

Biodiversity

The 1992 United Nations Earth Summit in Rio de Janeiro 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, between species and of ecosystems”. This definition was adopted by the United Nations Convention on Biological Diversity (1993), signed by nearly every country in the world, including Australia. Signatory countries are committed to three main goals: conservation of biodiversity; development of national strategies for the sustainable use of biodiversity; and fair and equitable sharing of benefits arising from resources (e.g. transfer of biotechnology).

There are three levels of biodiversity:

- *Species diversity* – is often used as an indicator of ecosystem health and quality, defining the number of species and their relative abundance in a defined area. For example, rainforest vegetation contains a higher diversity of plant species (up to 500 species per hectare); more levels of vegetation (up to 8), providing ideal conditions for nesting and feeding. This may be compared with *Eucalyptus* open forest which supports less biodiversity (up to 150 species per hectare) and fewer levels of vegetation (up to 5), and is subject to more disturbance (e.g. periodic fires). A heathland contains less diversity than the rainforest and *Eucalyptus* open forest (up to 60 species per hectare) and fewer levels (up to 2). Heathlands also require regular fire for regeneration and are therefore more disturbance-prone ecosystems.
- *Genetic diversity* – is the variety and combination of genes within species of plants, animals, fungi and micro-organisms. The maintenance of genetic diversity is essential for natural selection, adaptation and survival.
- *Ecosystem diversity* – refers to the variety of habitats such as forests, deserts, wetlands, rivers, mountains, and coral reefs and the interaction between species within

a given ecosystem. Ecosystems function according to complex networks between biotic (living) components such as plants and animals, and the abiotic (non-living) factors such as air, sunlight, water, minerals and nutrients. Diversity within natural ecosystems leads to stability; the modification of a natural ecosystem leads to lower diversity and unstable ecosystems.

Biodiversity is the result of four billion years of evolution. Maintaining biodiversity is essential to life on Earth. The interaction of natural processes form a complex web of life. Plants purify the air and water, trap sunlight and produce food for other species. Trees provide habitat and food for birds, insects, plants and animals, and are important ‘sinks’ for the absorption of carbon dioxide. Fungi and micro-organisms create and maintain the productivity of soils by recycling organic materials. Birds, insects and mammals pollinate plants and maintain nutrient cycles. Parasites and predators provide natural population control. Wetlands serve as ‘sponges’ to reduce floods and cleanse streams. Biodiversity provides air, water, food, fuel, shelter, warmth and underpins the success of many industries, including agriculture, tourism, cosmetics and pharmaceuticals. Biodiversity also holds the key to scientific knowledge on evolution and the origin of life.

Australia’s biodiversity

Australia is recognised as one of 17 megadiverse countries in the world with close to one million species out of approximately 5-30 million species so far identified worldwide. Seventy per cent of the world’s species are found in Australia, Brazil, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Madagascar, Mexico, Peru and the Democratic Republic of Congo. Australia has more than 80 per cent (endemic) species that are not naturally found anywhere else. This includes 85 per cent of the nation’s flowering plant species (the highest in the world); 84 per cent of its mammals; 85 per cent of its temperate inshore marine fish; and more than 45 per cent of its bird species. There

are 2830 endemic plant species in the eucalypt forests, woodlands and heathlands of south-western Western Australia alone. Australia's rich biodiversity is largely due to geographical isolation, continental separation and the uniqueness of its climate and environment.

Biodiversity loss in Australia

The factors that contribute to biodiversity loss include: soil and vegetation disturbance; feral animals; the introduction of other exotic species such as weeds and parasites; fire; the depletion of water resources; habitat loss and destruction; and plant disease. These threats are largely the result of land modification, such as deforestation, mining, agriculture, road works and urban development, and the impact of climate change, salinity, pollution and unsustainable commercial activities (e.g. over-fishing). While some species can adapt to changing conditions, many cannot, resulting in their depletion or disappearance. The National Land and Water Resources Audit (1997-2002), identified 2891 threatened ecosystems and ecological communities across Australia. Of Australia's bioregions, 94 percent have one or more threatened ecosystems; these are especially prevalent in the south and eastern regions of the continent. Described below are some examples of biodiversity threats in different regions and habitats:

Northern Australia

The tropics and rangelands of northern Australia are home to hundreds of species of native plants, mammals, birds, reptiles and amphibians and tens of thousands of different species of invertebrates. They include some of Australia's most loved natural wonders, such as World Heritage listed Kakadu National Park and the wetlands of Roebuck Bay. Northern Australia's environments are under increased pressure from land clearing, overgrazing, inappropriate or altered fire regimes and mining. Wetlands face serious threats such as salt water intrusion into freshwater floodplains and invasion by introduced plants and feral animals such as buffaloes, cane toads and pigs.

Forests

Australia's forests, extending from the towering ancient forests of the Styx in Tasmania to the tropical Daintree rainforest of Queensland, are recognised worldwide for their grandeur and the rich array of life forms they support. Since European settlement, half of Australia's forests

and three quarters of its rainforests have been cleared and over 90 per cent of old growth forests have been logged. Of our remaining forest areas, only 17 per cent are protected from logging and half of these have already been logged. The forests under threat are beautiful, important to wildlife and irreplaceable. They include the tallest flowering plants on Earth and some of Australia's most significant tracts of temperate rainforest. Saving our forests does not have to mean loss of employment. There are many opportunities to create jobs and new industries while protecting old growth forests.

Rural landscapes

Australia's rural landscapes have suffered from past mistakes and misunderstandings. The policies now needed to create sustainable landscapes include:

- promoting wildlife conservation and bushland restoration on farms;
- fighting proposals to weaken land clearing and protected area laws;
- investing in the tools, science and people needed to restore landscape health;
- rewarding private landholders where they provide conservation services over and above their generally accepted duty of care;
- carrying out urgent tasks such as control of environmental weeds, fencing around wetlands, managing salinity and restoring wildlife habitat on a large scale throughout the country; and
- cooperative work between farmers, conservationists and governments.

Marine environments

Australia's marine environments reach from the tropics to Antarctica. For many years the ocean has been considered an inexhaustible fish resource and a bottomless pit for our waste. As our population has grown, the pressures on oceans have increased. A decade ago, Australia had five fish species categorised as 'over-fished'; now there are seventeen. Over-fishing, pollution from urban and rural runoff, introduced marine pests, loss of habitat due to coastal developments, coral bleaching and other problems linked to climate change contribute to the destruction of marine environments and ocean life.

Table 1: Threatened fauna in Australia
Mammals, reptiles, birds, frogs, fishes

Extinct	fauna (54)
Extinct in the wild	fauna (1)
Critically endangered	fauna (22)
Endangered	fauna (127)
Vulnerable	fauna (197)
Conservation dependent	fauna (1)
Total	Fauna (402)

Source: <http://www.deh.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna>

Table 2: Threatened flora in Australia
Plants of all kinds

Extinct	flora (49)
Extinct in the wild	
Critically endangered	flora (71)
Endangered	flora (514)
Vulnerable	flora (664)
Conservation dependent	
Total	Flora (1298)

Source: <http://www.deh.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora>

Threatened flora and fauna

Table 1 shows that 402 fauna are currently under threat and/or extinct in Australia, while Table 2 shows 1298 threatened and/or extinct flora. Mammal extinctions represent a high proportion of the world's most recent extinctions.

Biodiversity policies and programs

The Environment Protection and Biodiversity Conservation Act 1999 provides the main legal instrument and the National Strategy for the Conservation of Australia's Biological Diversity provides the framework for protecting Australia's biodiversity. The National Reserve System Program includes a comprehensive system of protected areas; it aims to protect rare or threatened species and areas of high species diversity. The Australian Government's \$36 million Maintaining Australia's Biodiversity Hotspots Programme concentrates on high conservation

areas that are still relatively intact. In 2003, the Threatened Species Scientific Community announced 15 national biodiversity hotspots.

Biodiversity is the common heritage of humankind. It is now recognised that conservation strategies must include the protection of ecosystem, genetic and species diversity across all types of land, including reserves, and public and private lands (This is also called 'bioregional planning'). Protection must cover invertebrates, non-flowering plants, fungi and micro-organisms which make up the majority of species diversity in any ecosystem.

Useful sources

Department of the Environment, Water, Heritage and the Arts, The National Strategy for the Conservation of Australia's Biological Diversity: <http://www.environment.gov.au/biodiversity/> This site contains up-to-date information on biodiversity in Australia, including legislation, policies, publications and key reports, as well as links to popular websites.

Department of the Environment, Water, Heritage and the Arts, Climate Change Impacts on Biodiversity in Australia (2003): <http://www.environment.gov.au/biodiversity/publications/greenhouse/> This publication examines research and policy responses to the impact of climate change on biodiversity in Australia.

United Nations Convention on Biological Diversity <http://www.biodiv.org/default.shtml> This site provides access to the UN Convention on Biological Diversity and the Biosafety Protocol, as well as up-to-date information about biodiversity in a global context.

Wilderness Society, "Australia's Biodiversity: A Summary (1999)". <http://www.wilderness.org.au/campaigns/policy/biodivsum/> On this site, the Wilderness Society, a national, community-based environmental organisation, gives a summary of issues relating to Australia's biodiversity.

See also Australian Conservation Foundation – <http://www.acfonline.org.au>

Authors

Professor Emeritus David Yencken, The University of Melbourne, and Dr Nicola Henry, La Trobe University. April 2008.