	long-tails	AMARANTHACEAE				T
Ptilotus spathulatus forma *spathulatus*	pussy-tails	AMARANTHACEAE				R
Puccinellia stricta var. *stricta*	Australian saltmarsh-grass	GRAMINEAE				
Pultenaea acerosa	bristly bush-pea	LEGUMINOSAE				U
Pultenaea canaliculata var. *canaliculata*	soft bush-pea	LEGUMINOSAE				
Pultenaea canaliculata var. *latifolia*	soft bush-pea	LEGUMINOSAE				
Pultenaea daphnoides	large-leaf bush pea	LEGUMINOSAE				
Pultenaea graveolens	scented bush-pea	LEGUMINOSAE			U	R
Pultenaea hispidula	rusty bush-pea	LEGUMINOSAE			U	R
Pultenaea involucrata	Mount Lofty bush-pea	LEGUMINOSAE		R	U	U
Pultenaea largiflorens	twiggy bush-pea	LEGUMINOSAE				
Pultenaea laxiflora	loose-flower bush-pea	LEGUMINOSAE				
Pultenaea pedunculata	matted bush-pea	LEGUMINOSAE				
Pultenaea scabra	rough bush-pea	LEGUMINOSAE			R	R
Pultenaea tenuifolia	narrow-leaf bush-pea	LEGUMINOSAE				K
Pultenaea trinervis	three-nerve bush-pea	LEGUMINOSAE				
Pyrorchis nigricans	black fire-orchid	ORCHIDACEAE				
Quinetia urvillei	quinetia	COMPOSITAE			U	R
Ranunculus amphitrichus	small river buttercup	RANUNCULACEAE			U	R
Ranunculus lappaceus	native buttercup	RANUNCULACEAE				
Ranunculus pachycarpus	thick-fruit buttercup	RANUNCULACEAE			U	R
Ranunculus parviflorus	small-flower buttercup	RANUNCULACEAE				

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Ranunculus pumilio var. *pumilio*	ferny buttercup	RANUNCULACEAE				R
Ranunculus sessiliflorus var. *sessiliflorus*	annual buttercup	RANUNCULACEAE				
Rhagodia candolleana ssp. *candolleana*	seaberry saltbush	CHENOPODIACEAE				
Rhagodia crassifolia	fleshy saltbush	CHENOPODIACEAE				
Rhagodia parabolica	mealy saltbush	CHENOPODIACEAE				V
Rhagodia spinescens	spiny saltbush	CHENOPODIACEAE				E
Rhodanthe corymbiflora	paper everlasting	COMPOSITAE				K
Rhodanthe laevis	smooth daisy	COMPOSITAE				U
Rhodanthe pygmaea	pigmy daisy	COMPOSITAE				U
Rosaceae sp.	rose family	ROSACEAE				
Rubus parvifolius	native raspberry	ROSACEAE			U	U
Rumex bidens	mud dock	POLYGONACEAE				K
Rumex brownii	slender dock	POLYGONACEAE				
Rumex dumosus var. *dumosiformis*	wiry dock	POLYGONACEAE				
Ruppia megacarpa	widgeon grass	POTAMOGETONACEAE				
Ruppia polycarpa	widgeon grass	POTAMOGETONACEAE				
Rutidosis multiflora	small wrinklewort	COMPOSITAE				
Salsola kali	buckbush	CHENOPODIACEAE				
Samolus repens	creeping brookweed	PRIMULACEAE				U
Santalum acuminatum	quandong	SANTALACEAE				V
Santalum murrayanum	bitter quandong	SANTALACEAE			U	R
Sarcocornia blackiana	thick-head samphire	CHENOPODIACEAE				
Sarcocornia quinqueflora	beaded samphire	CHENOPODIACEAE				
Scaevola albida	pale fan-flower	GOODENIACEAE				
Scaevola angustata	coast fanflower	GOODENIACEAE				V
Scaevola crassifolia	cushion fanflower	GOODENIACEAE				R
Scaevola linearis ssp. *confertifolia*	bundled fanflower	GOODENIACEAE			U	R
Schizaea fistulosa	narrow comb-fern	SCHIZAEACEAE			V	E
Schoenoplectus litoralis	shore club-rush	CYPERACEAE				U
Schoenoplectus pungens	spiky club-rusf	CYPERACEAE				U
Schoenoplectus validus	river club-rush	CYPERACEAE				
Schoenus apogon	common bog-rush	CYPERACEAE				
Schoenus breviculmis	matted bog-rush	CYPERACEAE				
Schoenus carsei	wiry bog-rush	CYPERACEAE			U	U
Schoenus lepidosperma ssp. *lepidosperma*	slender bog-rush	CYPERACEAE			R	R
Schoenus maschalinus	leafy bog-rush	CYPERACEAE			U	U
Schoenus nanus	little bog-rush	CYPERACEAE				R
Schoenus nitens	shiny bog-rush	CYPERACEAE				R
Schoenus tesquorum	grassy bog-rush	CYPERACEAE			R	E
Scleranthus pungens	prickly knawel	CARYOPHYLLACEAE				R
Sclerolaena diacantha	grey bindyi	CHENOPODIACEAE				R
Sclerolaena uniflora	small-spine bindyi	CHENOPODIACEAE				K
Sclerostegia arbuscula	shrubby samphire	CHENOPODIACEAE				
Scutellaria humilis	dwarf skullcap	LABIATAE			R	R
Sebaea ovata	yellow sebaea	GENTIANACEAE				
Selliera radicans	shiny swamp-mat	GOODENIACEAE				R
Senecio glomeratus	swamp groundsel	COMPOSITAE				
Senecio glossanthus	annual groundsel	COMPOSITAE				
Senecio hispidulus var. *hispidulus*	rough groundsel	COMPOSITAE			U	U
Senecio hypoleucus	pale groundsel	COMPOSITAE			U	U
Senecio lautus	variable groundsel	COMPOSITAE				
Senecio minimus var. *minimus*	fine-tooth groundsel	COMPOSITAE			U	V
Senecio odoratus var. *odoratus*	scented groundsel	COMPOSITAE				U
Senecio picridioides	purple-leaf groundsel	COMPOSITAE				
Senecio quadridentatus	cotton groundsel	COMPOSITAE				
Senecio squarrosus	squarrose groundsel	COMPOSITAE				R
Senecio tenuiflorus	woodland groundsel	COMPOSITAE				
Senna artemisioides nothossp. *coriacea*	broad-leaf desert senna	LEGUMINOSAE				
Senna artemisioides ssp. *filifolia*	fine-leaf desert senna	LEGUMINOSAE				
Senna artemisioides ssp. *petiolaris*	flat-stalk senna	LEGUMINOSAE				
Sida corrugata var. *angustifolia*	grassland sida	MALVACEAE			Q	R
Sida corrugata var. *corrugata*	corrugated sida	MALVACEAE				
Sida petrophila	rock sida	MALVACEAE				K
Sigesbeckia orientalis ssp. *orientalis*	oriental sigesbeckia	COMPOSITAE			Q	R
Solanum laciniatum	cut-leaf kangaroo-apple	SOLANACEAE				R
Solenogyne dominii	smooth solenogyne	COMPOSITAE			U	U
Sonchus hydrophilus	native sow-thistle	COMPOSITAE				

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Sonchus megalocarpus	coast sow-thistle	COMPOSITAE				K
Sphaerolobium minus	leafless globe-pea	LEGUMINOSAE			R	R
Spinifex sericeus	rolling spinifex	GRAMINEAE				
Spiranthes sinensis ssp. *australis*	austral lady's tresses	ORCHIDACEAE			R	V
Sporobolus caroli	yakka grass	GRAMINEAE				
Sporobolus virginicus	salt couch	GRAMINEAE				
Sprengelia incarnata	pink swamp-heath	EPACRIDACEAE			R	R
Spyridium parvifolium	dusty miller	RHAMNACEAE				
Spyridium spathulatum	spoon-leaf spyridium	RHAMNACEAE		3RCa	R	R
Spyridium tricolor	rusty spyridium	RHAMNACEAE		Q	K	
Spyridium vexilliferum var. *vexilliferum*	winged spyridium	RHAMNACEAE				
Stackhousia aspericocca ssp. (Cylindrical)	bushy candles	STACKHOUSIACEAE				
Stackhousia aspericocca ssp. (One-sided)	one-sided candles	STACKHOUSIACEAE				
Stackhousia monogyna	creamy candles	STACKHOUSIACEAE				
Stellaria palustris var. *tenella*	swamp starwort	CARYOPHYLLACEAE			R	R
Stuartina muelleri	spoon cudweed	COMPOSITAE				
Stylidium calcaratum	spurred trigger-plant	STYLIDIACEAE				
Stylidium despectum	small trigger-plant	STYLIDIACEAE				
Stylidium graminifolium	grass trigger-plant	STYLIDIACEAE				
Stylidium inundatum	hundreds and thousands	STYLIDIACEAE				
Suaeda australis	austral seablite	CHENOPODIACEAE				
Swainsona behriana	Behr's swainson-pea	LEGUMINOSAE			K	E
Swainsona formosa	Sturt pea	LEGUMINOSAE				
Swainsona lessertiifolia	coast swainson-pea	LEGUMINOSAE				R
Tetragonia implexicoma	bower spinach	AIZOACEAE				
Tetraria capillaris	hair sedge	CYPERACEAE				V
Tetratheca pilosa ssp. *pilosa*	hairy pink-bells	TREMANDRACEAE				
Teucrium racemosum	grey germander	LABIATAE				T
Thelymitra antennifera	lemon sun-orchid	ORCHIDACEAE				
Thelymitra aristata	great sun-orchid	ORCHIDACEAE				
Thelymitra benthamiana	leopard sun-orchid	ORCHIDACEAE			U	R
Thelymitra carnea	small pink sun-orchid	ORCHIDACEAE			R	R
Thelymitra circumsepta	naked sun-orchid	ORCHIDACEAE			E	E
Thelymitra flexuosa	twisted sun-orchid	ORCHIDACEAE			R	R
Thelymitra grandiflora	great sun-orchid	ORCHIDACEAE			U	U
Thelymitra holmesii	blue star sun-orchid	ORCHIDACEAE			V	V
Thelymitra ixioides	spotted sun-orchid	ORCHIDACEAE				
Thelymitra juncifolia	spotted sun-orchid	ORCHIDACEAE				
Thelymitra luteocilium	yellow-tuft sun orchid	ORCHIDACEAE				
Thelymitra mucida	plum sun-orchid	ORCHIDACEAE			R	R
Thelymitra nuda	scented sun-orchid	ORCHIDACEAE				
Thelymitra pauciflora	slender sun-orchid	ORCHIDACEAE				
Thelymitra rubra	salmon sun-orchid	ORCHIDACEAE				
Thelymitra x *macmillanii*	crimson sun-orchid	ORCHIDACEAE				
Thelymitra x *truncata*	hybrid sun-orchid	ORCHIDACEAE				
Themeda triandra	kangaroo grass	GRAMINEAE				
Thomasia petalocalyx	paper-flower	STERCULIACEAE				
Threlkeldia diffusa	coast bonefruit	CHENOPODIACEAE				
Thysanotus baueri	mallee fringe-lily	LILIACEAE				E
Thysanotus juncifolius	rush fringe-lily	LILIACEAE				
Thysanotus patersonii	twining fringe-lily	LILIACEAE				
Todea barbara	king fern	OSMUNDACEAE			E	E
Trachymene cyanopetala	purple trachymene	UMBELLIFERAE				R
Trachymene pilosa	dwarf trachymene	UMBELLIFERAE				
Tricoryne elatior	yellow rush-lily	LILIACEAE				
Tricoryne tenella	tufted yellow rush-lily	LILIACEAE				
Triglochin calcitrapum	spurred arrowgrass	JUNCAGINACEAE				R
Triglochin centrocarpum	dwarf arrowgrass	JUNCAGINACEAE				
Triglochin mucronatum	prickly arrowgrass	JUNCAGINACEAE			Q	K
Triglochin procerum	water-ribbons	JUNCAGINACEAE				U
Triglochin striatum	streaked arrowgrass	JUNCAGINACEAE				
Triglochin trichophorum	arrowgrass	JUNCAGINACEAE				
Triptilodiscus pygmaeus	small yellow-heads	COMPOSITAE				U
Trymalium wayae	grey trymalium	RHAMNACEAE			U	V
Typha domingensis	narrow-leaf bulrush	TYPHACEAE				
Typha orientalis	broad-leaf bulrush	TYPHACEAE				R
Utricularia dichotoma	purple bladderwort	LENTIBULARIACEAE			U	U

SPECIES DESCRIPTION			Status			
Species	Common Name	Family	EPBC Act	Rotap	SA	SL
Utricularia lateriflora	small bladderwort	LENTIBULARIACEAE			V	E
Utricularia tenella	pink bladderwort	LENTIBULARIACEAE			U	R
Velleia arguta	toothed velleia	GOODENIACEAE				R
Velleia paradoxa	spur velleia	GOODENIACEAE			Q	U
Veronica gracilis	slender speedwell	SCROPHULARIACEAE			V	V
Villarsia reniformis	running marsh-flower	MENYANTHACEAE				
Villarsia umbricola var. *umbricola*	lax marsh-flower	MENYANTHACEAE			U	U
Viminaria juncea	native broom	LEGUMINOSAE			R	R
Viola cleistogamoides	shy violet	VIOLACEAE			R	R
Viola hederacea	ivy-leaf violet	VIOLACEAE				R
Viola sieberiana	tiny violet	VIOLACEAE				
Vittadinia australasica var. *australasica*	sticky New Holland daisy	COMPOSITAE				R
Vittadinia blackii	narrow-leaf New Holland daisy	COMPOSITAE				R
Vittadinia cervicularis var. *cervicularis*	waisted New Holland daisy	COMPOSITAE				
Vittadinia cuneata var. *cuneata* forma *cuneata*	fuzzy New Holland daisy	COMPOSITAE				
Vittadinia dissecta var. *hirta*	dissected New Holland daisy	COMPOSITAE				T
Vittadinia gracilis	woolly New Holland daisy	COMPOSITAE				
Vittadinia megacephala	giant New Holland daisy	COMPOSITAE				R
Vulpia bromoides/myuros		GRAMINEAE				
Wahlenbergia communis	tufted bluebell	CAMPANULACEAE				
Wahlenbergia gracilenta	annual bluebell	CAMPANULACEAE				
Wahlenbergia gracilis	sprawling bluebell	CAMPANULACEAE			K	K
Wahlenbergia litticola	coast bluebell	CAMPANULACEAE				R
Wahlenbergia luteola	yellow-wash bluebell	CAMPANULACEAE				
Wahlenbergia multicaulis	Tadgell's bluebell	CAMPANULACEAE				U
Wahlenbergia preissii		CAMPANULACEAE				
Wahlenbergia stricta ssp. *stricta*	tall bluebell	CAMPANULACEAE				
Westringia rigida	stiff westringia	LABIATAE				R
Whalleya proluta (syn. *Homopholis proluta*)	rigid panic	GRAMINEAE				R
Wilsonia humilis var. *humilis*	silky wilsonia	CONVOLVULACEAE				U
Wilsonia rotundifolia	round-leaf wilsonia	CONVOLVULACEAE				V
Wurmbea dioica ssp. *dioica*	early star-lily	LILIACEAE				
X *calassodia tutelata*		ORCHIDACEAE				
Xanthorrhoea quadrangulata	rock grass-tree	LILIACEAE				
Xanthorrhoea semiplana ssp. *semiplana*	yacca	LILIACEAE				
Xanthorrhoea semiplana ssp. *tateana*	Tate's grass-tree	LILIACEAE				U
Xanthosia pusilla	hairy xanthosia	UMBELLIFERAE				
Xyris operculata	tall yellow-eye	XYRIDACEAE			R	V
Zieria veronicea	pink zieria	RUTACEAE			R	R
Zostera muelleri var. *muelleri*	dwarf grasswrack	ZOSTERACEAE				
Zygophyllum billardierei	coast twinleaf	ZYGOPHYLLACEAE				R
Zygophyllum confluens	forked twinleaf	ZYGOPHYLLACEAE				R
Zygophyllum glaucum	pale twinleaf	ZYGOPHYLLACEAE				T

Appendix 3 Threatened Species Conservation Categories

Taxa	Source of Conservation Status		
	Regional	South Australia	Australia
Plants	Lang & Kraehenbuehl (1998)	*National Parks and Wildlife Act (1972) Schedules 7, 8 and 9* (2000 version)	*Environment Protection and Biodiversity Conservation Act (1999)*
Mammals	Kemper *pers. comm.*		
Birds	Carpenter & Reid (1997)		
Reptiles	Hutchinson *pers. comm.*		
Frogs			
Freshwater Fishes	None used	None used	
Butterflies	None used	Grund (1998)	
Other Invertebrates	None used	None used	

Definitions of Conservation Categories

Environment Protection and Biodiversity Conservation Act (1999)

X ***Extinct*** No reasonable doubt that the last member of the species has died.

EW ***Extinct in the Wild*** Species is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.

CE ***Critically Endangered*** Species is facing an *extremely high risk* of extinction in the wild in the immediate future.

E ***Endangered*** Species is not critically endangered, but it is facing a *very high risk* of extinction in the wild in the near future.

V ***Vulnerable*** Species is not critically endangered or endangered, but it is facing a *high risk* of extinction in the wild in the medium-term future.

CD ***Conservation Dependent*** Species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Under the previous *Endangered Species Protection Act (1992)*, there existed only three conservation categories- *Extinct*, *Endangered* and *Vulnerable*. The additional three categories of *Extinct in the Wild*, *Critically Endangered* and *Conservation Dependent* have been established following the promulgation of the EPBC Act. However, as of November 2000, there are no species listed under these categories. Following the next meeting of the Threatened Species Scientific Committee, it is expected that some species will have their conservation category changed and some species not currently listed, will following nomination be listed under one of the six categories above (Sarah May *pers. comm.*).

National Parks and Wildlife Act (1972) Schedules 7 (Endangered), 8 (Vulnerable) & 9 (Rare)

E ***Endangered*** Taxa that are likely to become extinct in South Australia unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate

V ***Vulnerable*** Taxa that are likely to move into the "Endangered" category in South Australia in the near future unless the circumstances and factors threatening their abundance, survival or evolutionary development cease to operate.

R ***Rare*** Taxa that occur in small populations in South Australia, that are not at present "Endangered" or "Vulnerable" but are at some risk due to their low numbers. These taxa are usually localised within restricted geographical areas or are thinly scattered over a more extensive range. This may include taxa which are perceived to be at risk for which there is insufficient information available to

assign them to any other category, and taxa that are considered to be dependent on ongoing conservation programs to prevent them moving into the endangered or vulnerable categories. Populations or rare taxa in Australia may be contiguous with populations interstate that are considered to be secure. The rare category does not include taxa that are considered to be vagrants in South Australia.

ROTAP (Briggs & Leigh 1995) (National Conservation ratings for plants)

The Distribution Code (can be 1, 2 or 3)

1	Known by one collection only
2	Geographic Range in Australia less than 100km
3	Geographic Range in Australia greater than 100km

The Conservation Status (can be X, E, V, R or K)

X	**Presumed Extinct**: taxon not collected or otherwise verified over the past 50 years despite thorough searching in all known and likely habitats, or of which all known wild populations have been destroyed more recently.
E	**Endangered**: taxon in serious risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate. This category includes taxa with populations possibly too small (usually less than 100 individuals) to ensure survival even if present in proclaimed reserves.
V	**Vulnerable**: taxon not presently Endangered, but at risk over a longer period (20-50years) of disappearing from the wild through continued depletion, or which occurs on land whose future use is likely to change and threaten its survival.
R	**Rare**: taxon which is rare in Australia (and hence usually the world) but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.
K	**Poorly Known**: taxon that is suspected, but not definitely known, to belong to one of the above categories. At present accurate field distribution information is inadequate.
C	**Reserved**: indicates taxon has at least one population within a national park, other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora. The taxon may or may not be considered adequately conserved within the reserve(s), as reflected by the conservation status symbol assigned to it. Where applicable, the 'C' symbol immediately follows the conservation status symbol in the written code, eg 2RC.

Size-class of all reserved populations (options are a, i or -)

a	1000 plants or more are known to occur within a conservation reserve(s),
i	less than 1000 plants are known to occur within a conservation reserve(s),
-	reserved population size not accurately known;
t	**Total known population reserved;**
+	**Overseas occurrence** (included if the taxon has a natural occurrence overseas)

Lang & Kraehenbuehl (1998) (Regional Conservation ratings for plants)

X	***Extinct/ Presumed extinct:*** not located despite thorough searching of all known and likely habitats; known to have been eliminated by the loss of localised populations(s); or not recorded for more than 50 years from an area where substantial habitat modification has occurred.
E	***Endangered:*** rare and in danger of becoming extinct in the wild.
T	***Threatened:*** likely to be either endangered or vulnerable but insufficient data for a more precise assessment.
V	***Vulnerable:*** rare and at risk from potential threats or long-term threats which could cause the species to become endangered in the future.
K	***Uncertain:*** likely to be either threatened or rare but insufficient data for a more precise assessment.
R	***Rare:*** has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant threats, but warrants monitoring and protective measures to prevent reduction of population sizes.
U	***Uncommon:*** less common species of interest but not rare enough to warrant special protective measures
Q	Not yet assessed but flagged as being of possible significance.
N	***Not of particular significance/ Common*** (also indicated by a blank entry)

Hutchinson *pers. comm.* (Regional conservation ratings for reptiles and amphibians)

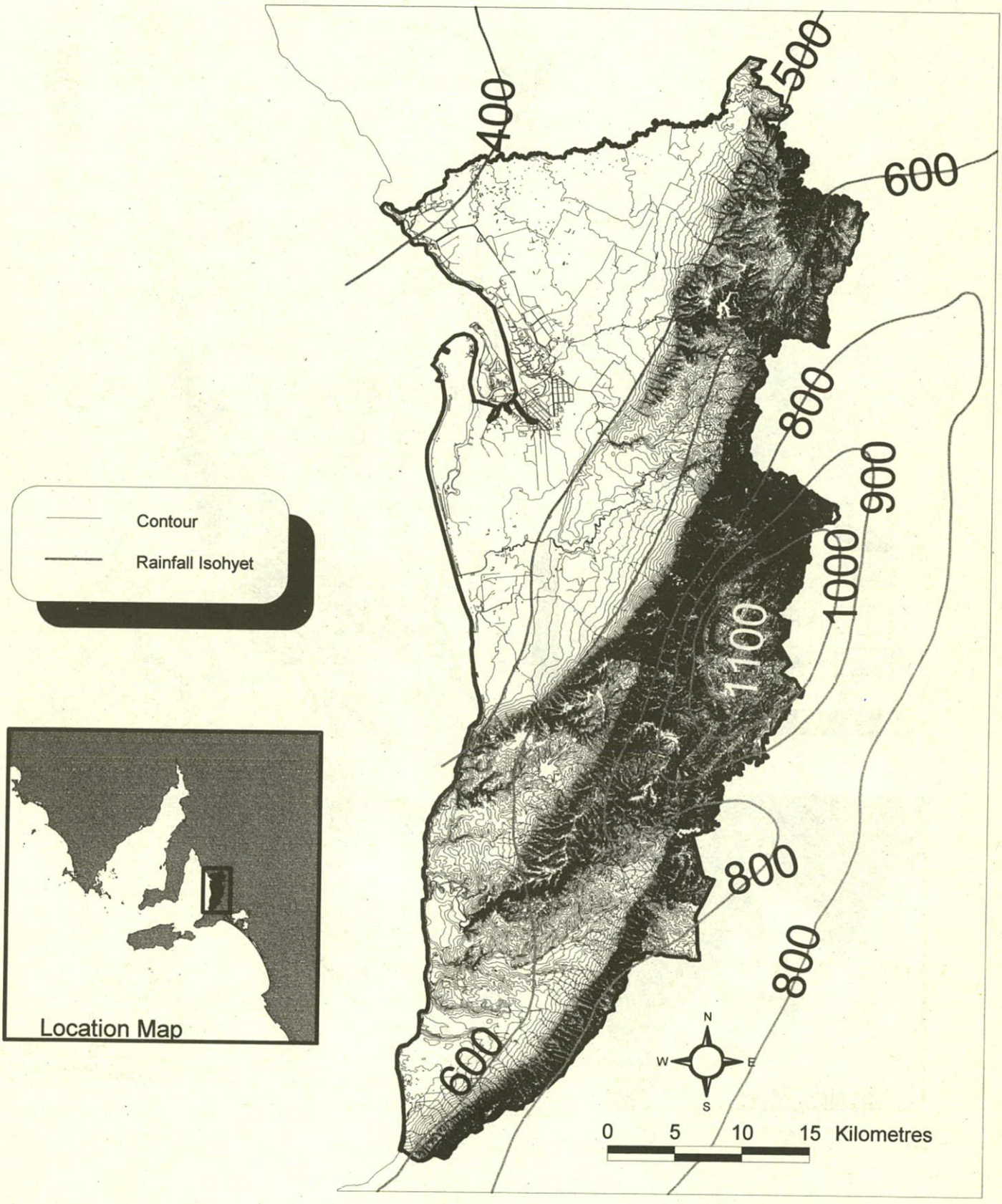
Extinct	No longer found in survey area.
Endangered	Will become extinct if current processes continue or if populations continue to decline.
Vulnerable	Not presently endangered, but likely to become so if current trends are not reversed.
Uncommon	Found in only a few local populations, or widespread but seldom encountered. Conservation status not clear

Carpenter & Reid (1987, updated to 1999) (Regional conservation ratings for birds)

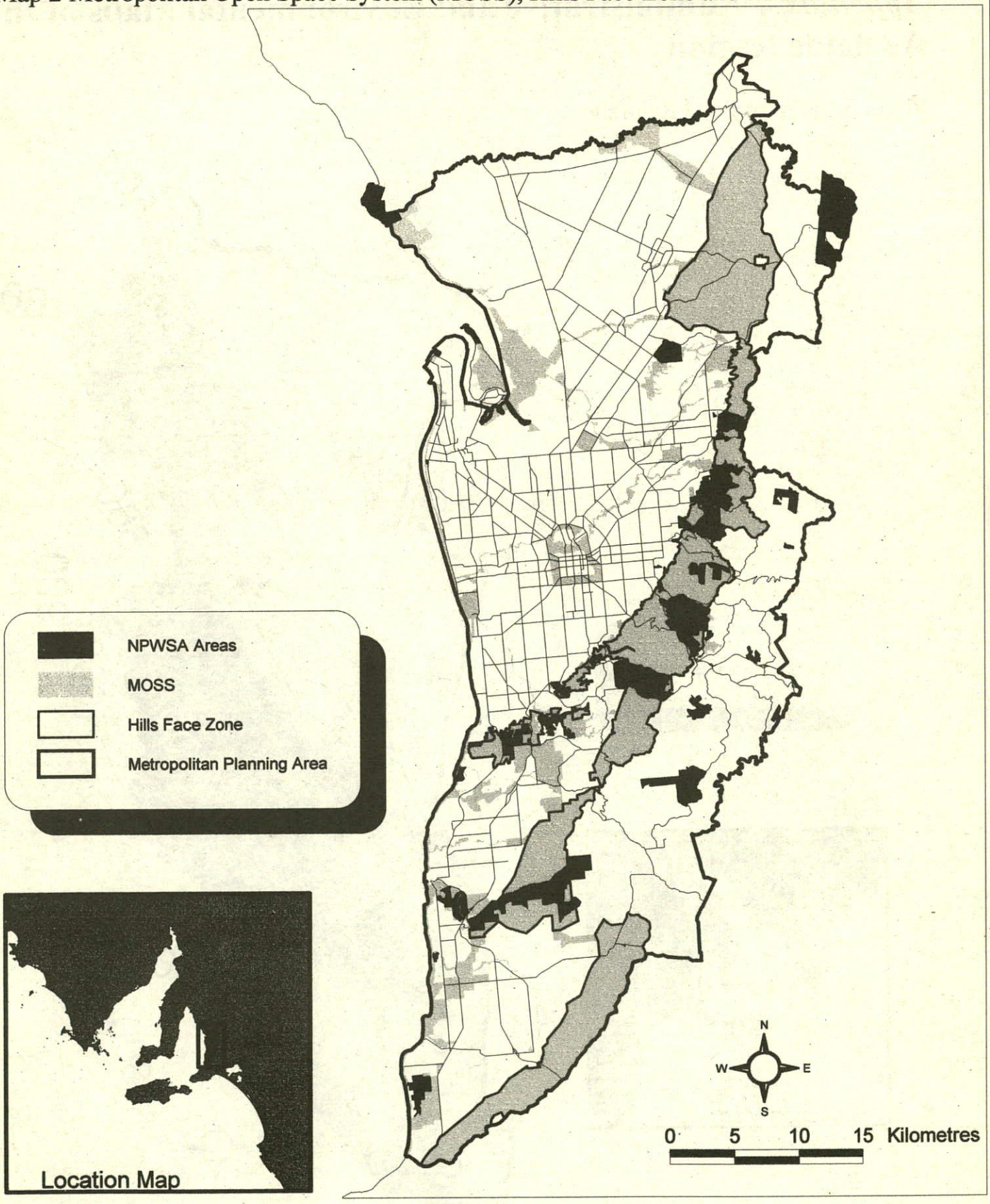
X	***Extinct:*** considered to be extinct in the area because it has not been recorded in the wild for at least 50 years. For animals, this also includes species which no longer breed in the area although individuals may visit occasionally.
E	***Endangered:*** in danger of becoming extinct in the wild in the immediate future given current trends in populations and reasons for decline.
V	***Vulnerable:*** likely to become endangered in the immediate future given current trends in populations and reasons for decline.
R	***Rare:*** at risk due to low numbers of individuals even though no or little decline in distribution has been detected.
K	***Indeterminate:*** Rare or Vulnerable but current information on populations are grossly inadequate to provide a better estimate of its conservation significance.
U	***Uncommon:*** animals or vegetation types which are inadequately conserved or declining but are not yet sufficiently threatened to be listed as vulnerable.
C	***Common:*** widespread throughout most of its known distribution and under no immediate threat.
I	***Introduced:*** native species introduced or re-introduced.

Appendix 4 Administrative and Environmental Maps of the Adelaide Region

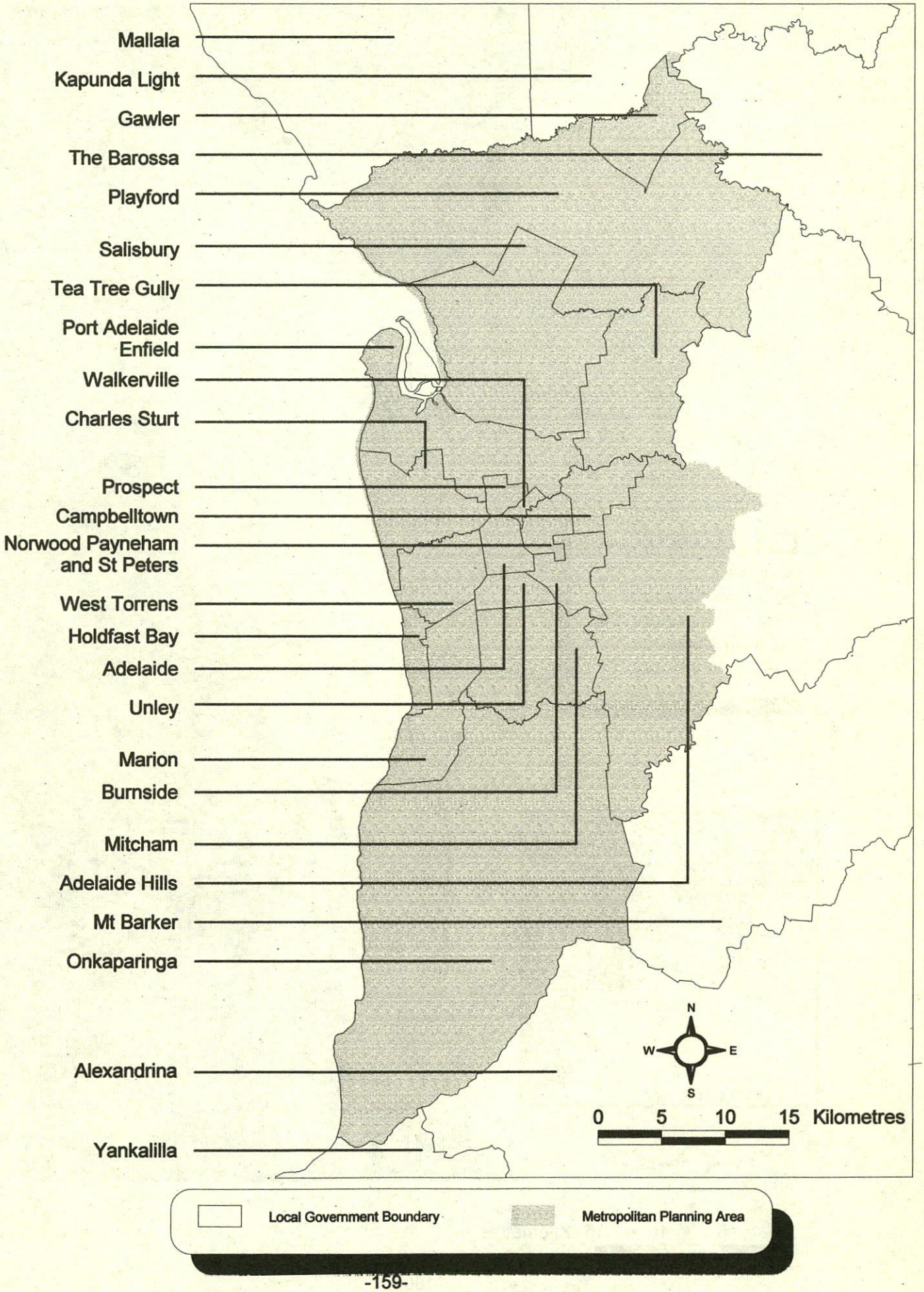
Map 1 Topography and Rainfall



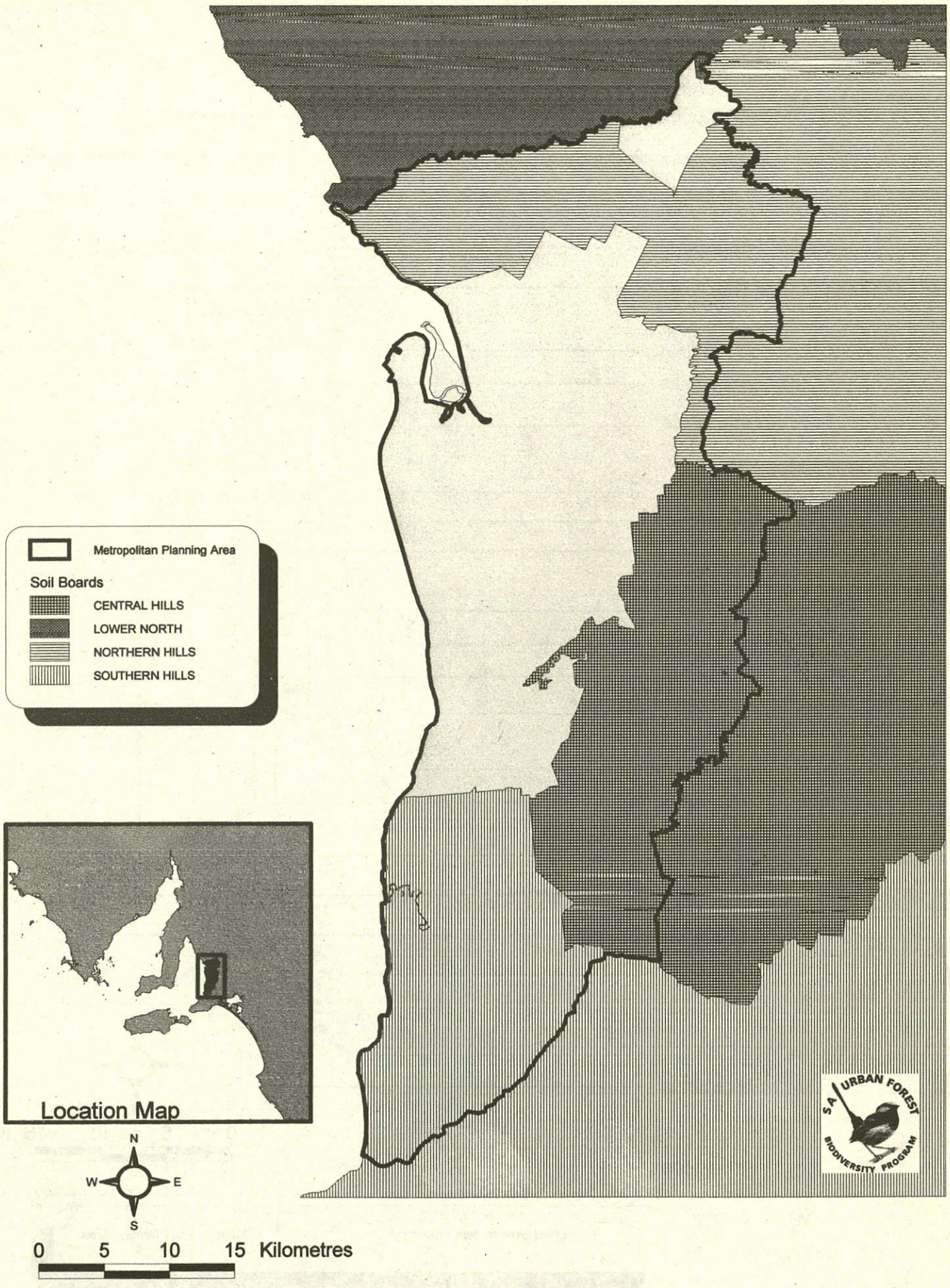
Map 2 Metropolitan Open Space System (MOSS), Hills Face Zone and NPWSA Areas



Map 3 Local Government Areas

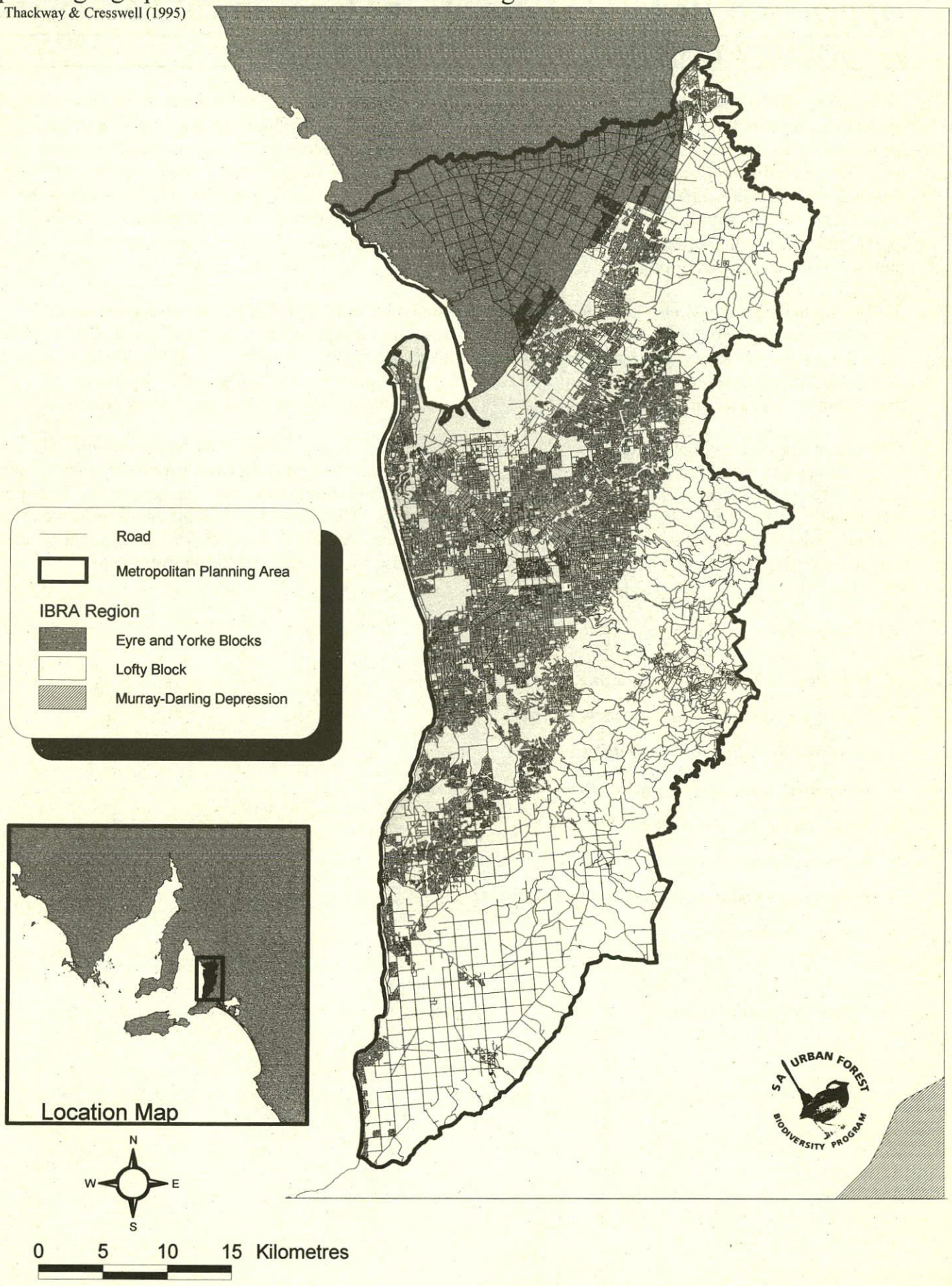


Map 4 Soil Boards



Map 5 Biogeographic boundaries of the Adelaide region

(From Thackway & Cresswell (1995)



Appendix 5 Roadside Vegetation Management Factsheets

RMS 1.98 VALUE & BENEFIT OF PROTECTING ROADSIDE REMNANTS

Within the settled agricultural regions of the State, responsibility for the care and control of roadsides, including vegetation, is vested in local councils under the Local Government Act. Indigenous roadside vegetation is protected under the Native Vegetation Act. Local Councils must therefore be consulted before any disturbance occurs. All road management agencies carry out roadworks that have the potential to adversely impact on the roadside environment, and in particular, on roadside vegetation. It is therefore important to be aware of the location of areas of significant vegetation in order that roadwork activities can be appropriately modified. In the past Councils have had different cultures for managing roadside vegetation. There is now a move to adopt more uniform policies across regions.

Following the lead of a Mount Lofty Ranges conservation group in 1995 a simple, cost effective method of discreetly marking native vegetation sites, as adapted from similar schemes in WA and Victoria, was initiated. This process for systematically marking roadside sites that have significant native vegetation was developed by the Roadside Marker System Steering Group with members representing five local Councils, Department of Environment, Heritage and Aboriginal Affairs (DEHAA), Transport SA and two conservation groups.

The use of this discreet Road Marker System (RMS), in conjunction with in-house native vegetation training programmes and individual Council database registers is allowing Council staff, contractors and other agency workers to apply guidelines set out in each site's action plan. This system has now been adopted by Transport SA and a number of Mount Lofty Ranges Catchment Area councils. They consider the RMS helps preserve local natural heritage and reduces the risk of unnecessary disturbance. A Code of Practice for management of roadside vegetation using RMS as the process is being developed for use by agencies and local government.

Other Fact Sheets available:

- ***Why Protect Remnant Vegetation?***
- ***Native Vegetation Roadside Marker System***
- ***Roadside Significant Sites Database***
- ***Integrated Management-Native Remnants on Roadsides***
- ***Roadside Vegetation Survey Methods***
- ***Support & Supplies***
- ***Legislation~Roadside Vegetation Management***
- ***Related Publications***

For Further Information Contact:

RMS (Native Vegetation) Steering Group
PO Box 44
WOODSIDE SA 5244
Ph: 8408 0400

RMS 2.98 WHY PROTECT REMNANT VEGETATION

What is Local Native Vegetation?

Local or indigenous species are plants that originated within a defined area. They give an area it's own distinct characteristics and help reflect an image of the landscape that existed pre-European settlement. It is distinct from 'exotic' vegetation, which can include introduced European trees like oaks and elms, environmental weeds (non-indigenous natives), like Cootamundra Wattle and common weeds like broom, gorse and blackberry.

Values and Benefits of Retaining Native Vegetation:

- Preserves local flora and fauna populations and gene pools of biodiversity which reflects the variety of life on earth.
- Serves as a natural, sustainable, minimal cost groundcover which helps prevent soil erosion and reduce storm water run-off damage.
- Reduces fire fuel hazard levels along roadsides. Slow growth rate and low flammability aspects of some native species, particularly summer-green native grasses, lower fire risk in direct contrast to hot intense fires generated by gorse, phalaris, blackberry and broom.
- Reduces maintenance costs.

Impacts and Threats to Native Vegetation:

A number of threats to native vegetation exist including wildfire, unauthorised clearance and weed invasion. Weeds can spread quickly and invasion is often enhanced by soil disturbance, causing problems for Councils and adjoining landowners because of:

- Increased cost and time spent on control and lowered return on grazing and cropping country.
- Vermin (eg starlings, foxes) acting as dispersal agents for olive and gorse seed or bacterial/fungal diseases which have the potential to devastate orchards and reserves (eg fire blight and phytophthora).
- Fire fuel hazard build up, thus creating a risk to CFS crews or other road users during a wildfire.
- Increased risk to assets through increased fire intensity.
- Degraded value of natural assets and foregone recreation and tourism opportunities.

Re-establishing Local Species

Revegetation projects never replicate natural vegetation associations. Establishing revegetated plantings are however important for their roles:

- In stabilisation of potential erosion sites;
- Control of siltation in water catchment areas; and
- Extending the buffer zone (lessens edge effect) for adjoining local native vegetation.

Only projects utilising locally sourced indigenous seed are acceptable for roadside re establishment.

For Further Information Contact:

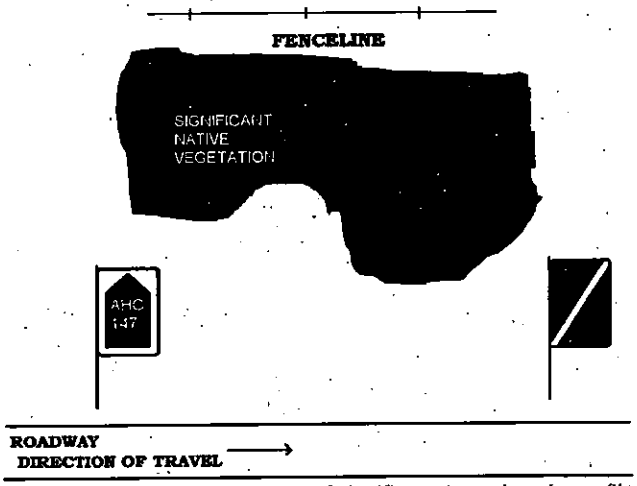
RMS (Native Vegetation) Steering Group
PO Box 44
WOODSIDE SA 5244
Ph: 8408 0400

RMS 3.98 ROADSIDE MARKER SYSTEM

The Roadside Marker System (RMS) has been designed to identify sites of natural, historic and cultural significance so that these important sites can be avoided and protected during roadworks and other public utility work nearby. In particular Councils[1] are adopting the RMS to assist in management of Roadside Native Vegetation. The system is voluntary, and uses a simple uniform standard for marking sites assisting Council and other agencies to protect remnant native stands, and to comply with the requirements of Commonwealth and State conservation, heritage, soil and Landcare legislation. It thus supports best practice management for roadside native vegetation. The marking system may be readily extended for identifying other landscape, historic and cultural features if and when required by council.

Components of the marker system include:

- A register (data base) that records the location of significant roadside features providing details of each site's special features or management needs.
- Marker plates fastened to posts to discreetly mark the site for operational reference (see figure below).
- An Environmental Code of Practice for planning and site management is recommended.
- Environmental Awareness Training for road gangs and other roadside operators is recommended.



Above: Location of markers in relation to a typical significant site and roadway. Shown from a travelling position of left to right.

The register of sites is used by staff during planning of roadworks to advise work gangs of the location of significant sites and special work practice requirements. The roadside marker system will also enable Council and agency work crews to respond to identified site markers by getting details from the Council's Roadside Marker System register, and implement appropriate management methods and constraints to avoid unnecessary damage to the site.

Other agencies which should be aware of Roadside Markers include:

- Animal and Plant Control Boards; Transport SA; ETSA Corporation; SA Water; Telecommunications operators and sub-contractors, and other road and roadside operators.

For Further Information Contact:

RMS (Native Vegetation) Steering Group
PO Box 44
WOODSIDE SA 5244
Ph: 8408 0400

[1] Three Councils are currently implementing the RMS scheme: Adelaide Hills Council, City of Playford & City of Onkaparinga

RMS4.98 ROADSIDE SIGNIFICANT SITES DATABASE

The Roadside Significant Sites Database, or RSSD, is a collection of information on sites of natural and cultural significance within road reserves. It has been developed by Transport SA and is available for use by councils.

Identifying Sites

Natural features recorded in RSSD include rare plants, important vegetation, fauna habitat, wetlands, watercourses, geological features, conservation reserves and water catchment areas. Features of high cultural value include heritage sites, buildings and artefacts of Aboriginal and non-Aboriginal origin together with features of unique aesthetic or functional value.

Sources of information on significant sites vary widely. Many sites are identified in the registers of the National Estate, State Heritage, Local Heritage, National Trust - Significant Trees, and Geological Monuments. Others sources include the Gazetted boundaries of National Park Reserves and published information on endangered, rare, and/or vulnerable native plants and animals, plant communities and habitats. An important source of information on roadside vegetation are roadside surveys based on a rapid survey procedure developed by Transport SA and Planning SA (See Fact Sheet 6).

Recording Site Data

Each identified Site is assigned an individual site number known as the Site ID. Information is then recorded on the sites location, details of its significance, actions required for site protection, information source, and contact details of those who can assist if this is required. A typical site data sheet is shown on the back of this sheet.

Accessing Site Data

Raising staff awareness of the existence of significant sites is fundamental to their successful protection. RSSD allows fast remote access to reliable information about site identification and protection. Data can also be plotted onto maps indicating sites of significance by Site ID.

Roadside Marking

The real value of RSSD lies in its use as a tool to protect the locations it identifies. Each site listing includes instructions to assist field staff in the most appropriate course of action to protect the site. In many cases, simply being aware of the site will trigger behaviour appropriate to protecting the site.

Sites identification in the field is aided by the Roadside Marker System (See Fact Sheet 3). In this system markers showing site ID are placed at the beginning and end of a significant site. The markers are discreet so as not to attract undue attention yet clear enough to raise the awareness of field staff from any agency working in the vicinity of a site.

General Roadside Care

Protecting the roadside environment doesn't stop at protecting significant sites. All roadsides should be subject to a code of environmental best practice. RSSD sites are simply sites of special significance for which specific restrictions or conditions apply.

For Further Information Contact:

RMS (Native Vegetation) Steering Group
PO Box 44
WOODSIDE SA 5244
Ph: 8408 0400
OR
Transport SA-Environmental Unit
PO Box 1
WALKERVILLE SA 5081
Ph: 8343 20 40

RMS 5.98 INTEGRATED MANAGEMENT-NATIVE REMNANTS ON ROADSIDES

Councils must meet their obligations under the catchment, native vegetation, pest plant, soil, Landcare and natural resource legislation. A change in management practice and a more sensitive, integrated and informed approach to native vegetation management is appropriate and necessary best practice. Control of weeds on roadside reduces long-term maintenance costs for councils and provides the community with cost effective vegetation management, reduces the potential for soil erosion, and eliminates a potential fire hazard to native vegetation and community assets.

Managing and maintaining native vegetation requires the adoption of broad strategies and management plans which includes the involvement of council staff, outside agencies and community volunteers. In contrast to exotic species native vegetation needs little in the way of maintenance. Occasionally a tree may need to be trimmed to avoid damage to traffic. In late summer, areas of native grass can be mown to reduce the height of spent seed heads. This lowers the fuel load without the need to remove the ground cover. In general native vegetation survival is assured providing the following procedures take place:

1. **Monitoring:** mainly recording changes in species distribution and populations; seasonal seed production; general condition of the plant association; signs of weed invasion; and fuel loading in the understorey.

2. **Tactical response to weed invasion:** where exotics and pest plants have invaded remnant native roadside vegetation methods of management may include:

Integrated Environmental Weed Control:
Emphasis needs to be placed on cooperative and coordinated management between council, other agencies and the community. By integrating weed control in a sustainable manner costs are reduced in the long-term with more beneficial results in management practices. Council's strategic plan should be considered in developing these practices. Various methods of control are suitable, but the method used needs to be suitable for the site. Some examples follow:

- Using the cut and swab method to control olives, broom and gorse in sensitive areas of native vegetation.
- Boom spray in exotic grasses in areas with no native vegetation present.
- Alternative control methods for water courses which allow natural regeneration to occur and avoids soil disturbance and erosion.
- Control burn programmes in areas of roadside with tall eucalypts and exotic grass understorey.

Rehabilitation of native vegetation: Rehabilitation reduces the need for expensive weed control works, prevents soil erosion and provides habitat for native birds while improving the landscape aesthetics of the district. Also it creates a buffer zone which acts as a strategic link to areas of remnant vegetation which can be designed as a fire break or wildfire control area.

For Further Information Contact:

RMS (Native Vegetation) Steering Group
PO Box 44
WOODSIDE SA 5244
Ph: 8408 0400

RMS 6.98 ROADSIDE VEGETATION SURVEY METHODS

Indigenous vegetation found in road reserves in South Australia, represents remnants of pre-European settlement vegetation. These important biological assets have significant conservation value, as much of the native vegetation within the agricultural region of the state has been removed or highly disturbed. Roadside vegetation, both indigenous and introduced, is also an integral part of the road asset from a road managers perspective. Protection, management and maintenance of roadside vegetation have benefits for the road user, road maintenance and adjacent land management. The benefits of managing existing remnant vegetation are also significant when considering the high cost of revegetation and the difficulties in achieving successful revegetation.

Road managers need information to know what is present on roadsides and the significance of what is present. This is important for road planning and road maintenance purposes from road network planning, management of maintenance contracts, construction project planning to development of environmental programmes and strategies. To assist this process a standard and consistent survey, mapping and assessment methodology has been developed in a joint project by Transport SA and Planning SA (DTUPA). This method provides quality information, which helps determine appropriate protection, management and maintenance for the roadside assets through such activities as fencing, weed control and wildfire prevention

This methodology enables rapid collection of information, in a standard and consistent format, and facilitates assessment of the roadside vegetation at both a road network and individual road level. The methodology combines roadside survey, mapping, geographic information systems (GIS) and database technology to provide a cost effective mapping and assessment procedure.

Survey data collected is input into the Roadside Vegetation Database, a sub-set of the Biological Survey of South Australia (SA) which provides biological data for the Environmental Database of SA. The roadside data is stored, maintained and assessed through a relational database and GIS which enables it to be integrated with other road asset data, such as drainage, in a GIS environment. Road managing agencies can use this information to identify environmentally significant remnant roadside vegetation. Appropriate management can be implemented to ensure roadworks do not adversely impact on the vegetation. Such an inventory of roadside vegetation may provide the basis of a strategy for protecting and managing high value indigenous vegetation along roadsides on a regional basis.

Data will be able to be reproduced on a GIS map with other appropriate information (i.e. road networks, drainage and contours) to support and clearly illustrate a particular roadside management strategy for any road section. In addition, once the survey information is entered into the database it is then able to be output in an appropriate format for display and query in the user friendly GIS package ArcView, for use by individual road management agencies.

The survey aspect of the methodology involves surveyors' determining typical species composition of vegetation communities, the condition of these communities and any disturbances in the roadside corridor, from a vehicle travelling at low speed. Appropriate field inspections are required to verify the observations made from the vehicle.

Roadside vegetation survey data recorded on field sheets is entered into the Roadside Vegetation Database, within the Geographic Analysis and Research Unit, Planning SA. This information is then analysed and outputs are produced.

A full roadside vegetation survey methodology consists of a hierarchy of components that build towards a comprehensive knowledge of the vegetation and its condition. The main components are:

1. A "drive-by" roadside vegetation survey that describes and maps all the vegetation present on selected roadsides. This type of rapid assessment collects data that can be used to determine the ecological significance of different remnants and the extent of weed invasion. Most information is collected while in a vehicle driving along roads.

2. An analysis of the information, which summaries the information and assigns a category of overall significance to each defined segment. The information is then used to generate management recommendations for the roadside vegetation in the survey area. Combined, the rapid assessment and the analysis produce a comprehensive general overview of the remnant native roadside vegetation, providing the framework for the collection of more

detailed botanical information.

3. A detailed botanical survey that re-visits high quality areas ("Reference Sites") identified during the "drive-by" survey, to collect detailed floristic and structural data describing the vegetation associations identified during the rapid assessment. The methods used during this phase conform to the standard procedures for the Biological Survey of South Australia (Heard & Channon, 1997).

For information on possible consultants experienced in the use of the methodology and database please contact Planning SA. The South Australian Indigenous Growers & Revegetators Association (SAIGRA), PO Box 10082, Gouger St, Adelaide, 5000. Phone: 1800 065 363 also have information on possible contractors.

For further information on the roadside methodology, database and possible contract specifications contact:

Lee Heard
Roadside Vegetation Project Coordinator
Geographic Analysis & Research Unit
Planning SA
GPO Box 1815
Adelaide SA 5001
Ph: 8303 0697

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Transport SA
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WALKERVILLE SA 5081
Ph: 8343 2281

Appendix 6 Geographical Information System (GIS) Datasets used in Analysis and Map Production for this document

GIS Dataset	Mapping Scale	Custodian/ Source	Description
Natural Features Mapping			
Native Vegetation - Cover	1:40,000	Planning SA	Mapping of presence/absence of native vegetation along with broad landcover features
Native Vegetation - South Mount Lofty Ranges	1:40,000	Planning SA	Floristic vegetation mapping South Mount Lofty Ranges
Vegetation Sites 2000 (UFBP)	Varied (DEH digital cadastral database)	Urban Forest Biodiversity Program	Mapping of native vegetation sites too small to be mapped by Planning SA. Primarily on the Adelaide plains.
Roadside Vegetation	1:50,000 (DEH digital roads data)	Transport SA/ Planning SA	Drive by roadside vegetation survey data spatially stored using Arc/Info and relational Oracle database
Administrative / Regional Boundaries			
NPWSA Reserves	cadastre based	DEH	NPWSA Reserve Boundaries (NPW Act 1972)
NPWSA Conservation Reserves	cadastre based	DEH	NPWSA Conservation Reserve Boundaries (Crown Lands Act 1929)
Heritage Agreement Areas	cadastre based	DEH	Heritage Agreement Area Boundaries (*Native Vegetation Act 1991*)
Local Government Areas	cadastre based	DEH	
Biodiversity Regions		DEH	DEH, NHT region boundaries used for Biodiversity Plans
District Soil Boards	LGA based	PIRSA	District Soil Board Boundaries
Herbarium Regions		DEH	SA Herbarium Regions
Survey Records			
Biological Survey SA - Vegetation	1:40,000	Planning SA	Vegetation survey sites and associated records
Rare & Threatened Plant Population Database	1:50,000	DEH	Location of known rare & threatened plant populations
SA Museum Database	varied	SA Museum	Catalogued vertebrate specimens for SA
Line Feature Data			
Coastline	1:50,000	DEH	
Roads/Railways	1:50,000	DEH	

Appendix 7 South Australian Vegetation Structural Formations

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

Note: Table originally derived from Specht (1972), Muir (1977) and Forward & Robinson (1996).

Trees - woody; perennial; erect; canopy raised well above the ground. Depth of canopy is usually less than or equal to two thirds of the total tree height. Single stemmed, or if multi-stemmed, fewer than five individual trunks resulting from branching of a single short trunk, that is not a mallee-like lignotuber. Height usually >2m.

Mallees - genus *Eucalyptus;* multi-stemmed, trunks arising from lignotuber. Low mallee - < 3m. Mallee - > 3m

Shrubs- woody; perennial; erect, procumbent or weeping; foliage occupies all or part of total plant height; multiple stems and branches arising from a rootstock or very short common trunk; generally <5m tall.

Mat Plants - Herbaceous or woody plants of prostrate habit, with major stems growing along the ground. Rarely exceeds 10 cm in height. Examples of mat plants are *Kunzea pomifera*, *Myoporum parvifolium*, *Carpobrotus rossii* and *Mimulus repens*.

Hummock Grass - Genera *Triodia* or *Plectrachne* only.

Grasses (tussock) - family Poaceae (Gramineae); leaf sheath always split.

Sedges - herbaceous, usually perennial, erect, generally tufted; arise from stolons, tubers, bulbs, rhizomes or seeds. Leaf sheath never split. Includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae and Xyridaceae and other sedge-like forms.

Herbs - herbaceous or slightly woody; annual or sometimes perennial; erect or creepers; rarely exceeds 0.5m height.

Ferns - Ferns and fern allies, ie. non-vascular cryptogams of classes Filicopsida and Lycopsida. This category includes *Ophioglossum* spp., *Lycopodium* spp., *Selaginella* spp. and *Isoetes* spp.

Source: Heard and Channon (1997)

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The SA Urban Forest Biodiversity Program is supported by a range of community groups and local councils. In particular, the financial and in-kind support of the following organisations is gratefully acknowledged.

Planning SA

National Parks & Wildlife South Australia

DEPARTMENT FOR environment and heritage

Government of South Australia

lga Local Government Association of South Australia

City of Salisbury

City of Burnside

City of Onkaparinga

Patawalonga Catchment Water Management Board

Torrens Catchment Water Management Board

Onkaparinga Catchment Water Management Board

NORTHERN ADELAIDE AND BAROSSA CATCHMENT WATER MANAGEMENT BOARD

Bushcare

Conservation Council of South Australia Incorporated

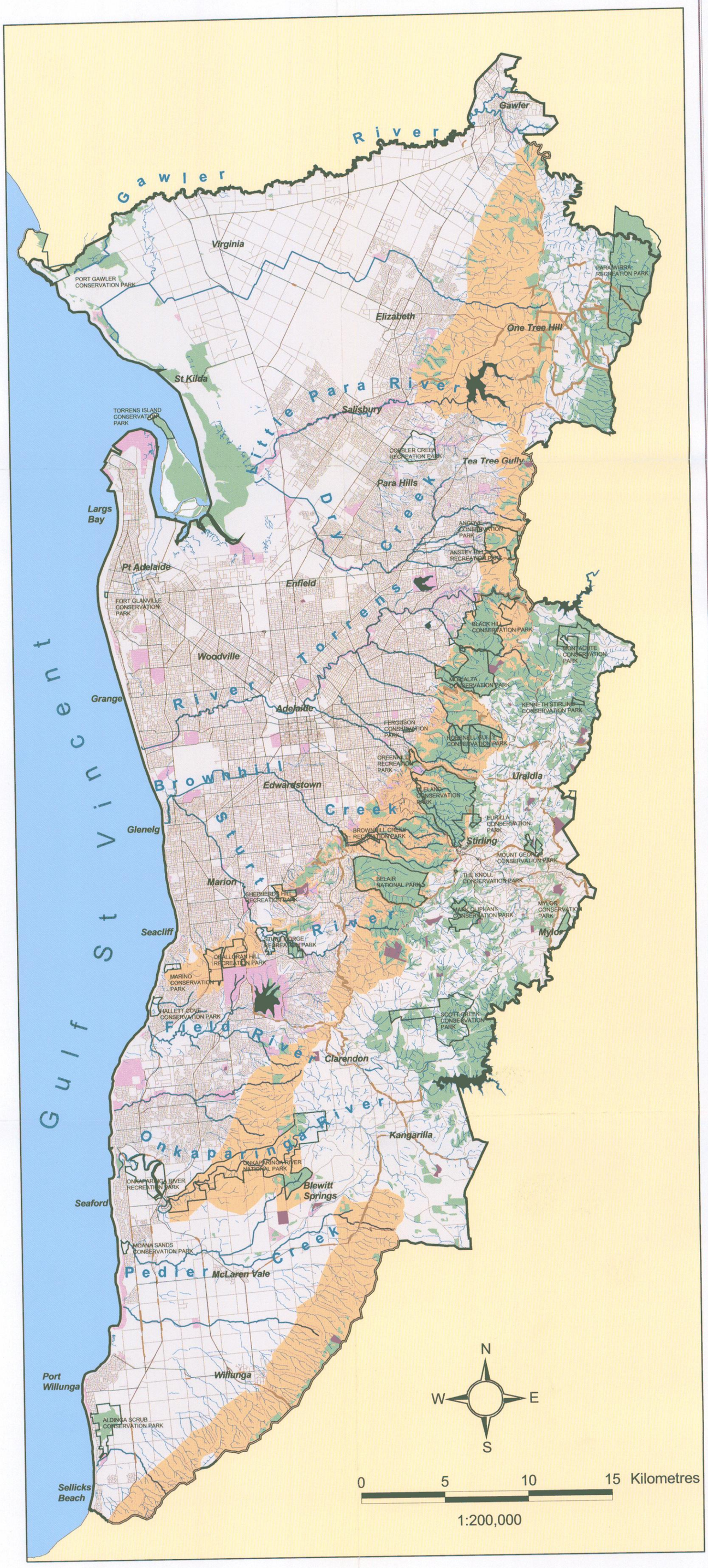
Natural Heritage Trust

Helping Communities Helping Australia

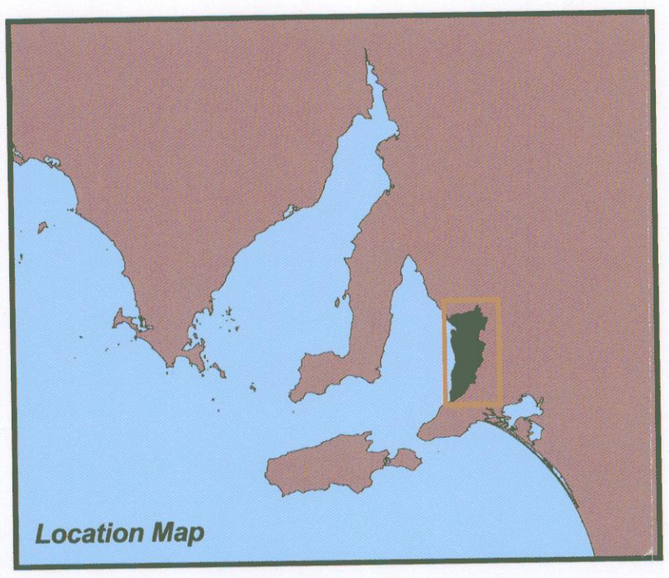
Printed on recycled paper using soy based ink.

Adelaide Metropolitan Area

Native Vegetation, NPWSA Areas, Heritage Agreements,
Roadside Vegetation, Watercourses, Hills Face Zone & Roads



- Metropolitan Planning Area
- Roadside Vegetation
- River/ Creek
- Road
- NPWSA Area
- Heritage Agreement
- Native Vegetation (Planning SA 1985)
- Native Vegetation Site (UFBP 2000)
- Hills Face Zone



Produced by: SA Urban Forest Biodiversity Program

Data Source: Native Vegetation, Hills Face Zone, Metropolitan Planning Area and Roadside Vegetation supplied by Planning SA; Road, Drainage, Heritage Agreement, and NPWSA areas supplied by Department for Environment & Heritage, Native Vegetation Sites (UFBP) supplied by The Urban Forest Biodiversity Program.

Cartography: Matthew Turner

Projection: AMG Zone 54

Datum: Australian Geodetic Datum, 1984

Complied: February 2001

Native Vegetation mapping (Planning SA) has some limitations. For example, some vegetation types such as Open Woodlands, Shrublands and Grasslands are likely to have been missed in the mapping process. For the most part, only areas greater than 5-10 hectares have been mapped.

Roadside vegetation data has been collected using the Roadside Vegetation Survey Methodology for SA (Planning SA/ Transport SA). This is an incomplete dataset.

Native Vegetation Sites (UFBP) indicates property on which native vegetation is found. It does not give any indication of the area of remnant vegetation on each site. This data has been mapped using digital cadastral data obtained from the Department for Environment and Heritage.

SA Urban Forest Biodiversity Program · Natural Heritage Trust — Helping Communities Helping Australia · Planning SA · National Parks & Wildlife South Australia · Department for Environment and Heritage · Government of South Australia