

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 Biodiversity 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 Primary Industries and Resources South Australia - Natural Heritage Trust Biodiversity Planning Regions.

The South Australian Government following lobbying from the Australian Conservation Foundation, Nature Conservation Society of South Australia and the South Australian Farmers Federation has embraced the concept of Regional Biodiversity Planning. The recent input of funding from the Natural Heritage Trust (NHT) 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, [Appendix 4](#)).

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*