National Strategy for the Conservation of Australia's Biological Diversity

Foreword

Conservation of biological diversity is a foundation of ecologically sustainable development and is one of the three core objectives of the National Strategy for Ecologically Sustainable Development. Biological resources provide all our food and many medicines and industrial products. Biological diversity underpins human well-being through the provision of ecological services such as those that are essential for the maintenance of soil fertility and clean, fresh water and air. It also provides recreational opportunities and is a source of inspiration and cultural identity.

The Convention on Biological Diversity, ratified by Australia on 18 June 1993, deals at a global level with the full range of biological diversity conservation, its sustainable use, and the fair and equitable sharing of the benefits arising from this use.

This National Strategy for the Conservation of Australia's Biological Diversity aims to bridge the gap between current activities and the effective identification, conservation and management of Australia's biological diversity. The Strategy's primary focus is Australia's indigenous biological diversity. Implementation of the Strategy will require actions affecting virtually all of Australia's land and sea, most of which will continue to be subject to a multiplicity of uses, either in parallel or in sequence.

Governments, community groups, the private sector and individuals are engaged in numerous activities aimed at the conservation of biological diversity in Australia, but much remains to be done. There are deficiencies in resourcing and coordination, in the adequacy of the protected area system, and in the knowledge upon which we base our decisions. There is also scope to improve resource management and conservation outside protected areas and to coordinate this with the protected area system. Greater consistency in approaches between governments and improved information flows between all sectors of the community are also necessary.

The Strategy was prepared by the Australian and New Zealand Environment and Conservation Council, in consultation with the Agriculture and Resources Management Council of Australia and New Zealand, the Australian Forestry Council, the Australian and New Zealand Fisheries and Aquaculture Council, the Australian and New Zealand Minerals and Energy Council, and the Industry, Technology and Regional Development Council. The views of business, industry and the conservation movement were also sought and the provisions of the Convention on Biological Diversity and the draft national strategy prepared by the Biological Diversity Advisory Committee, were taken into account.

The Strategy is a product of the spirit of cooperation engendered by the InterGovernmental Agreement on the Environment. It meets the requirements of the National Strategy for Ecologically Sustainable Development and complements the National Forest Policy Statement, the National Greenhouse Response Strategy and the draft strategy entitled Conservation of Australian Species and Ecological Communities Threatened with Extinction-a National Strategy.

All Australians are affected by loss of biological diversity and stand to benefit from the implementation of this Strategy.

We commit our respective governments to implement this Strategy as a matter of urgency.

Implementation of the Strategy by our respective governments will be subject to budgetary priorities and constraints in individual jurisdictions.

The Honourable Paul Keating MP	*Prime Minister of the Commonwealth of Australia*
The Honourable Bob Carr MP	*Premier of the State New South Wales*
The Honourable Jeff Kennett MP	*Premier of the State of Victoria*
The Honourable Wayne Goss MLA	*Premier of the State of Queensland*
The Honourable Richard Court MLA	*Premier of the State of Western Australia*
The Honourable Dean Brown MP	*Premier of the State of South Australia*
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Introduction

Biological diversity is the variety of all life forms -the different plants, animals and microorganisms, the genes they contain, and the ecosystems of which they form a part. It is not static, but constantly changing; it is increased by genetic change and evolutionary processes and reduced by processes such as habitat degradation, population decline, and extinction. The concept emphasises the interrelatedness of the biological world. It covers the terrestrial, marine and other aquatic environments.

For the purpose of this Strategy, biological diversity is considered at three levels

- genetic diversity - the variety of genetic information contained in all of the individual plants, animals and microorganisms that inhabit the earth. Genetic diversity occurs within and between the populations of organisms that comprise individual species as well as among species;

- species diversity - the variety of species on the Earth;

- ecosystem diversity - the variety of habitats, biotic communities and ecological processes.

Millions of years of isolation from the other continents have resulted in Australia's plants and animals evolving in ways different from elsewhere. As a result, a high percentage of Australian species occur nowhere else. At the species level, about 82 per cent of our mammals, about 45 per cent of our birds, about 85 per cent of our flowering plants, about 89 per cent of our reptiles, and about 93 per cent of our frogs are found only in Australia. Australia is also very rich in some groups of species: the Acacias, comprising perhaps 1070 species, subspecies and varieties, are one example. Some of Australia's species contain populations with markedly different genetic makeups.

Human activity has been changing Australian ecosystems for approximately 50 000 years, but the pace and extent of change have increased since European settlement, about 200 years ago. Australia’s temperate zones and coastal ecosystems have been extensively altered, many wetlands have been degraded, and most other parts of the country have been modified to some extent by various factors, including introduced plants and animals. The result has been dramatic declines in the distribution and abundance of many species.

Maintaining biological diversity is much more than just protecting wildlife and their habitats in nature conservation reserves. It is also about the sustainable use of biological resources and safeguarding the life-support systems on Earth. Ecologically sustainable management of all Australia's terrestrial and marine environments is essential for the conservation of biological diversity.

The benefits of conserving biological diversity are numerous. Biological diversity is the primary source for fulfillment of humanity’s needs and provides a basis for adaptation to changing environments. An environment rich in biological diversity offers the broadest array of options for sustainable economic activity, for nurturing human welfare and for adapting to change.

The world’s species provide us with all our food and many medicines and industrial products. For example, the fishing, forestry, and wildflower industries rely on the harvest of biological resources from the wild. There is great scope for developing new or improved food crops from our biological diversity.

Benefits arising from the conservation of Australia's biological diversity are not, however, restricted to the continued harvest of resources - they include the provision and maintenance of a wide array of ecological services. The maintenance of hydrological cycles (groundwater recharge, watershed protection and buffering against extreme events), climate regulation, soil production and fertility, protection from erosion, nutrient storage and cycling, and pollutant breakdown and absorption are some of the services. They are fundamental to the quality of our life and our economy, but they are often grossly undervalued.

Another benefit of conservation is avoidance of the rising costs incurred through degradation of ecological systems. Although measurement is difficult, the CSIRO estimates that land degradation costs about $1 billion annually (arising from lost production and ongoing nutrient losses valued at replacement cost).[1] Redressing environmental degradation can be prohibitively expensive.

Australians have broad expertise in managing a diverse array of species, habitats and ecosystems, ranging from arid lands to tropical rainforests and coral reefs. This expertise is itself a marketable commodity.

Biological diversity can be important for cultural identity throughout Australia. Aboriginal and Torres Strait Islander people have a rich cultural diversity that is closely linked with their environment.

The aesthetic values of our natural ecosystems and landscapes contribute to the emotional and spiritual well being of a highly urbanised population. Both active and passive recreational benefits of our ecosystems are highly valued by an increasing number of people.

There is in the community a view that the conservation of biological diversity also has an ethical basis. We share the Earth with many other life forms that warrant our respect, whether or not they are of benefit to us. Earth belongs to the future as well as the present; no single species or generation can claim it as its own.

Individuals, organisations, governments and the private sector are making numerous efforts to conserve, understand and manage parts of our biological diversity. Some of these efforts have been continuing for many years.

Internationally, Australia is party to a large number of agreements that are relevant to the conservation of biological diversity. These range from agreements about the protection of the habitats of migratory species, World Heritage properties, Antarctica, and the South Pacific region to agreements on trade in wildlife and pollution control. Australia is pursuing further agreements to fill some of the gaps in the present range of agreements.

The recently concluded Convention on Biological Diversity is global in scope, covers the full range of biological diversity, and has as its primary aims the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources. Australia ratified the Convention on 18 June 1993.

At a national level, major initiatives agreed to by governments include the National Strategy for Ecologically Sustainable Development, the InterGovernmental Agreement on the Environment and the National Forestry Policy Statement (not agreed to by Tasmania). The National Strategy for Ecologically Sustainable Development has three core objectives: to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations; to provide for equity within and between generations; and to protect biological diversity and maintain essential ecological processes and life-support systems. It will be used by governments to guide policy and decision making, particularly in those industry sectors that rely on the use of natural resources.

Current Commonwealth efforts for the conservation of biological diversity are aimed at all three levels of biological diversity - genetic diversity, species diversity and ecosystem diversity - and consist of a number of programs relating to identification, research, management, control of alien species, and rehabilitation. The Commonwealth also has legislation relevant to biological diversity conservation including the import and export of species, endangered species protection, and environmental impact assessment.

There are many State and Territory initiatives for the conservation of biological diversity, among them identification and biological survey; the establishment and management of protected areas, from nature reserves to multiple-use areas; education, extension and support programs outside protected areas; legislation by several States for the protection of native species, especially those threatened with extinction; legislation by some States to protect wilderness areas; and reviews by some States of their policies on native vegetation with a view to including criteria relating to biological diversity for the assessment of proposals to clear land. Increasingly, State, Territory and local governments are adopting more integrated approaches to planning and management on a biogeographic basis or for individual species.

Universities, scientific and other research organisations are playing an essential role in enhancing our knowledge and understanding of biological diversity and thus our ability to conserve it more effectively.

Individuals and community groups have an increasingly important role in conserving biological diversity through such activities as tree planting, weed eradication, surveying and monitoring. Some 1600 landcare and similar community-based groups now exist in Australia; they are proving extremely effective in disseminating information and in the adoption of ecologically sustainable natural resource management in the rural sector. Community groups also contribute to the debate on such issues as institutional change. Examples of such groups are the World Wide Fund for Nature, the national parks associations, the Society for Growing Australian Plants, and Greening Australia.

The private sector, too, is contributing to the conservation of biological diversity, not only through land ownership and management but also through research, databases, technical expertise, donations, promotion and public awareness. Increasing numbers of resource managers are seeking and adopting new management methods that integrate ecological and economic considerations. These improved approaches and techniques are contributing to viable long-term economic returns for producers while at the same time allowing for the conservation of biological diversity.

Although these programs and activities all contribute to the conservation of biological diversity, by themselves they are not sufficient. Conservation efforts are under-resourced, in places uncoordinated, and sometimes inappropriate. There are still many ecosystems, species and communities that are important for biological diversity conservation but that are not represented in protected areas or adequately conserved elsewhere. Large parts of Australia are not managed sustainably. In many cases past economic, social, policy or institutional factors have prevented the adoption of appropriate management practices.

Of fundamental importance to the successful conservation of biological diversity is incorporation of the concept in all relevant decision-making and management processes. Objectives for the conservation of biological diversity must be integrated into resource allocation and management, into development assessments and decisions, into intersectoral policies, and into conservation and rehabilitation.

The loss of biological diversity cannot be slowed effectively unless its underlying causes are directly confronted. These underlying causes are extremely complex; they include the size and distribution of the human population, the level of resource consumption, market factors and policies that provide incentives for biological diversity depletion, undervaluation of environmental resources, inappropriate institutions and laws, ignorance about the importance and role of biological diversity, underinvestment in biological diversity conservation, and inadequate knowledge of our biological diversity and the rate at which it is being lost.

It is necessary to ensure an integrated approach across State and Territory and local government boundaries and to approach national problems with nationwide strategies and standards. At the international level there is a need to strengthen or add to existing arrangements, and there remain a number of areas where our international obligations could be better met.

Australia needs a comprehensive approach to bridge the gap between current efforts and the effective identification, conservation and management of Australia’s biological diversity. Governments have come together to provide a framework for cooperative protection of Australia's biological diversity, within a context of change and continuing development. This Strategy covers all of Australia's biological diversity - terrestrial, marine and other aquatic biological systems, including those of the external territories, and focuses on the conservation of indigenous biological diversity. It recognises that many existing programs and efforts warrant increased application, resources and community involvement, but that by themselves they are only part of the solution to conserving Australia’s biological diversity.

An important result of developing this Strategy will be the removal of uncertainty for industry by providing clear guidelines for biological diversity conservation, within which investment decisions can be made.

Implementation of the Strategy will require cooperation and coordination from all levels of government, industry, community groups and individual land managers: each has some responsibility for the management of biological diversity. In addition, public awareness, education and community involvement are critical to the conservation of biological diversity. The knowledge and experience of local communities must be drawn upon and fully used, and awareness must be extended to engender a sense of community involvement and action.

Formal protocols for interaction between Commonwealth, State and Territory and local governments in environmental management have been established through the InterGovernmental Agreement on the Environment. Further intergovernmental arrangements will be necessary to facilitate the cooperation and coordination required to implement this Strategy, including the development of national policies, bioregional approaches, and State and Territory and local government strategies.

All sectors of the community will share the costs and benefits of conserving biological diversity. Among the costs are the costs of establishing and managing conservation programs and the cost of opportunities foregone. But there are significant economic benefits to be gained from acting now to conserve biological diversity, among them future opportunities for resource use and substantial future savings in the cost of rehabilitating species and ecosystems. The relative economic costs and benefits are very difficult to quantify.

Part of the cost of implementing the Strategy will be met through some reallocation of existing appropriations for programs concerned with biological diversity. The extent to which objectives are achieved will also depend on the availability of additional funds at all levels of government and from the private sector. Private sector investment in biological diversity conservation would be encouraged by a carefully planned range of economic instruments.

Governments accept responsibility for protecting Australia's biological diversity for the benefit of the community now and in the future. Not all the objectives listed in the Strategy can be achieved within the term of office of a single government. Actions will be implemented within budgetary and economic constraints and by regularly reviewing and altering the objectives and their priorities, where appropriate, in changing circumstances and with increasing knowledge.

Of particular importance is the recognition of a need to change the way we think, act and make decisions, so as to ensure that economic development is ecologically sustainable. Now, as never before, human activities are having a significant impact on the fundamental ecological processes of the planet. If we are to achieve a sustainable future in which food, shelter, health and other basic needs of a growing global population are met, we must act now to change so that we live within the Earth’s carrying capacity. Implementation of the National Strategy for the Conservation of Australia’s Biological Diversity is part of this necessary process of change.

Goal

The Strategy recognises that

- The conservation of biological diversity provides significant cultural, economic, educational, environmental, scientific and social benefits for all Australians.
- There is a need for more knowledge and better understanding of Australia's biological diversity.
- There is a pressing need to strengthen current activities and improve policies, practices and attitudes to achieve conservation and sustainable use of biological diversity.
- We share the Earth with many other life forms that have intrinsic value and warrant our respect, whether or not they are of benefit to us.

It acknowledges the core objectives of the National Strategy for Ecologically Sustainable Development

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations;
- to protect biological diversity and maintain essential ecological processes and life-support systems.

And it accepts the guiding principles of National Strategy for Ecologically Sustainable Development

- Decision-making processes should effectively integrate both long- and short-term economic, environmental, social and equity considerations.
- Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- The global dimension of environmental impacts of actions and policies should be recognised and considered.
- The need to develop a strong, growing and diversified economy which can enhance the capacity for environmental protection should be recognised.
- The need to maintain and enhance international competitiveness in an environmentally sound manner should be recognised.
- Cost effective and flexible policy instruments should be adopted, such as improved valuation, pricing and incentive mechanisms.
- Decisions and actions should provide for broad community involvement on issues which affect them.

The Goal is to protect biological diversity and maintain ecological processes and systems.

Principles

The following principles have been adopted as a basis for the Strategy's objectives and actions and should be used as a guide for implementation.

1 Biological diversity is best conserved in situ.

2 Although all levels of government have clear responsibility, the cooperation of conservation groups, resource users, indigenous peoples, and the community in general is critical to the conservation of biological diversity.

3 It is vital to anticipate, prevent and attack at source the causes of significant reduction or loss of biological diversity.

4 Processes for and decisions about the allocation and use of Australia's resources should be efficient, equitable and transparent.

5 Lack of full knowledge should not be an excuse for postponing action to conserve biological diversity.

6 The conservation of Australia's biological diversity is affected by international activities and requires actions extending beyond Australia's national jurisdiction.

7 Australians operating beyond our national jurisdiction should respect the principles of conservation and ecologically sustainable use of biological diversity and act in accordance with any relevant national or international laws.

8 Central to the conservation of Australia's biological diversity is the establishment of a comprehensive, representative and adequate system of ecologically viable protected areas integrated with the sympathetic management of all other areas, including agricultural and other resource production systems.

9 The close, traditional association of Australia's indigenous peoples with components of biological diversity should be recognised, as should the desirability of sharing equitably benefits arising from the innovative use of traditional knowledge of biological diversity.

1 Conservation of biological diversity across Australia

In the face of significant and continuing reductions to our biological diversity, there is a pressing need to strengthen conservation activities across Australia. About 70 per cent of Australia's land area is under the control of private landholders and resource managers, including indigenous peoples; their cooperation is essential for the success of conservation activities. High priority must be placed on developing and implementing integrated approaches to conservation that both conserve biological diversity and meet other community objectives.

The conservation-oriented objectives dealt with in this chapter include identification of ecosystems, species and subspecific variation; bioregional planning and management; management for conservation; establishing and managing a comprehensive, adequate and representative system of protected areas; improving biological diversity conservation outside reserves; and recognising the contribution of ethnobiological knowledge of indigenous peoples to the conservation of biological diversity.

These objectives are to be integrated with the objectives for achieving ecologically sustainable use of natural resources (see Chapter 2).

1.1 Identification

Objective 1.1
Identify important biological diversity components and threatening processes.

Actions

1.1.1 Components of biological diversity
Identify the terrestrial, marine and other aquatic components of biological diversity that are important for its conservation and ecologically sustainable use, including

(a) ecosystems and habitats that contain high diversity, large numbers of endemic or threatened species, or wilderness, that are required by migratory species, that are of social, economic, cultural or scientific importance, or that are representative, unique or associated with key evolutionary or other biological processes;

(b) species and communities that are rare or threatened, that are wild relatives of domesticated or cultivated species, that are of medicinal, agricultural or other economic value, that are of social, scientific of cultural importance, or that are of importance for research into the conservation and sustainable use of biological diversity (such as indicator species);

(c) described genomes and genes of social, scientific or economic importance.

In particular, identify those components requiring urgent protective measures.

1.1.2 Threatening processes
Identify processes and categories of activities that have or are likely to have significant adverse impacts on the conservation and ecologically sustainable use of biological diversity. Monitor the effects of these processes and activities in conjunction with the actions set out in Chapter 4.

1.2 Bioregional planning and management

Objective 1.2

Manage biological diversity on a regional basis, using natural boundaries to facilitate the integration of conservation and production-oriented management.

Bioregional planning

Regional planning in which environmental characteristics are a principal determinant of boundaries is considered to be of major importance if biological diversity conservation is to succeed. The Murray-Darling Basin Commission, for example, plans on an environmental basis, using catchment boundaries as well as existing local, State and Commonwealth structures. Several State and Territory governments are also beginning to plan and manage on a bioregional basis as part of their land management responsibilities. Actions such as this are needed elsewhere in Australia; they must be based on ecological parameters, vegetation types, catchment areas and climatic factors, combined with the interests of those living and working in the area.

One of the major determinants of the success of bioregional planning will be the extent to which all levels of government cooperate and coordinate their activities. For this to occur, a concerted nationwide effort is necessary to establish better lines of communication and coordination mechanisms that can be activated as soon as appropriate bioregional boundaries have been determined and accepted.

Actions

1.2.1 Planning units

Determine principles for establishing bioregional planning units that emphasise regional environmental characteristics, are based on environmental parameters, and take account of productive uses and the identity and needs of human communities as appropriate. This will include

(a) identifying the biological diversity elements of national, regional and local significance, the extent to which they need to be protected, and the extent to which they already occur in protected areas;

(b) identifying the major activities taking place within the region and in adjoining regions and analysing how these may adversely affect the region's biological diversity, to ensure its use is ecologically sustainable;

(c) identifying any areas that are important for biological diversity conservation and require repair or rehabilitation;

(d) identifying priority areas for biological diversity conservation and for ecologically sustainable use, and their relationship to essential community requirements such as infrastructure and urban and industrial development;

(e) providing mechanisms for genuine, continuing community participation and proper assessment and monitoring processes;

(f) coordinating mechanisms to ensure ecologically sustainable use of biological diversity, with particular reference to agricultural lands, rangelands, water catchments and fisheries;

(g) incorporating flexibility, to allow for changes in land use allocation, including multiple and sequential uses of particular locations, and to accommodate improvements in knowledge and management techniques and changes in institutional arrangements.

1.2.2 Bioregional plans
Undertake bioregional planning for the conservation of biological diversity. This will involve

(a) identifying appropriate intergovernmental and intragovernmental mechanisms to ensure cooperation and coordination in bioregional planning;

(b) promoting the inclusion of biological diversity goals and principles in local government planning schemes and strategy plans.

(c) promoting sympathetic and coordinated management of biological diversity for land and sea areas adjoining protected areas;

(d) improving protection of and management for biological diversity in closely settled environments and the coastal zone, with particular attention being paid to corridors and remnant areas;

(e) increasing the number and involvement of those in the community who have special knowledge of biological diversity and skills in regional management, making use of existing community networks;

(f) providing suitably trained facilitators to help with community participation, facilitate cooperation, and encourage resource managers to pursue ecological sustainability.

1.3 Management for conservation

Objective 1.3
Improve the standards of management and protection of Australia's biological diversity by encouraging the implementation of integrated management techniques.

Actions

1.3.1 Integrated techniques
Develop and improve integrated land management techniques, extending across protected and other areas. Emphasis should be given to research into practical, cost-effective methods for the conservation of natural habitat, including remnants and corridors, and techniques for management at catchment and regional levels.

1.3.2 Consistent management approaches
Ensure consistency between Commonwealth, State and Territory and local governments' management approaches affecting the conservation of biological diversity; for example, fire management and weed and pest management.

1.3.3 Marine conservation strategy
Ensure development and implementation of a marine conservation and management strategy for Australian coastal waters, including estuaries and the Australian Fishing Zone. This should include mechanisms (zoning, for instance) for minimising the adverse impacts of such activities as coastal development, land-based discharge of pollutants, shipping, and the harvesting of marine resources.

1.3.4 Option analysis

Develop effective methods for the economic analysis of management and protection options, with particular reference to the allocation of external costs and benefits.

1.4 Protected areas

Objective 1.4

Establish and manage a comprehensive, adequate and representative system of protected areas covering Australia's biological diversity.

The protected area system

A 'protected area' is defined in the Convention on Biological Diversity as 'a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives'. The terminology that applies to protected areas varies from country to country; in Australia alone there are some 40 different categories of reserves, from specific-purpose areas such as scientific reserves to very large areas such as the Great Barrier Reef Marine Park, which has zones ranging from multiple use to restricted access.

The World Conservation Union (formerly the International Union for Conservation of Nature and Natural Resources - IUCN) is continuing to refine a protected area classification system for global use. All categories of protected area, including multiple - use categories, are significant for biological diversity conservation. Those that have nature conservation as their primary goal are particularly important.

Australia's current protected area system includes a significant proportion of our biological diversity. The terrestrial reserve system covers 6.4 per cent of the land area.[2] Of the total area of protected marine and estuarine environments, most is managed on a multiple-use zoning basis - less than 0.5 per cent being set aside purely for nature conservation.[3] There are, however, many gaps, including ecosystems in arid and semi-arid environments, and native grassland, wetland and marine ecosystems. State and Commonwealth agencies have been endeavouring to increase the representativeness of terrestrial reserves and have recently committed themselves to expanding the currently inadequate marine protected area system. The expansion of these protected area systems in the last few decades has not, however, been accompanied by a concomitant increase in the resources needed for orderly planning and management.

At present a number of initiatives are being pursued at the national level to improve Australia's reserve system. The Commonwealth Government is committed to the progressive establishment, in cooperation with the States and Territories, of a comprehensive, adequate and representative system of reserves by the year 2000. Through the National Forest Policy Statement, governments have agreed to set aside parts of the public and private native forest estate in dedicated nature reserve systems in order to protect native forest communities. Arrangements under the National Forest Policy Statement will be based on the principles of comprehensiveness, adequacy and representativeness, as defined in the Statement.

Through the Ocean Rescue 2000 program, the Commonwealth Government is working with State and Territory governments to expand the existing system of marine parks and reserves. This will enable representative examples of the full range of Australia's marine environments to be managed and protected while allowing a range of appropriate uses.

Establishment and management of the terrestrial reserve system is best undertaken in a bioregional or catchment context that takes into account the contribution environmentally sympathetic management of non-reserve areas can make in meeting biological diversity conservation objectives. Achieving ecological viability of protected areas can often be accompanied by complementary management of surrounding areas. Further, voluntary wildlife refuges and land subject to conservation covenants and heritage agreements are important components; their expansion can be encouraged by appropriate incentives (see Action 1.5.1).

Within the protected area system, land designated as wilderness may be of particular importance for biological diversity conservation. Areas designated as wilderness must be large and relatively undisturbed, with core areas remote from mechanical access and edge effects. The absence of artificial barriers to the movement of native species and of artificial channels such as roads and power line easements, which aid the movement of exotic species, is directly beneficial to biological diversity conservation. Under the National Forest Policy Statement, a Working Group is developing criteria for forest reserves, including wilderness reserves.

The establishment and management of protected areas is not free of cost. Not only are there costs in acquiring and managing land, there may also be opportunity costs where multiple use is restricted and resources are no longer available for development.

Actions

1.4.1 Protected area establishment
Undertake a l0-year Commonwealth, State and Territory cooperative program, which includes the provision of adequate resources, to ensure that the terrestrial and marine protected area systems are comprehensive, adequate and representative. Particular attention should be paid to those components of biological diversity identified by action taken in accordance with Objective l.l as requiring special conservation measures.

In developing the program, immediate action should be taken to identify those components of biological diversity that are known to be threatened and inadequately protected in reserves. These components should be incorporated in the protected area system if this is the best approach to their conservation. Determination of the ecological viability of protected areas should take into account the impacts of activities in non-reserve areas.

Ensure that all jurisdictions have the capacity to establish multiple land use reserves to permit conservation of biological diversity in concert with resource identification, harvest or extraction.

The processes used to determine the location and size of new protected areas should also involve transparent assessment of the environmental, social and economic costs and benefits.

1.4.2 Protected area management
Undertake a 10-year Commonwealth, State and Territory cooperative program to

(a) develop management plans for all protected areas. These plans should ensure that genotypes, species or communities that depend on a particular protected area for their security are given high priority in management. They should also recognise interactions with surrounding areas and include provisions for monitoring and review of management objectives;

(b) evaluate boundaries of and management arrangements for protected areas as part of the management planning process, to identify whether alterations will better meet biological diversity conservation and other objectives of the National Strategy for Ecologically Sustainable Development;

(c) ensure public participation in the development and implementation of management plans, using, where appropriate, the traditional knowledge and skills of Aboriginal and Torres Strait Islander and local peoples;

(d) provide and maintain sufficient resources, including trained staff, to implement management plans;

(e) ensure that the range of protected area types has consistent nomenclature and associated management requirements, in keeping with the World Conservation Union's classification of protected areas.

1.5 Conservation outside protected areas

Objective 1.5
Strengthen off-reserve conservation of biological diversity.

The need for conservation outside protected areas

Australia's biological diversity and the threats to it extend across tenure and administrative boundaries. At present more than two-thirds of Australia (some 500 million hectares) are managed by private landholders, while about 40 million hectares are within the terrestrial reserve system. The conservation of biological diversity is best achieved in situ and requires integrated and consistent approaches across freehold and leasehold and other Crown lands.

The majority of these lands are subject to a multiplicity of uses, providing for varying levels of biological diversity conservation. Although many programs exist to encourage better management of biological diversity on such lands, greater effort is required to raise both the standards of management and protection and the levels of financial and technical assistance.

Actions

1.5.1 Incentives for conservation
Ensure that adequate, efficient and cost effective incentives exist to conserve biological diversity. These would include the use of appropriate market instruments and appropriate economic adjustments for owners and managers, such as fair adjustment measures for those whose property rights are affected when areas of significance to biological diversity are protected. Priority should be given to

(a) areas important for migratory species, threatened indigenous species, remnant vegetation, wetlands and corridors between protected areas;

(b) maintaining environmental conditions, including associated flora and fauna, for the conservation of microbial diversity;

(c) establishing voluntary wildlife refuges and negotiating conservation covenants and heritage agreements between owners and managers and governments, and providing sufficient resources, including trained facilitators, on an area or regional basis to assist in the implementation phase.

1.5.2 Urban conservation
Promote the conservation of biological diversity in urban areas by

(a) encouraging retention of habitat;

(b) improving strategic planning and infrastructure coordination so as to enhance the biological diversity of urban areas;

(c) seeking ways of reducing fringe development and focusing future development on existing built-up areas in Australian cities;

(d) encouraging action by local governments to retain and improve natural ecosystems and to use locally indigenous species for plantings in urban areas;

(e) integrating biological diversity conservation considerations into relevant policies and programs such as the Building Better Cities program.

1.6 Wildlife conservation

Objective 1.6

Ensure the maintenance of, and where necessary strengthen, existing arrangements to conserve Australia's native wildlife.

Actions

1.6.1 Lesser known groups
Increase the level of knowledge about and undertake appropriate conservation action for less well known groups such as invertebrates, bryophytes, fungi and microorganisms.

1.6.2 Shared ranges
Ensure the development of appropriate measures for the maintenance and management of wildlife whose ranges are shared with neighbouring countries, priority being given to threatened species and species used by one or more of the countries concerned.

1.6.3 Migratory species
Ensure the development of national management plans for the protection of migratory species and their critical habitats.

1.6.4 Protection and interstate trade
In accordance with the InterGovernmental Agreement on the Environment, develop and apply Commonwealth, State and Territory legislation for the protection of indigenous species and develop cooperative arrangements for management and enforcement of permit provisions for possession of and interstate trade in protected species.

1.6.5 Export control
Maintain and periodically review Commonwealth and Australian and New Zealand Environment and Conservation Council policies relating to the export of indigenous species, and monitor and improve the conservation effectiveness and enforcement of the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*.

1.7 Threatened biological diversity

Objective 1.7

Enable Australia's species and ecological communities threatened with extinction to survive and thrive in their natural habitats and to retain their genetic diversity and potential for evolutionary development, and prevent additional species and ecological communities from becoming threatened.

This objective is the aim of the draft strategy entitled Conservation of Australian Species and Ecological Communities Threatened with Extinction - a National Strategy.

Conservation of threatened biological diversity

Threatened species and subspecies, their natural habitats, and threatened ecological communities require special measures if they are to survive. Although mechanisms exist for conserving threatened species and endangered ecological communities, a national strategy is needed urgently to provide the additional focus and coordination for funding and resources and to identify new mechanisms and actions that are needed and how the success of these can be measured.

As a result of the InterGovernmental Agreement on the Environment, the Commonwealth, State and Territory governments have, through the Australian and New Zealand Environment and Conservation Council, been developing the draft strategy, Conservation of Australian Species and Ecological Communities Threatened with Extinction - a National Strategy. The process has involved other relevant ministerial councils and consultation with industry, business and conservation organisations. It will provide the framework for a major improvement in endangered species conservation in the next decade.

The Commonwealth, States and Territories are also actively involved in endangered species recovery work and a number of jurisdictions have enacted or are preparing threatened species legislation.

Despite these efforts, we have inadequate knowledge of the extent of endangerment and there are some deficiencies in legislative coverage and resourcing. More also needs to be done to develop cooperative, non-legislative arrangements to assist in redressing the problem.

Nearly all species currently known to be threatened are either vertebrates or flowering plants. As our knowledge of conservation requirements improves, the list of threatened species will probably expand to include species from other groups such as non-vascular plants, invertebrates and microorganisms. Improved knowledge of ecological processes will also enhance our understanding of the importance of these groups and emphasise the importance of conserving and managing ecological communities.

Actions

1.7.1 Threatened species strategy
Ensure the completion, adoption and implementation of Conservation of Australian Species and Communities Threatened with Extinction - a National Strategy, in accordance with the InterGovernmental Agreement on the Environment.

Ensure that adequately funded threatened species programs operate at the Commonwealth and State and Territory levels in order to implement this National Strategy, including the development and implementation of

(a) mechanisms to enable the identification of endangered and vulnerable species and communities and to identify threatening processes;

(b) recovery plans for endangered and vulnerable species and communities, covering the full geographic range of species and ecological communities and deal with cross-jurisdictional problems;

(c) plans for mitigating or eliminating the effects of threatening processes.

1.7.2 Threatened species legislation
Develop and implement complementary and cooperative threatened species legislation at the Commonwealth and State and Territory levels and review the operation and impact of the legislation.

1.8 Biological diversity and Aboriginal and Torres Strait Islander peoples

Objective 1.8

Recognise and ensure the continuity of the contribution of the ethnobiological knowledge of Australia's indigenous peoples to the conservation of Australia's biological diversity.

Aboriginal and Torres Strait Islander interests

As a consequence of their long history in Australia, Aboriginal and Torres Strait Islander peoples have developed a special knowledge of biological diversity and have a particular interest in the conservation status of indigenous species and environments.

Traditional Aboriginal and Torres Strait Islander law and cosmology establish intimate connections between people, land and other species, with ritual, custodial and management responsibilities for the land and other species being passed down through generations.

These traditional approaches and outlooks persist in many parts of Australia; in other areas, despite the historical undermining of indigenous structures, contemporary Aboriginal and Torres Strait Islander cultures maintain a lively interest in, practical knowledge of, and concern for the well-being of the land and natural systems.

Although Aboriginal and Torres Strait Islander peoples may be willing to share some of their cultural knowledge, aspects of that knowledge may be privileged and may not be available to the public domain.

Traditional Aboriginal and Torres Strait Islander management practices have proved important for the maintenance of biological diversity and their integration into current management programs should be pursued where appropriate.

The maintenance of biological diversity on lands and waters over which Aboriginal and Torres Strait Islander peoples have title or in which they have an interest is a cornerstone of the well-being, identity, cultural heritage and economy of Aboriginal and Torres Strait Islander communities.

Actions

1.8.1 Access to information
Provide resources for the conservation of traditional biological knowledge through cooperative ethnobiological programs.

Provide access to accurate information about biological diversity for Aboriginal and Torres Strait Islander peoples, and involve them in research programs relevant to the biological diversity and management of lands and waters in which they have an interest.

1.8.2 Use and benefits of traditional biological knowledge
Ensure that the use of traditional biological knowledge in the scientific, commercial and public domains proceeds only with the cooperation and control of the traditional owners of that knowledge and ensure that the use and collection of such knowledge results in social and economic benefits to the traditional owners. This will include

(a) encouraging and supporting the development and use of collaborative agreements safeguarding the use of traditional knowledge of biological diversity, taking into account existing intellectual property rights;

(b) establishing a royalty payments system from commercial development of products resulting, at least in part, from the use of traditional knowledge.

Such arrangements should take into account relevant work in international forums such as the United Nations Commission on Human Rights; they should also take into account Australian obligations under the Convention on Biological Diversity.

1.8.3 Species recovery plans
Provide resources for the establishment of cooperative species recovery plans for endangered and vulnerable species of particular significance to Aboriginal and Torres Strait Islander communities.

1.8.4 Cooperative arrangements
Recognising that a representative reserve and off-reserve system to conserve biological diversity will extend across the boundaries of Aboriginal and other tenure systems, negotiate cooperative arrangements for conservation management that recognise traditional land tenure and land management regimes.

1.8.5 Sustainable harvesting of wildlife
Recognising the importance of harvesting of indigenous plant and animal species, both on land and in water, to the well-being, identity, cultural heritage and economy of Aboriginal and Torres Strait Islander peoples, provide assistance for the establishment of management programs for ecologically sustainable harvesting of wildlife by individual communities.

1.8.6 Ethnobiological education
Ensure that curricula at all levels in Australia promote an understanding of the importance of traditional knowledge and the social and economic benefits of ethnobiology. This will include

(a) an understanding of Aboriginal and Torres Strait Islander practices that have been instrumental in shaping the biological resources of Australia;

(b) an appreciation of the cultural heritage of biological knowledge in Aboriginal and Torres Strait Islander communities.

1.9 Ex-situ conservation

Objective 1.9

To complement in-situ measures, establish and maintain facilities for ex-situ research into and conservation of plants, animals and microorganisms, particularly those identified by action taken in accordance with Objective 1.1.

Complementary ex-situ measures

Although in-situ conservation is the most effective means of conserving biological diversity, there are several situations in which ex-situ conservation may be of great importance.

Unpredictable events may threaten rare genotypes or species. Ex-situ conservation provides insurance in these circumstances. Some threatened species require cultivation or breeding in captivity to build up their numbers for reintroduction to the wild. Other genotypes and species can survive only ex situ because of total loss or alteration of their habitat.

Some significant steps have been taken to achieve ex-situ conservation of threatened species, among them the establishment of the Australian Network for Plant Conservation and the Australasian Species Management Program, the captive breeding and propagation activities of the State and Territory conservation agencies, and the establishment and maintenance of seed and germplasm banks and microbial collections in a range of institutions.

Actions

1.9.1 Strengthening ex-situ conservation

Strengthen ex-situ conservation, including the provision of adequate resources to relevant institutions and organisations, by

(a) enhancing the Australian Network for Plant Conservation and the Australasian Species Management Program to ensure that those species identified in accordance with Objective 1.1 and that require ex-situ measures are being managed effectively;

(b) establishing or strengthening networks of culture collections of microbial species, including those of medicinal, agricultural and industrial importance;

(c) encouraging germplasm banks to identify and develop commercial and other applications of germplasm relevant to the conservation of biological diversity, especially those involving the use of plants for rehabilitation.

1.9.2 Reintroduction

At a national level, integrate ex-situ and other measures for the conservation of threatened species, particularly through research and the development of a strategy for the recovery, rehabilitation and reintroduction of each such species to its natural habitat.

1.9.3 Non-threatening collection

Regulate and manage the collection of biological resources from natural habitats for ex-situ conservation purposes to ensure that it does not threaten ecosystems and in-situ populations of species. The taking of threatened species from the wild for ex-situ conservation purposes should occur only when it offers the best chance for, and is directed towards, the long-term survival of the species in the wild.

2 Integrating biological diversity conservation and natural resource management

All Australians rely on industries that use biological resources to maintain and enhance their standard of living. These industries provide employment for many Australians, support secondary industries, and contribute significantly to the economy. For example, total expenditure by local and overseas tourists in 1989-90 amounted to $23.4 billion.[4] In 1990-91 the forest and forest product industries contributed $9.8 billion to the Australian economy[5] and, in 1992-93, production from the farm and fisheries industries was valued at $22.2 billion and $1.4 billion respectively.[6] A range of other industries are directly or indirectly dependent on biological diversity.

But these resource-based industries, however, have direct and indirect costs to the environment.

Community and industry attitudes to the use of biological resources are changing from the 'maximum yield' approach to one of ecologically sustainable yield, which recognises the need for conservation of biological diversity and maintenance of ecological integrity. Integration of management regimes within and between industry sectors to meet environmental, economic and social objectives must be improved to reflect that this attitudinal change.

2.1 National integrated policies

Objective 2.1

Develop and implement national integrated policies for the ecologically sustainable use of biological resources.

Integrated policies for ecologically sustainable use of biological resources

The development of integrated policies for major uses of biological resources is necessary to coordinate activities within and between all levels of government, to ensure that the full social and environmental consequences, and the opportunity costs, of development activities are considered, and to ensure that the public interest is properly taken into account.

Integrated policies will also provide the opportunity for all Australians to accept responsibility for the impacts on biological diversity of their activities, including resource consumption, and to participate in achieving ecological sustainability within industries and lifestyles.

Improved management of Australia's biological resources is essential for ecologically sustainable use and is being dealt with in a number of ways, including through the ecologically sustainable development process. This process has yielded information about what needs to be done to better manage Australia's biological resources. Improved management of Australia's forests, fisheries, agricultural lands and rangelands is necessary for the industries involved and at the same time will provide considerable benefits for the conservation of biological diversity. Other sectors and areas that could also benefit from improved management are urban and coastal areas, the industrial and extractive sectors and infrastructure development.

Actions

2.1.1 Develop and implement national policies

Through cooperation between the Commonwealth, State and Territory and local governments and relevant industries and non-government organisations, develop and implement national policies based on the objectives and principles of the National Strategy for Ecologically Sustainable Development. This will integrate the conservation and ecologically sustainable use of biological diversity into relevant sectoral and cross-sectoral activities. In developing these national policies, the need to maintain the international competitiveness of industries must be taken into account. The policies will require

(a) implementation on a bioregional basis;

(b) improved coordination and integration mechanisms between all levels of government, industry and community groups;

(c) better planning to overcome incremental decision making;

(d) effective monitoring and development of performance indicators;

(e) rapid dissemination and application of new information;

(f) implementation measures including regulatory arrangements, legislation, standards and economic instruments;

(g) proper evaluation of the full environmental, social and economic benefits and costs of the protection of biological diversity;

(h) greater public accountability.

2.1.2 Improved assessment and approval procedures
Develop improved methods for the appraisal and measurement of public expenditure relating to the major resource-based sectors - agriculture and pastoralism, fisheries, forestry, water and tourism and recreation. Particular attention should be paid to

(a) the environmental benefits and costs of the uses of biological diversity;

(b) the externalities of existing use practices;

(c) opportunity costs;

(d) risk assessment of existing and proposed activities that could significantly affect the conservation and management of biological diversity.

Where necessary, modify approval procedures to ensure that they appropriately take into account the expanded knowledge base.

2.2 Agriculture and pastoralism

Objective 2.2
Achieve the conservation of biological diversity through the adoption of ecologically sustainable agricultural and pastoral management practices.

Actions

2.2.1 Improving the knowledge base
Conduct additional coordinated research into

(a) achieving ecologically sustainable use of biological resources in agriculture and further developing systems approaches such as whole farm or property management planning;

(b) developing improved techniques to integrate farm land use with surrounding land uses, such as urban, forest and reserve lands and waters, to promote the conservation of biological diversity;

(c) alternative or modified economically viable and sustainable land uses in areas where current land uses are incompatible with the conservation of biological diversity;

(d) the diversity of Australian soil organisms, their role in the dynamics of soils, and their relationship with plant growth;

(e) the impact of total grazing pressure in rangelands on biological diversity and the resilience and regenerative capacity of palatable species;

(f) developing and implementing tools for adaptive management of rangelands.

2.2.2 Government support and institutional arrangements

Strengthen delivery of government services connected with management of agricultural and pastoral systems by

(a) encouraging continued institutional reform and incorporation of biological diversity conservation and other ecologically sustainable development objectives in corporate strategic plans;

(b) where necessary, developing and applying financial and other incentives for conservation and rehabilitation programs and assessing their success. In some cases consideration may need to be given to promoting alternative land uses;

(c) encouraging rural extension agencies to promote land use practices that conserve biological diversity;

(d) ensuring that State and Territory land management legislation and administrative arrangements take into account the conservation of biological diversity;

(e) developing and promoting programs to reduce negative impacts on biological diversity arising from the use of artesian waters.

2.2.3 Improved management

Encourage landholders, other land managers, governments and industry organisations to protect biological diversity by

(a) continuing to review the impact of agricultural and pastoral management activities on biological diversity and seeking changes where appropriate;

(b) jointly developing and adopting practical and acceptable codes of practice that acknowledge the need for change in management techniques;

(c) incorporating biological diversity conservation objectives in whole farm or property management, bioregional and catchment planning, including

- the management of pests and weeds,

- identifying and managing critical biological diversity areas, including refuge areas, riparian vegetation, nutrient patches in semi-arid regions, habitat remnants on farmlands, watercourses and stock routes,

- reducing the impacts of sedimentation and nutrient and other chemical applications on freshwater, wetland and marine biological diversity,

- incorporating the risks of climate variability in property management to enhance the long-term sustainability and productivity of the environmental resource base, as reflected in the National Drought Policy,

- monitoring rangeland condition and adjusting management practices as appropriate;

(d) managing irrigation practices to encourage efficient use of water and minimise waterlogging, salinisation and other adverse effects on biological diversity;

(e) incorporating biological diversity conservation objectives in tree planting and other activities carried out for soil conservation and productivity maintenance and restoration purposes.

2.3 Fisheries

Objective 2.3

Achieve the conservation of biological diversity through the adoption of ecologically sustainable fisheries management practices.

Actions

2.3.1 Improving the knowledge base

Increase data collection and coordinated research into the biological diversity and human use of the Australian Fishing Zone and estuarine and freshwater areas. Priority should be given to

(a) the impact of recreational fishing on fisheries, fish and their habitats;

(b) the impact of commercial fishery practices on non-target and by-catch species and ecosystems, on the viability of populations, and on genetic diversity;

(c) the development of fishing techniques that are species specific, that have the least impact on non-target species, and that minimise waste of the resource, with particular emphasis on trawling and shellfish dredging;

(d) the development of rapid monitoring techniques, especially where native species are used;

(e) the identification of critical habitats for harvested native fishes, in particular spawning and nursery grounds;

(f) the development of 'state of the environment' reporting for freshwater, estuarine and marine areas;

(g) determination of the impact of both aquaculture species and aquaculture management practices on the environment, including aquatic wildlife.

2.3.2 Improved management

Ensure that the implementation of fisheries ecosystem management, as agreed to by the Australian and New Zealand Fisheries and Aquaculture Council and outlined in the National Strategy for Ecologically Sustainable Development, is consistent with the conservation of biological diversity and gives priority to

(a) reviewing the appropriateness of current management strategies, techniques, standards, jurisdictions and legislation;

(b) using economic instruments such as incentives for conservation activities, including rehabilitation programs;

(c) developing and adopting practical and acceptable codes of practice for the management and monitoring of commercial and recreational fishing, for the harvesting of invertebrates, for the rehabilitation of depleted stocks, and for key habitat and spawning areas;

(d) developing through the Australian and New Zealand Fisheries and Aquaculture Council, in consultation with relevant ministerial councils, the national strategy and guidelines for managing recreational fishing on an ecologically sustainable basis;

(e) implementing, in consultation with industry, such necessary changes to current practices as are identified in the priority research areas outlined in Action 2.3.1;

(f) developing through the Australian and New Zealand Fisheries and Aquaculture Council, in consultation with relevant ministerial councils, the national strategy and guidelines for managing aquaculture developments; and

(g) developing, where necessary, rehabilitation programs for aquatic habitats of importance to biological diversity conservation.

2.4 Forestry

Objective 2.4

Achieve the conservation of biological diversity through the adoption of ecologically sustainable forestry management practices.

The National Forest Policy Statement provides a framework for governments to take action to implement ecologically sustainable management of forestry in Australia. The Statement is a primary means by which the objectives of the National Strategy for the Conservation of Australia's Biological Diversity will be accomplished in forest habitats.

Actions

2.4.1 Improving the knowledge base

Improve the knowledge base underpinning forestry in a coordinated way by

(a) undertaking regional surveys of forests for old-growth values and of forested and other lands for wilderness values;

(b) undertaking assessments of forests to identify their value for the conservation of biological diversity;

(c) developing methods for assessing the positive and negative contributions of silvicultural systems to the maintenance of biological diversity;

(d) ensuring improved analytical techniques and greater accessibility and compatibility between databases and techniques and between local government, regional, and State, Territory and Commonwealth agencies;

(e) undertaking research and long term monitoring of the impacts on biological diversity and ecological processes resulting from the commercial use of native forests and the effectiveness or otherwise of management prescriptions (relating to, for example, habitat trees and streamside reserves) in conserving biological diversity.

2.4.2 Improved management

As agreed in the National Forest Policy Statement, governments should apply to all public and private native forests in Australia the Australian Forestry Council's set of national principles for forest practices related to wood production in native forests. This set of principles includes principles of environmental care to foster the maintenance of biological diversity values.

Ensure that State and Territory land management legislation and administrative arrangements take into account the conservation of biological diversity.

Increase the resources devoted to the conservation of biological diversity in forests and give priority to

(a) ensuring that State and Territory forestry management legislation and administrative arrangements take into account the conservation of biological diversity;

(b) better control of pests, weeds and disease in public forests;

(c) the management of plantations to minimise impacts on adjacent ecosystems;

(d) providing to private forest owners technical advice about improved ways of managing for the conservation of biological diversity and offering incentives to promote conservation activities, including rehabilitation programs;

(e) promoting integrated catchment management objectives among public and private forest owners through the application of codes of practice, forest management plans and, where appropriate, land clearing controls. In addition, by disseminating information through landcare and other community groups, promote among landowners the objectives of establishing and maintaining forest cover;

(f) ensuring that the relevant forest management agencies develop regional plans to protect the biological diversity, wilderness and old-growth values determined in forest surveys;

(g) ensuring that management of public native forests outside the reserve system will complement the biological diversity objectives of conservation reserve management.

2.5 Water

Objective 2.5

Manage water resources in accordance with biological diversity conservation objectives and to satisfy economic, social and community needs.

Actions

2.5.1 Improving the knowledge base

Improve knowledge about the biological diversity of aquatic and associated systems by

(a) undertaking research into the interactions between surface hydrology and groundwater and biological diversity;

(b) identifying the impacts on biological diversity of accessible and widespread provision of artesian water in naturally dry areas;

(c) where appropriate, establishing inventories of the condition and extent of wetlands, floodplains and riparian ecosystems.

2.5.2 Legislative and policy framework

Protect aquatic ecosystems by introducing effective legislative and policy frameworks incorporating

(a) State and Territory land management legislation and administrative arrangements that take into account the conservation of biological diversity;

(b) better integration of regional planning and management for protection of biological diversity;

(c) multiple-use strategies for off-reserve management;

(d) better conservation and more efficient use of water by ensuring that water pricing reflects the full costs of water services and by providing greater flexibility in the transfer of water rights;

(e) rehabilitation of wetlands and rivers as links between areas of remnant vegetation;

(f) joint evaluation of conservation and water resource values.

2.5.3 Improved management

Ensure that the activities of water management agencies are consistent with the conservation of biological diversity and take into account

(a) the need to minimise the effect that barriers to water flow have on the migration and reproduction of aquatic fauna and dependent floodplain ecosystems;

(b) the impacts of artificial river flows and the lowered water temperatures downstream of large storages on the breeding of aquatic species;

(c) the importance of natural flow regimes and habitat complexity for aquatic and riparian ecosystems and the need to minimise the impacts of habitat alteration in river improvement projects;

(d) the need to minimise the adverse impacts of the use of artesian water on the biological diversity of naturally dry areas, as outlined for Action 2.2.2;

(e) the need to improve management of water allocations to ensure the maintenance of instream and floodplain biological diversity.

These actions also apply to the protection of aquatic biological diversity associated with mound and thermal springs, groundwaters, artesian systems and caves.

2.6 Tourism and recreation

Objective 2.6

Achieve the conservation of biological diversity through the adoption of ecologically sustainable management practices for tourism and recreation.

This objective is consistent with the National Tourism Strategy, which has as its strategic environmental goal 'to provide for sustainable tourism development by encouraging

responsible planning and management practices consistent with the conservation of our natural and cultural heritage'.

Actions

2.6.1 Improving the knowledge base

Initiate long term monitoring of the impacts of current tourism and recreation activities within and adjacent to protected areas and fragile ecosystems and review past experience.

2.6.2 Improved management
Encourage governments and participants in the tourism and recreation industry to conserve biological diversity by

(a) reviewing the impact of tourism and recreation management activities on biological diversity and seeking changes where appropriate;

(b) developing and implementing for tourism operators using areas with significant biological diversity codes of practice that acknowledge the need for any required changes to management practices;

(c) offering incentives for conservation activities, including rehabilitation programs.

Where tourism is dependent on the natural environment, encourage the development of management strategies in association with broader land use plans, including provisions for

(a) tourism facilities and services to be provided in accordance with the biophysical limits of an area;

(b) the development of criteria and conditions under which commercial activities within or adjacent to protected areas may be appropriate;

(c) rehabilitation of existing tourism sites where appropriate.

2.7 Utilisation of wildlife

Objective 2.7
Achieve the conservation of biological diversity through the adoption of other ecologically sustainable wildlife management practices.

Harvesting wildlife

At present a number of smaller industries are based on the harvest of native species. Some of these have grown from culling programs and some (for example, tree-fern harvesting) are by-products of other industries. Not all of these industries are operating with a management plan, and for some of the species harvested (for example, lawyer vine) there is inadequate biological knowledge of the species and of whether the current industry is ecologically sustainable.

Any harvesting of native species should take place in accordance with a management plan, incorporating provisions for continuing research, monitoring and public scrutiny.

Actions

2.7.1 Review and improve management
In accordance with the World Conservation Union's resolution on sustainable use, develop wildlife utilisation programs that create economic and other incentives for the retention, rehabilitation, maintenance and management of natural habitats.

Review the appropriateness and ecological sustainability of current management strategies involving the harvesting of native species by

(a) ensuring that coordinated research into and monitoring of exploited species is undertaken to determine ecological sustainability;

(b) ensuring the development and regular review of management plans, for both domestic and export purposes;

(c) ensuring that harvesting arrangements are based on the long-term viability of the species concerned;

(d) ensuring thorough public consultation and government accountability in the management, planning and implementation process.

2.8 Access to genetic resources

Objective 2.8

Ensure that the social and economic benefits of the use of genetic material and products derived from Australia's biological diversity accrue to Australia.

The need for control of genetic resources

Genetic resources include the genes and gene pools of native species, of introduced species, and of plant, animal and microbial varieties produced by breeding and genetic manipulation. Australia is rich in genetic resources that could be used in scientific and technological research and that have the potential to be developed into commercial products. Apart from the protection of plant varieties by rights legislation, foreign organisations and individuals have enjoyed almost free access to our genetic resources. The Convention on Biological Diversity recognises the sovereign rights of countries over their genetic resources and their authority to determine access conditions, including the sharing of any benefits gained. It is in Australia's interest to control access to our genetic resources and obtain an appropriate return for any permitted access.

Some States and Territories are already considering legislative action to control and obtain benefits from access to genetic resources. In the context of ratification of the Convention on Biological Diversity it was recommended that a Commonwealth, State and Territory Working Group be established to investigate and report on the strengthening of existing controls governing access to genetic resources, including legislation. The Commonwealth Co-ordinating Committee on Science and Technology is preparing a discussion paper on access to Australia's biological resources and their products.

Actions

2.8.1 Working group
Establish a Commonwealth/State working group to investigate and report on matters relating to access to Australian genetic resources, including the strengthening of existing controls and legislation.

2.8.2 Sharing benefits
Through effective controls, legislation and incentives (including secure property rights) ensure that Australia participates in research into and development of, and shares the benefits from, any commercial opportunities, including the development of biotechnologies that are based on genetic resources collected from areas within Australia's jurisdiction.

2.8.3 Non-threatening collection
Ensure that collection of genetic resources for research and development purposes does not adversely affect the viability or conservation status of the species or population being collected or of any component of its habitat.

2.8.4 Screening programs

Encourage and support the establishment of screening programs within Australia to identify genetic products of social and economic benefit.

2.8.5 Property rights

Ensure that Australia benefits from access to and use of its genetic resources through existing arrangements such as plant variety rights and patents legislation and any new arrangements that are developed.

The use and benefits of traditional knowledge are discussed under Action 1.8.2.

2.8.6 Ex situ conservation of genetic material

Encourage and support the activities identified for Actions 1.9.1(b) and 1.9.1(c).

3 Managing threatening processes

In addition to actions necessary to conserve biological diversity directly, there is a need for a range of supporting measures that can minimise the impact of various external factors on biological diversity. Among these factors is an array of threatening processes or events such as the effects of alien species, pollutants and altered fire regimes and the longer term changes to climate that may result from various atmospheric emissions. Effective repair and rehabilitation of degraded areas will also provide valuable support for biological diversity conservation. Such activities and the control of threatening processes or events need to be undertaken in the context of a well-developed system of bioregional planning.

3.1 Threatening processes and activities

Objective 3.1

Monitor, regulate and minimise processes and categories of activities that have or are likely to have significant adverse impacts on the conservation of biological diversity and be able to respond appropriately to emergency situations.

Actions

3.1.1 Monitor and manage processes

Through sampling and other techniques, monitor processes and categories of activities that have or are likely to have significant adverse impacts on the conservation of biological diversity. Where a significant adverse effect on biological diversity is determined, regulate or manage the relevant processes and categories of activities.

3.1.2 Emergency responses

Through cooperation between Commonwealth, State and Territory and local governments, establish arrangements for appropriate emergency responses to activities or events, whether caused naturally or otherwise, that present a grave and imminent danger to biological diversity. Australia should seek the cooperation of neighbouring countries in the development of regional arrangements such as joint contingency plans.

3.2 Clearing of native vegetation

Objective 3.2

Ensure effective measures are in place to retain and manage native vegetation, including controls on clearing.

Actions

3.2.1 Monitor clearing

Assess and monitor the current rate and distribution of native vegetation clearing on a national basis, including developing national inventories of native vegetation.

3.2.2 Government initiatives

Ensure that policies and controls are developed and implemented by the Commonwealth, State and Territory governments for the management and conservation of native vegetation on private and public lands, in consultation with landholders and community groups, and for controlling broad-scale clearance.

In accordance with the InterGovernmental Agreement on the Environment, review legislation relating to clearing and ensure that criteria for assessing land clearance applications take account of biological diversity conservation, land protection, water management, and landscape values.

3.2.3 Incentives and rebates

Undertake cooperative development of a range of measures at all levels of government, including financial incentives, cost reimbursements and rate rebates, to encourage land managers to improve conservation of native vegetation.

3.2.4 Information program

Work through appropriate agencies to develop a native vegetation conservation information program that is targeted at land managers and focuses on the value of retaining native vegetation in situ while integrating this retention with major land uses.

3.2.5 Voluntary protection

Encourage voluntary management of native vegetation remnants and review the effectiveness of all mechanisms for the long term voluntary protection of native vegetation and wildlife.

3.2.6 Expansion of Landcare

The Commonwealth Government will consider expansion of activities under the National Landcare Program to increase technical advice and the preparation and implementation of bioregional vegetation plans, involving local land managers where possible.

3.3 Alien species and genetically modified organisms

Objective 3.3

Control the introduction and spread of alien species and genetically modified organisms and manage the deliberate spread of native species outside their historically natural range.

The need for control of alien species and genetically modified organisms

Much of Australia's primary production depends on long-established domesticated and cultivated species that originated in other countries; further introductions seem probable in order to sustain and enhance productivity.

A large number of other species of plants, animals and microorganisms that have been introduced into Australia over the years have caused significant damage to Australia's biological diversity (including species extinctions). Examples are the European rabbit, which has caused enormous damage to the southern half of Australia, the weed *Mimosa pigra*, which is spreading rapidly on floodplains in northern Australia, and the fungus *Phytophthora*, which has had a devastating effect on the species-rich shrublands in the south of Western Australia.

Some exotic grazing species pose a continuing threat to rangelands biological diversity. Pastoral activities, particularly the increase in watering points, and pastoral modification have increased the suitability of pastoral lands for some pests (feral goats, rabbits and horses) as well as increased the populations of some kangaroo and wallaby species. The uncontrolled increase in the number of grazing animals will have significant impacts on present and future biological diversity.

There are many other species that, if carelessly introduced to Australia despite our strong quarantine laws, could cause further serious damage; their continued exclusion from this country is of paramount importance, both to industries based on biological resources and to biological diversity conservation. The strongest possible controls are required to prevent further unwanted introductions, and comprehensive control plans that take biological diversity conservation into account are necessary to deal with pest species already established. A national strategy for the control of weeds and guidelines for the control of vertebrate pests are being developed and should be implemented as a matter of priority.

A problem that is often overlooked is the adverse effects that can arise when native species are deliberately spread beyond their historically natural range. Although the use of non-local native species may be preferable to the use of non-indigenous species in plantation forestry and in some revegetation activities, there remains a risk that the genetic diversity of related local species will be adversely affected. Nevertheless, in some situations non-local species can be the best option for rehabilitation, especially if the areas concerned have had their original status significantly altered. In these cases vegetation that can provide a habitat for some native species may be preferable to no vegetation at all or to the use of a totally alien species.

Although it can confer significant benefits, the development of genetically modified organisms also brings with it potential risks, particularly the displacement or genetic modification of unmodified species. Procedures have been formulated covering the development and the release of these organisms. These procedures should be agreed and implemented by governments.

Actions

3.3.1 Research

For the next seven years, fund a comprehensive cooperative research program into the biology and ecology of alien species that threaten biological diversity. Emphasis should be given to

(a) assessing the types and levels of impacts and the likely extent of harm to native biological diversity;

(b) increasing risk assessment studies of potential impacts on biological diversity of species introduced for commercial, scientific and other purposes;

(c) understanding the population dynamics of pest species;

(d) developing biological and other control methods for pest species that threaten biological diversity;

(e) monitoring the effects of pest control programs and modifying those that have adverse side-effects for biological diversity.

3.3.2 Coordinated programs

Develop and implement well-resourced programs for the control or eradication of those alien species identified as a threat to biological diversity. Such programs should

(a) be coordinated between Commonwealth, State and Territory and local government agencies;

(b) involve the development of species-specific national or bioregional control plans;

(c) be integrated with catchment management, landcare programs, and whole farm or property planning and management;

(d) ensure effectiveness and consistency of regulations governing the control of alien species, including their deliberate or unintended release or spread;

(e) develop contingency plans and have the capacity to ensure rapid eradication of any newly established and unwanted alien species or populations;

(f) provide incentives to landowners;

(g) include public education campaigns.

Governments should move rapidly to finalise and implement the national weeds strategy and national vertebrate pests management guidelines.

3.3.3 Import control

Review, and if necessary strengthen, quarantine laws and other regulations, penalties, enforcement and public education arrangements relating to the control of the import of species into Australia. Particular attention should be paid to

(a) strengthened risk assessment procedures for identification of potentially harmful species, their entry, establishment and control;

(b) reducing unintentional introductions such as microorganisms or marine organisms in ballast water;

(c) ensuring the provision of adequate resources to implement quarantine controls, including coastal surveillance;

(d) establishing a public education program on the risks posed to biological diversity by the illegal import of species.

3.3.4 Translocated species

Promote the use of local indigenous species in rehabilitation; discourage the use of non-local native species in revegetation schemes, large-scale landscaping schemes and rehabilitation programs.

Exercise caution in the commercial use of any new non-local native species. Develop procedures to ensure that their establishment and propagation will not threaten the integrity of existing ecological systems.

3.3.5 Genetically modified organisms

Support the development of legislation and arrangements for regulating the import, development, use and release of genetically modified organisms through the work of the Commonwealth-State Consultative Group on Genetic Manipulation.

3.4 Pollution control

Objective 3.4

Minimise and control the impacts of pollution on biological diversity.

The pollution problem

Pollution continues to be an increasing problem for the conservation of biological diversity in Australia. River systems and near-shore environments are at particular risk. Localised impacts have occurred and their frequency is increasing. A number of river systems suffer from increasing salinity, silt loads, nutrient levels, and heavy metal and chemical pollution. Pollution of groundwater has adverse effects on ecosystems in both urban and rural environments. The Commonwealth Environment Protection Agency is developing a National Emissions Register and recommendations for standards and, once reflected in State and Territory control measures, this should help to minimise the impacts of pollution. The use of some agricultural, industrial and urban chemicals continues to cause problems for wildlife, including cumulative effects. Sewage discharge into the sea has a localised impact on biological diversity.

Under Schedule 4 of the InterGovernmental Agreement on the Environment, Commonwealth, State and Territory governments have agreed to establish the National Environment Protection Authority, and legislation is currently being drafted for this purpose. Through the Authority, the governments will develop measures for ambient air quality and ambient marine, estuarine and freshwater quality.

The draft National Water Quality Management Strategy, which is currently being developed, will contribute to the effort to deal with some of the problems of pollution control.

Actions

3.4.1 Assessing impacts

Assess the cumulative impact of the total pollutant load on biological diversity.

Promote the development and use of bio-indicators and other indicators of pollution.

Review and increase the levels of environmental monitoring of currently used pesticides and other hazardous chemicals.

3.4.2 Control

Encourage Commonwealth, State and Territory and local governments to review, and if necessary strengthen or develop, new pollution prevention and control measures, including market measures and national standards to minimise the impacts of pollution on biological diversity. This will require

(a) reviewing legislation and guidelines to ensure that criteria for minimising significant adverse impacts on the conservation of biological diversity are included as part of the basis for pollution prevention and control measures. Particular attention should be paid to non-point-source pollution, industrial pollution, control of the discharge of sewage, waste minimisation and accident prevention, and the need for a catchment or bioregional approach in implementation;

(b) strengthening measures to deal with activities or processes that result in detrimental changes to the physical environment of organisms, such as the potentially damaging discharge of dam water;

(c) strengthening the systems of control for the manufacture, importation and use of chemicals where scientific evidence shows that these chemicals adversely affect biological diversity, with a view to minimising their impacts.

3.4.3 Alternatives

Encourage research into, and the development and application of, alternatives to processes and activities that are known to have adverse effects on biological diversity.

3.4.4 Cleaning up

Investigate and expand the role of innovative biologically sound technologies in pollution management and give priority to the use of such methods in cleaning up pollution in areas of high biological diversity significance.

3.5 Fire

Objective 3.5

Reduce the adverse impacts of altered fire regimes on biological diversity.

Fire and biological diversity

Much of our native flora and fauna has evolved with fire and relies upon particular fire regimes for continued survival. With settlement, however, the timing, frequency and intensity of these fires have changed.

Although fire is a necessary part of many ecosystems, it can also be damaging. Inappropriate fire regimes - for example, fires of high or low intensity that are either too frequent or insufficiently frequent - can lead to loss of native species, communities and ecosystems. Burning can promote invasion of native vegetation by weeds, sometimes leading to increased fire hazard within a short time. And prescribed fires can escape to become wildfires.

Gaps in scientific knowledge make it difficult to difficult to balance the benefits and costs of the use of fire. At this stage, a cautious approach involving variable regimes should be adopted in the use of prescribed fire, until its impacts and its role in vegetation management are better understood.

Actions

3.5.1 Research
Support and coordinate further research into the role of fire in Australian ecosystems.

3.5.2 Fire management
Develop and coordinate management policies that seek to minimise the adverse impact of fire on biological diversity. This will include

(a) development of prescribed burning practices that take account of the fire responses of different ecosystems, natural patterns of succession, and the role of fire in the maintenance of biological diversity;

(b) promoting awareness on the part of property managers of the impact of fire on biological diversity on lands under their control, including providing extension services to advise on the timing and pattern of fire use to reduce fuel and promote pasture growth on rangelands.

3.6 Impacts of climate change on biological diversity

Objective 3.6

Plan to minimise the potential impacts of human-induced climate change on biological diversity.

Likely impacts of climate change

There is a growing body of evidence showing that increases in atmospheric concentrations of 'greenhouse' gases will enhance the greenhouse effect, resulting on average in additional warming of the Earth's surface. This is likely to lead to climatic changes, including increased temperatures, sea level rises and altered rainfall regimes. The extent, pattern and timing of such changes remain uncertain.

Australia's biological diversity will be affected by any climate change. For example, sea level rises would have a direct effect on coastal and estuarine ecosystems and freshwater lagoons near the coast, many of which are important breeding grounds for birds. In alpine ecosystems relatively small temperature changes may result in extensive loss of habitat and consequently extinction of some alpine species.

The ability of species and ecosystems to adapt to climate changes is affected by the rate of change and possible increases in the frequency of extreme climatic events. Pollution and the fragmentation of many natural habitats place further stresses on biological diversity and ecosystem function.

Integrated conservation and sympathetic management of large areas of the environment, within a bioregional context, have the greatest potential to mitigate the possible effects of climate change on biological diversity.

In the National Greenhouse Response Strategy, governments have emphasised the need to adopt land uses and management measures designed to conserve carbon sinks and increase the amount of vegetation in forests and elsewhere. They have also stated in the Strategy that they will seek to provide corridor systems that link reserves and refuges with a relatively large range of altitudinal and other geographical variation, to take into account possible impacts of climate change.

Actions

3.6.1 Research
Support research into the potential impacts of climate change on biological diversity. This will include

(a) investigation into the range and physiological tolerances of species and populations;

(b) predicting the responses of ecosystems and species to climate change;

(c) modelling the effects of climate change to predict future conservation management requirements;

(d) research into the secondary effects of climate change such as altered fire proneness, climatically driven land use changes, and conditions that would favour the spread of pathogens or introduced species.

3.6.2 Contingency arrangements
Investigate the capacity of protected areas to sustain their biological diversity in the event of climate change and where appropriate ensure that altitudinal and latitudinal buffer zones or corridors exist to allow for the movement of organisms in the event of shifts in climatic zones.

3.7 Rehabilitation

Objective 3.7
Repair and rehabilitate areas to restore their biological diversity.

Rehabilitation responsibilities

The best way to conserve biological diversity is to ensure that development activities are planned so as to minimise any impacts on it. Many past development activities have led to the degradation of land and water resources. This can lead to loss of biological diversity and loss of the opportunity to benefit from its future use. An example is the loss of an aquatic amenity and other uses through eutrophication. Effective planning and rehabilitation can allow resource development to occur in many areas without long-term adverse impacts on biological diversity. Governments, as well as industry, should provide a lead in restoration practices since they have responsibility for much of Australia's land and all marine areas. Direct beneficiaries of the use of land and water resources have a responsibility to maintain or restore the biological diversity functions of those resources. Degraded areas should be rehabilitated according to the principles and objectives of ecologically sustainable development.

Actions

3.7.1 Research

Develop techniques to restore biological diversity in degraded systems and to assess the success of the rehabilitation. This will require increased research into the collection and propagation of native species for use in land reclamation and rehabilitation programs.

3.7.2 Cooperative programs

Initiate a cooperative program between the Commonwealth, State and Territory and local governments in consultation with industry and community groups to rehabilitate degraded systems of national concern. The program should cover

(a) the development of improved procedures and standards for rehabilitation activities;

(b) investigation and trial of new mechanisms for increasing the role of the private sector in using rehabilitation to protect biological diversity (for example, in the establishment of native vegetation corridors);

(c) increased funding for necessary restoration programs;

(d) assistance to private landholders in the form of technical support and the provision of appropriate seed stocks;

(e) development of a monitoring and reporting program to determine the effectiveness of rehabilitation.

3.8 Environmental assessment

Objective 3.8

Ensure that the potential impacts of any projects, programs and policies on biological diversity are assessed and reflected in planning processes, with a view to minimising or avoiding such impacts.

Assessment procedures

Biological diversity conservation can often be affected by planning and development decisions and actions. These effects sometimes occur as a result of inadequate information or a lack of sensitive application of policies on the part of the public and private sectors. Although environmental impact assessment procedures have been developed in the Commonwealth and States and Territories, the application and scope of these procedures vary considerably between jurisdictions. To redress this problem, the Australian and New Zealand Environment and Conservation Council has overseen the development of common principles for environmental impact assessment in Australia and is currently developing guidelines and criteria for determining the need for and level of such assessment. The InterGovernmental Agreement on the Environment provides a mechanism for the Commonwealth and States and Territories to accredit their respective assessment processes and emphasises the need to avoid duplication.

Assessment of individual projects cannot always anticipate cumulative environmental impacts. Assessment of broader policies and programs that are likely to significantly affect biological diversity, together with bioregional environmental planning with appropriate development controls, can help overcome this problem.

Actions

3.8.1 Strengthen assessment

Ensure that all governments make environmental, including biological diversity, impact assessment procedures an integral part of policy formulation, planning and development activities. Such procedures should take account of significant adverse impacts on biological diversity, especially when assessing the likely impact of proposals in areas considered important for biological diversity. Where undertaken, the environmental impact assessment should, if appropriate, provide for continuing monitoring and the adoption of mitigating measures.

Ensure that environmental impact assessment procedures allow for informed and comprehensive public participation.

3.8.2 Cumulative impacts

Integrate into regional planning processes and environmental impact assessment procedures consideration of the cumulative impacts on biological diversity of development proposals.

4 Improving our knowledge

Full and effective implementation of many of the actions identified in this Strategy requires considerable improvement in our knowledge and understanding of Australia's biological diversity in terrestrial, marine and other aquatic environments. Accordingly, there is a need for a significant increase in research into biological diversity at the genetic, species and ecosystems levels.

Many of the actions in this Strategy must be implemented now: we cannot wait until the full sum of knowledge becomes available from research programs. It is therefore essential that those actions be supported by research projects, so that the actions can be improved and assessed as new scientific knowledge is obtained.

Major research initiatives are required in the areas of compilation and assessment of existing knowledge, conservation biology, rapid assessment and inventory, long-term monitoring, and ethnobiology.

It is also essential that there be adequate mechanisms to ensure that the results of research are rapidly disseminated and rapidly incorporated into current and future actions.

4.1 Knowledge and understanding

Objective 4.1

Provide the knowledge and understanding of Australia's biological diversity essential for its effective conservation and management.

Actions

4.1.1 Compilation of current knowledge

Undertake to coordinate, collate and synthesise available data and information from collections, survey results and geographic information systems to provide a basis for assessing research needs and priorities. This will include knowledge held by industry (for example, from environmental impact assessments and rehabilitation activities), community groups, local government and experts. Particular attention should be given to

(a) identifying components of biological diversity that are inadequately understood;

(b) identifying those components of biological diversity that are important for its conservation and sustainable use (see Objective 1.1);

(c) accelerating the activities of agencies and institutions involved in the development and networking of complementary environmental geographic information systems and databases and ensuring that there are adequate resources for the storage and maintenance of collections;

(d) developing and implementing, by the Australian and New Zealand Environment and Conservation Council, mechanisms for the improvement of research and coordination and dissemination of information about biological diversity.

This is consistent with the governments' undertakings in the National Strategy for Ecologically Sustainable Development to cooperate in developing analysis and information technologies and systems for optimising the use of natural resource databases and to use these in pursuit of ecologically sustainable development.

4.1.2 Rapid assessment

Establish a joint Commonwealth and State and Territory program to carry out rapid assessment of Australia's biological diversity. This will include

(a) strengthening the network of biological diversity laboratories and agencies to assist in the rapid processing of collected material;

(b) research into and development of new methods of processing large numbers of unidentified organisms;

(c) research into environmental and biological models and groups of organisms that may be used to assess biological diversity.

Rapid biological diversity assessment

Rapid biological diversity assessment uses a range of methods that facilitate rapid field survey work and classification. The fieldwork normally involves a multidisciplinary team, including experienced field scientists and people with local knowledge, in surveying component groups representative of biological diversity. Techniques and procedures are employed to quantify the variety of organisms collected by classifying them into recognisable taxonomic units. These techniques overcome the large time requirements of formal classification.

By establishing the relationship between these recognisable taxonomic units and the formal species they represent, rapid estimates of biological diversity will become available.

4.1.3 Management applications

Assist resource use industries to integrate the protection of biological diversity and other ecologically sustainable use objectives through

(a) a nationally funded and coordinated program to advance the development of information and modelling tools;

(b) research into performance indicators against which to measure the adequacy of policy and management arrangements in achieving biological diversity conservation objectives for ecologically sustainable management;

(c) improving our understanding and management, as outlined for Objectives 2.2, 2.3, 2.4, 2.5 and 2.6.

4.1.4 Conservation biology

Support research in conservation biology, including ecology and physiology, aimed at maintaining biological diversity and identifying patterns of genetic variation within and between species. This will include multidisciplinary research covering

(a) criteria for the identification and configuration of protected areas for the conservation of biological diversity;

(b) the interaction of protected areas with their surrrounds;

(c) rehabilitation techniques (see Action 3.7.1);

(d) population biology;

(e) the establishment of national standards for use of genetic markers and probes in the assessment of variability and the identification of taxonomic units;

(f) the consequences of changed landscape patterns on populations, ecological processes and functions;

(g) palaeobiology and biological responses to environmental change.

4.1.5 Inventory

Accelerate research into the taxonomy, geographic distribution and evolutionary relationships of Australian terrestrial, marine and other aquatic plants, animals and microorganisms, priority being given to the least known groups, including non-vascular plants, invertebrates and microorganisms. Where appropriate, methodologies should be standardised.

This can best be achieved by strengthening the role of the Australian Biological Resources Study, including an extension of the Study program to cover microorganisms. Resources available to Commonwealth and State and Territory institutions involved in taxonomic work and in the study of ecosystem and genetic diversity should also be maintained or enhanced.

The completion of a comprehensive inventory of Australia's ecosystems should be treated as a matter of urgency in research funding.

4.1.6 Training

Facilitate and support the development of collaborative taxonomic training programs by existing institutions such as museums, herbariums and universities for

(a) specialist taxonomists, particularly to work on inadequately studied groups;

(b) biological diversity technicians;

(c) ecologists;

(d) members of the public and community organisations assisting in biological diversity projects.

4.1.7 Monitoring

Establish a national coordinated program of long-term ecological monitoring to document patterns of change or lack of change in order to establish a baseline for understanding the impact of such change or lack of it on natural communities, ecosystems and ecological processes, and to detect changes in biological diversity and their causes. The program will

(a) combine remote sensing with a national network of secure field-based monitoring sites in representative habitats;

(b) develop and encourage the application of national monitoring protocols involving standardised sampling designs and techniques for testing management regimes and strategies, including rehabilitation and reintroductions;

(c) use biological diversity indicator groups to reveal the impacts of environmental disturbance;

(d) establish properly constituted and supported assessment panels or monitoring committees, or both, comprising representatives of industry, non-government conservation organisations, other appropriate community groups and governments;

(e) accelerate research into new, cost-effective methods of monitoring;

(f) integrate with an ecological research program aimed at improving our understanding of long-term and event-driven ecological processes.

4.1.8 Ethnobiological knowledge of Aboriginal and Torres Strait Islander peoples

Recognise the value of the knowledge and practices of Aboriginal and Torres Strait Islander peoples and incorporate this knowledge and those practices in biological diversity research and conservation programs by

(a) encouraging the recording (with the approval and involvement of the indigenous people concerned) of indigenous peoples' knowledge and practices;

(b) assessing the potential of this knowledge and these practices for nutritional and medicinal uses, wildlife and protected area management and other purposes;

(c) applying the knowledge and practices in ways that ensure equitable sharing of the benefits arising from their use.

4.1.9 Information: access, dissemination and use

Taking intellectual property rights into account, ensure that as information about Australia's biological diversity accumulates it is published and otherwise disseminated in ways readily accessible for national and regional planning, development, management and decision making, in both the private and public sectors, including through computer networks.

Ensure that the accumulated information is used to evaluate and improve the effectiveness of current management, to meet the objectives of ecologically sustainable use of biological diversity, including its protection.

5 Involving the community

The involvement of all Australians is vital to the conservation of biological diversity. Initiatives already being taken at the community level can be catalysed by a variety of integrated measures that increase awareness and involvement. These need to be supported by further opportunities in formal education institutions to develop an understanding of the importance of the conservation of biological diversity.

5.1 Awareness and involvement

Objective 5.1

Increase public awareness of and involvement in the conservation of biological diversity.

Encouraging action

The media, educational institutions, government agencies, and various societies and groups have all been effective in increasing public awareness of the importance of biological diversity conservation. Nevertheless, it is necessary to ensure the continued availability of accurate and persuasive information about the benefits, costs and means of biological diversity conservation. The meaning of biological diversity and the consequences of its decline should be communicated in locally relevant terms.

Extending that awareness to the development of a sense of community involvement and action is an essential progression. Everybody has a role to play in the conservation of biological diversity, by providing expertise and assistance at a variety of levels in a range of voluntary activities. It may be managing a backyard or local park, taking part in a conservation-related work program, participating in a statutory planning process, contributing to research, survey and monitoring programs, or otherwise contributing at a local, regional, national or international level.

Actions

5.1.1 Public information and education

Increase the availability and accessibility of information about biological diversity, the need and methods for its conservation, and the current and potential benefits deriving from it by

(a) incorporating 'state of biological diversity' reports in the 'state of the environment' reports prepared by the States and Territories and the Commonwealth;

(b) developing and promoting public information and education programs, in consultation with community groups (especially those involved in the management of biological diversity), by preparing

- accessible personal action guides aimed at specific rural and urban environments and explaining the ways in which individuals and groups can help to conserve biological diversity,

- information to allow consumers to make informed choices about products, services and activities that may affect the conservation and management of biological diversity, including information on taxation and other institutional incentives that encourage action conducive to the conservation of biological diversity,

- tailored information on biological diversity for government agencies, land managers, landowners and specific industries that rely on some component of biological diversity;

(c) encouraging the media networks to continue producing and broadcasting programs related to biological diversity and its conservation;

(d) developing and encouraging the use of an accessible clearing-house mechanism to disseminate relevant information prepared by government, research and educational institutions, industry, non-government organisations and individuals.

5.1.2 Public involvement and participation
Facilitate greater public involvement and participation in measures to conserve biological diversity by

(a) ensuring that public participation is a meaningful component in planning and environmental impact assessment procedures that involve biological diversity conservation;

(b) increasing community involvement in research and management activities relating to protected areas and vegetation remnants and in biological diversity programs, particularly those involving survey, revegetation and rehabilitation.

5.2 Formal education

Objective 5.2
Expand biological diversity studies in educational curricula.

Education programs

Achieving greater understanding of biological diversity and commitment to conservation action is central to the success of any conservation strategy.

The education system has an essential role to play in this regard. There are at present a number of effective environmental education programs operating in Australia, particularly at the primary school level. Nevertheless, greater emphasis on the conservation of biological diversity is required; programs should be offered throughout the education system, from pre-schools to TAFE colleges and tertiary institutions.

Teaching and learning should focus on the development of skills that will enhance understanding and acceptance of the need for biological diversity conservation as well as commitment to achieving it. Information should be presented not simply as science, but in a social, economic and political context, so that students are better able to understand the complex circumstances within which decisions about biological diversity conservation must be made.

Actions

5.2.1 Curriculum assessment
Review curricula in the light of current knowledge of biological diversity and modify the curricula where necessary to incorporate new material, emphasising inter-relationships between disciplines and their relevance to biological diversity.

5.2.2 Professional development

Support and encourage further professional development activities to equip teachers with the skills and understanding needed to include the scientific, economic and social aspects of biological diversity conservation in their education programs.

5.2.3 Continuing education

In conjunction with tertiary institutions, industry organisations and relevant professional groups, develop course components and continuing education programs designed to increase environmental awareness and involvement.

Encourage 'hands on' educational programs that involve the wider community as part of the educational process in biological diversity conservation.

6 Australia's international role

The conservation of biological diversity is a global issue and is best confronted through multilateral cooperation. Australia can do much to conserve its own biological diversity and contribute to the conservation and ecologically sustainable use of biological diversity on a global scale. Australia has a good record for participating in the development and implementation of a large number of international agreements dealing with cooperation in the field of environmental management and protection. These include bilateral agreements with a range of countries. Australia will continue to encourage its citizens and commercial entities to give due consideration to the impact of their activities on biological diversity beyond Australian shores.

Aspects of the conservation of biological diversity are both affected by and have implications for international trading arrangements. As a significant trading nation, Australia is seeking to encourage trade liberalisation and in doing so ensure that biological diversity conservation and other ecologically sustainable development objectives are accommodated. Australia is also pursuing international agreement on methods for incorporating full environmental costs associated with the production and use of natural resources. Incorporation of these costs - for example, through application of the polluter-pays principle - may be reinforced through international agreements. This can contribute to the global achievement of ecologically sustainable development.

6.1 International agreements

Objective 6.1

Support and encourage the development of and Australia's participation in international agreements for the conservation of biological diversity.

Actions

6.1.1 Existing agreements

Review the status of Australia's participation in all bilateral and international agreements relevant to the conservation of biological diversity to which Australia is a signatory and ensure that all necessary steps are taken to fully implement these agreements.

6.1.2 New agreements and arrangements

Actively participate in and promote the development of new agreements and arrangements that are relevant to the conservation and ecologically sustainable use of biological diversity and that are in Australia's interests as a member of the global community.

Continue to pursue the establishment of formal international mechanisms to improve the conservation of biological diversity through controls over the taking of species on the high seas, compliance with the United Nations General Assembly resolution banning the use of large-scale drift netting on the high seas, the regional protection of migratory species, the reduction of marine pollution from land-based sources, and the improvement of international shipping standards to minimise impacts on biological diversity.

The Convention on Biological Diversity

Australia ratified the Convention on Biological Diversity on 18 June 1993, following agreement by the Council of Australian Governments.

The Convention has global coverage, takes in the full range of biological diversity, and has as its primary aims the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from the use of genetic resources. The Convention emphasises in-situ conservation measures, with ex-situ conservation complementing these, and contains measures on the identification and monitoring of important components of biological diversity, establishment and management of protected areas, sustainable management of biological resources both within and outside protected areas, rehabilitation and restoration of degraded ecosystems, recovery of threatened species, control of pest species, control of threatening processes and activities, involvement of indigenous and local communities, sustainable customary use of biological resources, and research and training.

The main implementation measure for the Convention is national strategies, plans or programs, to be developed in accordance with each country's particular conditions and capabilities.

6.2 Overseas activities

Objective 6.2

Seek to ensure that the activities of Australians outside Australia are consistent with the conservation of biological diversity.

Actions

6.2.1 Trade

Take action, through multilateral forums such as GATT (the General Agreement on Tariffs and Trade), to make international trade and environment policies mutually supportive, in recognition of the contribution that this can make to the protection of biological diversity.

6.2.2 Conduct

Australians and Australian commercial entities operating beyond the limits of Australia's national jurisdiction should take full account of the need to conserve biological diversity. Their actions should be consistent with relevant national laws, international agreements and codes of conduct. Practices that would be unacceptable in Australia should be avoided.

6.2.3 Training

Ensure that trade and aid administrators have an understanding of the need to take into account the conservation and ecologically sustainable use of biological diversity and to seek expert advice when necessary.

6.3 International cooperation

Objective 6.3

Ensure continued and effective international cooperation in the conservation of biological diversity, directly between governments or through relevant international governmental and non-government organisations.

Actions

6.3.1 Bilateral and multilateral aid

Ensure that Australia's aid program continues to be developed in such a way as to avoid any significant adverse impacts on the biological diversity of recipient countries and that, where possible, it improves biological diversity conservation. This will include

(a) continuing to ensure that projects relating to biological diversity conservation are included in the Environment Assistance Program and other aid programs;

(b) continuing to assist developing countries to identify environmental priorities and strengthen environmental expertise, legislation and institutions relevant to biological diversity conservation;

(c) ensuring that opportunities to increase the level of technology transfer relevant to biological diversity conservation are included in relevant aid programs and projects;

(d) considering impacts on biological diversity as part of routine evaluation of aid projects, including annual environmental audits, with a view to improving future aid program contributions to biological diversity conservation. Where significant negative impacts are identified, consider the need for remedial action.

6.3.2 International scientific collaboration

Enhance international collaboration in research related to biological diversity.

6.3.3 Other forms of cooperation

Maintain and strengthen Australia's participation in multilateral efforts concerned with the conservation and sustainable use of biological diversity, particularly in respect of areas beyond national jurisdiction and other matters of mutual interest, through international organisations and programs such as the United Nations Commission on Sustainable Development, the South Pacific Regional Environment Programme, the Global Environment Facility, the OECD, the World Conservation Union, the United Nations Environment Programme, and UNESCO.

7 Implementation

If this Strategy is to be effectively implemented it is essential that priorities and the time frames for their achievement be identified. It is also important to establish the arrangements necessary for this to occur. This would include national coordination and review, the development of complementary strategies and the provision of adequate funding.

7.1 Priorities and time frames

Objective 7.1

Implement the Strategy through priority actions within established time frames.

Priority actions

A broad range of human endeavours and natural phenomena affect the future of Australia's biological diversity and the maintenance of essential ecological processes and systems. This is reflected by the large number of objectives and actions in this Strategy. The objectives and their actions do not contribute equally to ensuring protection of biological diversity, nor are they equally urgent. Many of the objectives, such as those associated with ecologically sustainable development, are being pursued as part of other national strategies or initiatives. Many of the actions are being pursued and will continue to be undertaken without an urgent need for enhanced resourcing from governments. These objectives and actions will provide a guide for determining priorities for expenditure from research funds and private sources and for community action. Those additional actions deemed to be urgent and having the capacity to make major contributions to the protection and ecologically sustainable use of Australia's biological diversity will be implemented as quickly as possible.

The priority areas for action, as depicted by their specific outcomes, are listed under Action 7.1.1 along with the time frames during which substantive results are to be achieved. These results are broadly defined and many encompass more than one of the Strategy's actions. The Strategy will be reviewed at five-yearly intervals to allow for assessment of progress, evaluation of priorities and, where necessary, adjustment.

Actions

7.1.1 Priorities and time frames

By the year 2000 Australia will have

(a) completed the identification of its biogeographical regions;

(b) implemented cooperative ethnobiological programs, where Aboriginal and Torres Strait Islander peoples see them to be appropriate, to record and ensure the continuity of ethnobiological knowledge and to ensure that the use of such knowledge within Australia's jurisdiction results in social and economic benefits to Aboriginal and Torres Strait Islander peoples;

(c) completed the identification and description of major ecosystems in each biogeographic region and developed specific priorities for conservation;

(d) established mechanisms for resourcing the development and implementation of programs and plans for the continuing management of Australia's biological diversity on public and private lands, including lands managed by Aboriginal and Torres Strait Islander peoples;

(e) completed development of a nationwide system of protected areas on public land, and waters, that are representative of the major ecosystems in each biogeographical region;

(f) implemented management plans for protected areas identified by the Australian and New Zealand Environment and Conservation Council as having major conservation significance because of high biological diversity, high endemicity or threatened species;

(g) established effective mechanisms for providing information to and support for biological diversity conservation projects undertaken by the community;

(h) clearly defined elements on the conservation of biological diversity in primary, secondary and tertiary curricula, giving emphasis to inter-relationships between disciplines;

(i) implemented programs consistent with this Strategy designed to encourage local government to play a major role in nature conservation in Australia;

(j) implemented institutional arrangements and programs to ensure and monitor the ecologically sustainable development of Australian industries based on the extraction or use of natural resources;

(k) implemented Conservation of Australian Species and Communities Threatened with Extinction - a National Strategy;

(l) arrested and reversed the decline of remnant native vegetation;

(m) avoided or limited any further broad-scale clearance of native vegetation, consistent with ecologically sustainable management and bioregional planning, to those instances in which regional biological diversity objectives are not compromised;

(n) completed species-specific management plans for major introduced pests and implemented effective controls for at least one introduced species of mammal and at least three major introduced plant pests;

(o) implemented a nationally coordinated program for long-term monitoring of the state of Australia's biological diversity and the impact of threatening processes;

(p) established legislative and administrative mechanisms for control of access to Australia's genetic resources;

(q) conducted an analysis of existing scientific knowledge about Australia's biological diversity and identified knowledge gaps and research priorities;

(r) fully implemented provisions of those international agreements relating to the conservation and sustainable use of biological diversity to which Australia is a signatory.

By the year 2005 Australia will have

(a) established effective cooperative mechanisms for bioregional planning and management;

(b) implemented management plans for the protected area network;

(c) established a system of voluntary or cooperative reserves, or both, and other management schemes on private lands to complement the protection provided by the public estate in protected areas;

(d) established networks of community groups and volunteers that play major roles in managing and monitoring biological diversity at the district level;

(e) local governments that have assumed a major role in the conservation of Australia's biological diversity;

(f) demonstrated maintenance of regional and district floras and faunas;

(g) successfully rehabilitated at least 10 endangered or vulnerable species;

(h) successfully controlled three introduced mammals, 10 introduced plants and one pathogen that pose major threats to biological diversity;

(i) sufficient information from long-term monitoring and other research to identify and understand the nature and extent of threats to Australia's biological diversity to develop actions for dealing with those threats.

7.2 Coordination and review

Objective 7.2

Ensure that appropriate arrangements are established to implement the National Strategy for the Conservation of Australia's Biological Diversity and monitor its effectiveness.

Actions

7.2.1 National coordination and review

The Australian and New Zealand Environment and Conservation Council, in consultation with other relevant ministerial councils, will

(a) assume overall responsibility for coordinating the implementation of the Strategy at the national level;

(b) monitor outcomes of the Strategy and undertake five-yearly reviews of its implementation;

(c) provide to governments regular publicly available reports on the state of Australia's biological diversity. These 'state of biological diversity' reports should form part of the 'state of the environment' reports that are to be prepared by the States and Territories and the Commonwealth;

(d) report regularly to Heads of Government on progress in implementing the Strategy.

7.2.2 Biological Diversity Advisory Council

Provide for the establishment of a Biological Diversity Advisory Council, comprising persons with relevant expertise, representatives of industry, non-government organisations and the scientific community, and private individuals, to advise governments on biological diversity conservation issues, including the ecologically sustainable use of biological resources. The Council will report regularly through the Australian and New Zealand Environment and Conservation Council to Heads of Government on further development and implementation of the Strategy. The Biological Diversity Advisory Council's views on the Strategy and its implementation are to be publicly available. Administrative support to the Council will be provided by the Commonwealth Government.

7.2.3 Decision making

Integrate the conservation of biological diversity into the decision making of all levels of government, in accordance with the principles of the National Strategy for Ecologically Sustainable Development.

7.2.4 Lead agencies

Commonwealth, State and Territory governments will each identify a lead agency to oversee implementation of the Strategy within their jurisdiction. Full implementation will, however, require the involvement of a wide range of government, including local government, and private interests and will be facilitated through consultation and cooperation.

7.3 Complementary strategies and legislation

Objective 7.3

Ensure that the National Strategy is complemented by State and Territory and bioregional strategies, supported by effective legislation where necessary.

Actions

7.3.1 Complementary strategies and legislation

State and Territory governments will develop complementary biological diversity strategies where these do not already exist and will review their existing legislative framework for implementing biological diversity conservation programs and any legislation that results directly or indirectly in loss of biological diversity.

7.3.2 Local government planning and environmental management

Local governments will be encouraged to cooperate with each other to develop bioregional biological diversity management plans, with assistance from State and Territory governments. Biological diversity conservation should be recognised as an important objective of local government; training and access to information on biological diversity for local government officials should be increased.

7.4 Funding implementation

Objective 7.4

Ensure that the costs of biological diversity protection are equitably shared, such that they reflect contributions to degradation and benefits from protection or use.

Actions

7.4.1 Government appropriations

Governments will review funding and administration of existing programs that relate to the conservation of biological diversity to identify the potential for reallocation of resources for improved efficiencies and the need for increased funds to ensure implementation of the Strategy.

Appendix 1 Australia's biological diversity

As a large island continent with a coastline of some 37 000 kilometres, an area of 771 million hectares, and an Australian Fishing Zone of 894 million hectares, Australia contains a diverse range of biogeographic regions. The arid interior occupies approximately 70 per cent of the continent, with tropical monsoon areas to the north and a Mediterranean and temperate climate to the south. Several mountain regions in the south-east are snow clad in winter and the external territories extend to subantarctic and antarctic regions. Australia's marine habitats are just as diverse, ranging from extensive coral reefs to seagrass plains, giant kelp forests and the sand-bottomed habitats that cover much of the continental shelf.

Australia's biological diversity has great scientific value, and many elements of it are unique. This results, in part, from the tectonic history of the continent and its relative isolation for more than 20 million years following the break-up of the ancient Gondwanan landmass, a period that saw extensive evolutionary divergence of its plants, animals and microorganisms. Australian marsupials have evolved into a great diversity of species filling an extraordinary range of niches, that in other countries are largely occupied by placental mammals.

Of particular significance is the high percentage of Australian species that occur nowhere else (that is, endemic species). Six families of mammals, four of birds, and 14 of flowering plants are endemic - far more families than in any other country. Further, at the species level about 82 per cent of our mammals,[7] about 45 per cent of our land birds,[8] about 89 per cent of our reptiles, and about 93 per cent of our frogs occur nowhere else.[9] These high levels of endemism are not restricted to terrestrial Australia. Of the estimated 600 inshore fish species in the southern temperate zone, about 85 per cent are found only in Australia.[10] Australia contains eight endemic families of fish, and more than half of the shark and ray species are confined to Australian waters. The high levels of endemism in the Australian biota are primarily why Australia is considered one of the world's 12 'megadiverse' countries.[11]

Australia's biota contains a number of groups of very high species richness. Victoria alone has around 270 species of orchid: on the other hand the entire North American continent has only 165 and Europe 116 species.[12] Australian deserts have a greater number of species of lizard per locality than do either the Kalahari or American deserts.[13] With an estimated 4000 species, Australian ants are also highly diverse compared with elsewhere:[14] Britain, for example, has only 41 species of native ants, a number well exceeded by 452-hectare Black Mountain Nature Reserve in Canberra alone, which has more than 100 species.[15] There are probably many other groups of invertebrates and microorganisms that exhibit similar species richness but have not yet been adequately studied.

Eucalypts and acacias

The genus *Eucalyptus* consists of about 900 taxa, with all but thirteen species being endemic; most of the approximately 1070 Australian taxa of *Acacia* occur nowhere else in the world. Indeed, the omnipresence of eucalypts and acacias characterises Australia's flora. They have diversified into almost every habitat on the continent. Eucalypts range in form from giant forest trees to mallee shrubs and can be found from snowline to shoreline, in deserts and swamps and on floodplains. The river red gums have an extraordinarily wide distribution, ranging from south-east Australia through the Red Centre to the north-west. They are a good example of a species complex comprising populations that differ markedly in their genetic makeup.

Components of Australia's biota are of major evolutionary significance. Examples are the Queensland lungfish, which has remained relatively unchanged for over 100 million years, and some species of the relict Gondwanan rainforests of north-east Queensland that have important ancestral links in the history of plant evolution. Nowhere else in the world is there such a concentration of primitive flowering plants. Of the 19 known families of primitive flowering plants, 13 are found in northern Australia. Two of these are found nowhere else.[16] Another illustration is Australia's southern marine platform, one of the largest in the world, which has remained stable for at least the last 40 million years and thus provides a unique glimpse of the direct ancestral lineages of many species found there today. Examples of ancient marine animals, or 'living fossils', that occur off the southern marine platform are members of the family Trigoniidae, a bivalve mollusc group widespread 200 million years ago and now reduced to a single genus, *Neotrigonia*, found only in Australian waters.

Australia's external territories also contain unusual and significant biota. The millions of endemic red crabs on Christmas Island, for example, dominate the forest floor and influence the development of the unique structural characteristics and species composition of the Island's vegetation.

For a number of once-widespread marine species now rare or threatened in our region, Australian habitats offer the best chance of survival. Among these species are the dugong and the loggerhead turtle.

At a global level, current rates of decline and loss of biological diversity are the highest for at least 60 million years. The declines and losses are continuing. Estimates of probable global losses of species have been as high as 25 per cent for the next 30 years.[17]

Although the state of Australia's biological diversity may not necessarily reflect global trends, it too has suffered severe declines and extinctions, especially in the past 200 years. There have been fluctuations in rates of decline during this period, but the rates have been greatest in the past 50 years. Despite increased concern and efforts to maintain biological diversity in the last two decades, declines continue and the threat of further extinctions persists.

Major vegetation changes

Human activities have been changing Australian ecosystems for at least 50 000 years, but during the past 200 years the pace and extent of change have increased significantly. As a consequence of the processes of economic and social development that were encouraged by all governments following European settlement, about 90 per cent of the native vegetation in the eastern temperate zone has been removed for human habitation, industry and transport or replaced by introduced pastures and crops.[18] About 50 per cent of our rainforests have been cleared, and the proportion of Australia covered by forest or woodland has been reduced by more than one-third.[19] Extensive clearing and vegetation modification continue to result in severe reduction and fragmentation of the mallee, mulga and brigalow woodlands. Further, with more than 80 per cent of Australia's 18 million people living in urban centres, most of them within 50 kilometres of the coast, land use and population pressures have had substantial impacts on the biological diversity of coastal ecosystems, including mangroves, estuaries and tidal marshes. Freshwater habitats have also suffered in recent decades, as a result of increasing salinity and nutrient levels, other pollutants, land fill or dredging operations, and the impacts of introduced species.

The map opposite illustrates the major vegetation changes in Australia since 1788.

Dramatic habitat modification and fragmentation have severely affected Australia's native species, and the effect has been compounded by introduced species and other impacts. Twenty mammal, 20 bird and 76 plant species[20] are known to have become extinct since European settlement.[21] Seventy-seven species of vertebrate animals and 236 species of vascular plants are considered endangered (that is, likely to become extinct if present threats continue), and another 66 species of vertebrates and 652 species of vascular plants are vulnerable (likely to become endangered in the near future).[22] Because the trends are similar in all of the better known groups of organisms, it is probable that losses will also have occurred in lesser known groups such as invertebrates, non-vascular plants and microorganisms.

On a regional basis, species declines have been much higher in some areas than in others. The number of endangered plants is highest in the agricultural areas of the south-east and south-west, in the eastern coastal region and in the rainforests of north Queensland. In the deserts, 33 per cent of the mammal species have become extinct[23] and 90 per cent of all mammal species weighing between 35 and 5550 grams (that is, from mouse size to small wallaby size) are either extinct or endangered.[24]

Extinctions and declines in the distribution and abundance of species result in a loss of genetic diversity. Without genetic variability a species is less able to evolve or adapt to changing environments and is probably more vulnerable to new conditions such as climate change or new diseases. Although they may not be classified as threatened nationally, many species are no longer found throughout their former range and may now occur only in reduced numbers. Large marine species such as sharks, elephant seals, southern blue-fin tuna and whales have dramatically declined in numbers and distribution in historical or recent times, as have some ground-dwelling and ground-foraging birds, a number of frog populations, native fish populations, and many invertebrate species.

On the other hand, large-scale habitat disturbance has in some cases led to increases in both the numbers and range of native species. Among the marsupials, populations of large kangaroos (the red kangaroo and the eastern grey kangaroo) have increased substantially in some areas in response to an increase in watering places. Several species of birds, such as the galah, the little corella, and the sulphur-crested cockatoo, have increased in abundance in recent times, and others, such as the striped honeyeater and the crested pigeon, have extended their distributions.

Despite the growth in environmental awareness during the past few decades, much of Australia's biological diversity faces continued threats, both from the effects of past actions and from current activities. Habitat destruction, modification and fragmentation pose the greatest threat to biological diversity. Over-exploitation of species of plants and animals, the impact of introduced species, and the pollution of soil, water and the atmosphere are also serious threats.

A number of forest, fishery, and other wildlife resources have been altered or reduced through exploitation. Extensive grazing of native vegetation communities has reduced the biological diversity of rangelands. As noted by the Ecologically Sustainable Development Working Group on Fisheries, Australia appears to be at or beyond the maximum production achievable in most of its established fisheries and many stocks have already been over-exploited. Harvesting practices can alter entire habitats, especially through environmentally destructive fishing techniques such as trawling or dredging. The number of bottom-dwelling fauna such as sponges and gorgonians has been markedly reduced in some areas where trawl fishing has taken place.

The introduction of alien species may appear to increase species diversity, but in general these species have serious negative effects on native species, including loss of genetic variation, reduction in distribution and abundance, and extinction.

Many introduced or translocated species, which are without predators or disease to control them, have rapidly increased in number and range and have had a devastating impact on other species or native vegetation. Through selection of the seedlings of many trees and shrubs, rabbits inhibit the regeneration of populations of many species. Many native grasses and herbs, chenopods and *Acacia*-dominated calcareous landscapes will probably disappear if rabbits are not controlled in the first instance. Recent studies have implicated foxes in the disappearance of remnant populations of endangered mammals, and they may be affecting ground-dwelling birds such as the mallee fowl. Other introduced species have dramatically reduced the habitat range of native species. For example, habitat competition from goats has resulted in yellow-footed rock wallabies becoming rare in their former range.

Marine organisms introduced either deliberately or by accident may cause significant declines in indigenous species, often species of commercial significance. For instance, the Sydney rock oyster is being displaced by the introduced Pacific oyster. Furthermore, algal and other species introduced in ballast water discharged from ships may adversely affect commercial shellfish and other species.

Twenty-one species of exotic fish are known to have established breeding populations in Australia.[25] Lowland rivers have been invaded by carp, goldfish, redfin and trout. Exotic or translocated fish species may cause the decline or disappearance of native species or distinct genetic stocks through competition or predation, hybridisation or the disturbance of ecosystems. The import of exotic fish has also resulted in the introduction of fish diseases previously unknown in this country.

Introduced species now constitute up to 15 per cent of the Australian flora; the proportion is as high as 31 per cent in Tasmania.[26] Plant invasions have predictable consequences. Through competition for limited resources and consequential effects, introduced species reduce native plant and animal diversity and modify the landscape. For example, bitou bush is spreading vigorously through a wide range of coastal communities, displacing native species, placing at risk known endangered and endemic flora, and reducing the range of some widespread communities and species.

Introduced flora

Jurisdiction	**% of total numbers**
Australia	10 - 15
Tasmania	31
Australian Capital Territory	28
South Australia	25
Victoria	24
New South Wales	16
Queensland	13
Western Australia	11
Northern Territory	4-5
Norfolk Island	60
Lord Howe Island	48

Source : Humphries *et.al*. [27]

Pathogens introduced to a region to which they are not indigenous also have adverse effects on biological diversity. Perhaps the best example of this is *Phytophthora*: up to eight alien species are documented as occurring in temperate forest and shrubland areas. The effect of *Phytophthora* species in the south of Western Australia has been to reduce the biomass of native flora by up to 90 per cent in some areas.[28]

The release of pollutants into the environment is both a potential and an actual threat to biological diversity, with severe impacts such as the degradation of freshwater ecosystems or seagrass communities. There are also long-term potential impacts on biological diversity arising from any climate change caused by increases in atmospheric concentrations of greenhouse gases.

The use of chemicals in urban areas and by industry and agriculture has had immense benefits but at times has caused serious pollution. Improved technology has eased but not eliminated the problem and the run-off from industrial plants, urban areas and farms still causes loss of biological diversity and disruption of ecological processes. Aquatic environments are particularly vulnerable to the discharge of nutrients such as phosphates and nitrates in the form of urban, agricultural and industrial effluents; these nutrients contribute to eutrophication and algal blooms, which release toxins that poison organisms such as fish.

Although most of these threats are being dealt with in various ways, dealing with them alone is not sufficient. Biological diversity loss cannot be effectively slowed unless its underlying causes are directly confronted. These causes are extremely complex; they include the size and distribution of the human population, the level of resource consumption, market factors and policies that provide incentives for biological diversity depletion, under-valuation of environmental resources, inappropriate institutions and laws, ignorance about the importance and role of biological diversity, and under-investment in biological diversity conservation.

Glossary

Alien species	A species occurring in an area outside its historically known natural range as a result of intentional or accidental dispersal by human activities (including exotic organisms, genetically modified organisms and translocated species).
Biological diversity	The variety of life forms: the different plants, animals and microorganisms, the genes they contain, and the ecosystems they form. It is usually considered at three levels: genetic diversity, species diversity and ecosystem diversity.
Biological diversity technicians	Trained in the elements of biological science and systematics, biological diversity technicians will assist professional scientists in surveys, sort survey material, process it by means of new rapid biological diversity assessment techniques, and prepare it for analysis by ecologists and description by taxonomists.
Biomonitor	A species that is sensitive to, and shows measurable responses to, changes in the environment, such as changes in pollution levels.
Bioregion	A territory defined by a combination of biological, social and geographic criteria rather than by geopolitical considerations; generally, a system of related, interconnected ecosystems.
Biota	All of the organisms at a particular locality.
Close management measures	Techniques used to assist the reintroduction and establishment of viable populations of a species into its natural habitat; for example, artificial nesting boxes.
Conservation	The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment.
Ecologically sustainable use	The use of a species or ecosystem within the capacity of the species, ecosystem and bioregion for renewal or regeneration.
Ecosystem	A dynamic complex of plant, animal, fungal, and microorganism communities and the associated non-living environment interacting as an ecological unit.
Endemic	Restricted to a specified region or locality.
Exotic species	see Alien species.
Ex-situ conservation	Conservation of species outside their natural habitat; for example, in zoos, botanic gardens and seed banks.
Feral species	A domesticated species that has become wild.
Gene	The functional unit of heredity; that part of the DNA molecule that encodes a single enzyme or structural protein unit.

Genetically engineered organisms	Organisms whose genetic make up has been altered by the insertion or deletion of small fragments of DNA in order to create or enhance desirable characteristics from the same or another species.
Genetic material	All or part of the DNA of a genome or all or part of an organism resulting from expression of the genome.
Genetic products	Identifiable chemical compounds from extracts, distillates, secretions and exudates of biological material that result from the expression of a gene, or set of genes governing a metabolic pathway, within an organism. Using this definition, wood is a genetic material and any chemicals extracted from wood or trees (for example, a pharmaceutical chemical from bark, such as taxol, or rubber) are genetic products.
Genome	The total genetic complement of the cell(s) of organisms - in eukaryotic cells, all the genes contained in a single set of chromosomes, and extra-nuclear DNA; in prokaryotic cells, circular DNA molecule(s) and any plasmids; in viruses, the RNA or DNA combined with the viral protein coat.
Germplasm	The genetic material that carries the inherited characteristics of an organism.
Gondwana	The southern supercontinent that started to break up about 150 million years ago, consisting of what are now South America, Africa, Antarctica, Arabia, Australia, India, Madagascar and New Zealand.
Gorgonians	Horny corals; for example, sea fans.
Habitat	The place or type of site in which an organism naturally occurs.
Indicator species	A species whose presence or absence is indicative of a particular habitat, community or set of environmental conditions.
In-situ conservation	Conserving species within their natural habitat.
Introduced species	see Alien species.
Management for biological diversity conservation	Taking action aimed at the maintenance of biological diversity and the environment, including protection, intervention and non-intervention.
Minimum viable population	The minimum number of individuals of a species in a given locality that could be expected to survive in the long term.
Native vegetation	Any local indigenous plant community containing throughout its growth the complement of native species and habitats normally associated with that vegetation type or having the potential to develop these characteristics. It includes vegetation with these characteristics that has been regenerated with human assistance following disturbance. It excludes plantations and vegetation that has been established for commercial purposes.
Protected area	A protected area is defined in Article 2 of the International Convention on Biological Diversity as a 'geographically defined area which is designated or regulated and managed to achieve specific conservation objectives'.
Protected area system	

characteristics With regard to the conservation of biological diversity within Australia's reserve system, comprehensiveness, adequacy and representativeness are defined thus

comprehensiveness - the degree to which the full range of ecological communities and their biological diversity are incorporated within reserves;

adequacy - the ability of the reserve to maintain the ecological viability and integrity of populations, species and communities. Note that the interactions between reserves and surrounding areas should be taken into account in determining the reserve's ability to meet ecological viability and integrity criteria. Complementary management of adjacent areas can play a significant role. In some instances, however, the ecological viability of the protected area itself will be paramount;

representativeness - the extent to which areas selected for inclusion in the national reserve system are capable of reflecting the known biological diversity and ecological patterns and processes of the ecological community or ecosystem concerned.

Protected areas management categories The World Conservation Union is currently developing a protected area classification system. The Union's work, along with that of other relevant organisations, will be considered in the development of a classification system under the National Strategy for Ecologically Sustainable Development and the National Reserve System commitment.

Species A group of organisms capable of interbreeding freely with each other but not with members of other species.

Taxon (pl. taxa) The named classification unit to which individuals or sets of species are assigned, such as species, genus and order.

Threatened A species or community that is vulnerable, endangered or presumed extinct.

Translocated species Native species introduced into suitable habitats within their own country, having been previously excluded from these habitats by natural barriers.

Wilderness Land that, together with its plant and animal communities, is in a state that has not been substantially modified by and is remote from the influences of European settlement or is capable of being restored to such a state, and is of sufficient size to make its maintenance in such a state feasible.

Abbreviations

ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
AGPS	Australian Government Publishing Service
ANPWS	Australian National Parks and Wildlife Service (now the Australian Nature Conservation Agency)
ANZECC	Australian and New Zealand Environment and Conservation Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEST	Commonwealth Department of the Environment, Sport and Territories
GATT	General Agreement on Tariffs and Trade
IUCN	International Union for Conservation of Nature and Natural Resources (now the World Conservation Union)
OECD	Organisation for Economic Cooperation and Development
TAFE	Technical and Further Education
UNESCO	United Nations Educational, Scientific and Cultural Organisation

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