# Australia's Biodiversity Conservation Strategy 2010–2020

## Consultation draft

**Vision:** Australia's biodiversity is healthy, resilient to climate change and valued for its essential contribution to our existence

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## Consultation draft

prepared by the
National Biodiversity Strategy
Review Task Group

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Multiple land use, Menglers Hill near Tanunda, Barossa Valley, South Australia (Photo: J Baker).
Thomas Amagula, traditional owner from Groote Eylandt, holding fruit (Photo: B Rose).
Racoon Butterfly fish (Chaetodon lunula) Cocos (Keeling) Islands (Photo: R Thorn and DEWHA).
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# Executive summary

*Australia's Biodiversity Conservation Strategy* is a new approach to addressing biodiversity conservation in a rapidly changing world. The strategy is a call to action. It sets a national direction for biodiversity conservation over the next decade and it asks all Australians to contribute.

Biodiversity, or biological diversity, is the variety of all life forms on earth: it is the different plants, animals and micro-organisms, their genes, and the terrestrial, marine and freshwater ecosystems of which they are a part. Biodiversity is essential for our existence and is intrinsically valuable in its own right Biodiversity contributes to the healthy environments, clean air and water that support human life.

The strategy reflects the intention of all Australian governments to ensure our biodiversity is healthy, resilient to climate change and valued for its essential contribution to our existence. All governments recognise the urgency of this task. Despite efforts to manage threats, put in place conservation programs and integrate biodiversity considerations into other natural resource management processes, biodiversity in Australia is still in decline.

Planning a long-term vision to reverse this decline must begin with immediate action. The strategy outlines the activities that must begin straight away and those that are needed to effect longer-term change with a minimum 10-year outlook.

All actions sit within a list of six 'priorities for change'. These priorities—building ecosystem resilience, mainstreaming biodiversity, knowledge for all, getting results, involving Indigenous peoples and measuring success—reflect the essential changes that we must make urgently to achieve the strategy's vision.

The main threats to our biodiversity are:

- climate change (resulting in conditions such as prolonged drought)
- invasive species
- loss, fragmentation and degradation of habitat
- unsustainable use of natural resources
- changes to the aquatic environment and water flows
- inappropriate fire regimes.

These threats and the resulting damage they cause to the environment need to be tackled head on by the priorities for change. The strategy makes it clear that all Australians—the community, governments, Indigenous peoples and businesses—must play an active role in protecting biodiversity.

Each priority for change is linked to objectives, actions and results which will guide the development of biodiversity conservation approaches for national, state, territory and local governments, and for businesses, non-government organisations and community groups. The listed results are the expected 'on-ground' consequences of successful implementation of the actions.

The longer-term impacts of the strategy on conserving Australia's biodiversity will ultimately determine its effectiveness. Implementation of the strategy will include the development of a long-term monitoring and evaluation framework and the incorporation of relevant monitoring actions from the strategy into existing well-established systems.

The Natural Resource Management Ministerial Council will monitor the strategy's implementation on a yearly basis and formally review it every five years. Information on trends and condition of Australia's biodiversity will be used to track the performance of the strategy and inform these yearly and five-yearly reviews. The strategy can then be adjusted on the basis of this information.

Since the original *National Strategy for the Conservation of Australia's Biological Diversity* (DEST 1996) was adopted, a number of specific national strategies have been developed. These include the *National Framework for the Management and Monitoring of Australia's Vegetation* (NRMMC 1999), the *Australian Weeds Strategy* (NRMMC 2007a) and the *Australian Pest Animal Strategy* (NRMMC 2007b). They will be implemented under the broad framework of this strategy.

# The Strategy

## Call to action
## Priorities for change

# Vision and principles for Australia's Biodiversity Conservation Strategy

## The strategy's vision

Australia's biodiversity is healthy, resilient to climate change and valued for its essential contribution to our existence.

### Principles underlying the development and implementation of the strategy

Biodiversity is essential for our existence.

Biodiversity is of value in its own right.

Biodiversity is best conserved in its natural state.

The state of biodiversity reflects the state of the nation.

Natural systems are dynamic but have a finite capacity to respond to changes in their biodiversity.

We should apply the precautionary approach to biodiversity conservation.

All Australians have a stake in biodiversity and should contribute to its wellbeing.

Our efforts to conserve biodiversity must acknowledge and respect the culture, values, innovations, practices and knowledge of Indigenous peoples.

Biodiversity should not be further degraded by the actions of the current generation.

An ecosystem approach to biodiversity conservation should be used to maximise conservation outcomes.

# 1 Call to action

Biodiversity, or biological diversity[1], is the variety of all life forms on earth; it is the different plants, animals and micro-organisms; their genes; and the terrestrial, marine and freshwater ecosystems of which they are a part.

All Australians depend on our biodiversity and the many ecological services provided by our natural environment. Some of us depend directly or indirectly on healthy environments for our livelihoods and culture, some enjoy them for sport and recreation, and some find artistic and spiritual inspiration from nature.

We are the custodians of our ancient continent with its unique animals and plants that make up its unique biodiversity. The record tells us that our biodiversity is still declining. We must take urgent and decisive action.

Every Australian should appreciate the uniqueness of our ancient continent and its variety of natural environments. Australian, state and territory ministers responsible for natural resources, the Natural Resource Management Ministerial Council (NRMMC), recognise the role and importance of all our land and sea managers in the stewardship of our biodiversity.

We now well understand how our past actions, while growing the economy and improving our quality of life, have had serious and lasting impacts on the health of our environment. We also know that pressure from expanding human populations, the ongoing intensification of resource uses and the impacts of climate change present our generation with the responsibility for action.

Past actions weren't taken entirely in ignorance: our forebears set in place many mitigation strategies that are still valuable today to reduce the impact current generations are having on the environment. We have a lot to learn from the experiences and actions of past stewards of our land. We have learnt lessons, for example, on the use of fire from our Indigenous land managers, the importance of setting aside public lands such as stock routes to help us to deal with the highly variable climate that we live in, and the need to maintain and manage public lands for water conservation, forests, recreation and culture.

We need to secure and enhance critical intact habitats to increase ecosystem resilience. Legislation to protect terrestrial and marine areas for nature conservation is a key strategy of all governments. The existing national reserve system provides us with a vital foundation for biodiversity conservation and separate work is currently underway for the expansion of the national reserve estate.

In recent years we have also learnt the importance of considering management activity at landscape and catchment scales. For example, intercepting groundwater

[1] The term 'biodiversity' is used throughout the document except where 'biological diversity' is used in a reference or quote to retain accuracy

in one area can affect areas hundreds of kilometres away. We have also learnt that maintaining healthy and diverse ecosystems supports and enhances their capacity to absorb and rebound from stresses.

We have learnt that our ecosystems are dynamic in both space and time, so management plans must cover more than just small discrete areas and short-term timescales. We are now more attuned to broadening the context of policy considerations to avoid the perverse outcomes that may result from attempting to solve one issue in isolation, although mistakes are still made. We must make better choices of management strategies, policy tools, procedures and activities if we are to conserve our biodiversity and maintain ecosystem health.

Despite our efforts our historical record is not good. We continue to witness the tragedy of the commons (Hardin 1968) and the tyranny of small decisions (Odum 1982). Many of Australia's natural environments are becoming increasingly degraded and fragmented and their long-term viability is at risk. The main threats that degrade the environment are:

- climate change (resulting in conditions such as prolonged drought)
- invasive species
- loss, fragmentation and degradation of habitat
- unsustainable use of natural resources
- changes to the aquatic environment and water flows
- inappropriate fire regimes.

Climate change is a threat likely to act as a significant stress on biodiversity in its own right as well as exacerbating many existing stressors such as fire and invasive species (Steffen et al. forthcoming).

We observe and note report after report of the downward trend in our biodiversity: the *Australia State of the Environment 2006* report found that biodiversity is in serious decline (Beeton et al. 2006); the second environmental performance review of Australia by the Organisation for Economic Co-operation and Development (OECD 2008), reports that despite improved efforts the downward trend in the conservation status of some species continues.

This document—*Australia's Biodiversity Conservation Strategy*—is a new and long-term approach to addressing biodiversity conservation in a rapidly changing world. It sets national direction for biodiversity conservation over the next decade.

The draft strategy sees a future in which all Australians are working together to conserve biodiversity because we all recognise that biodiversity and its health are crucial to our existence. In our lives each of us must balance our consumption against preserving and nurturing biodiversity.

Governments must play a critical leadership role, and the community, industry and non-government sectors must combine to take up the challenge. Only together can we stop biodiversity decline.

**Business as usual is no longer an option.**

## 1.1 Building on current work

All the governments of Australia have invested considerably in the development and implementation of biodiversity conservation policies and programs.

Since the release of the 1996 *National Strategy for the Conservation of Australia's Biological Diversity* (DEST 1996), we have achieved:

- a significant increase in the size of terrestrial and marine reserve systems, including World Heritage places
- improvements in the conservation status of particular species and communities
- collaborative development of Indigenous Protected Areas, where Indigenous peoples manage their country to preserve its values
- emergence of private conservation reserves run by non-government organisations
- development and implementation of sustainable fisheries management plans for all of Australia's major fisheries
- strengthened requirements and outcomes for conservation and sustainable forest management through regional forest agreements
- legislation by all governments to protect native vegetation from broadscale land clearing
- clarification of rights to extract water, and formal recognition of the right to allocations for environmental flows (i.e. the water needed to keep a watercourse healthy)
- incorporation of biodiversity objectives in all 56 natural resource management regions across the country
- development of new markets for protecting native habitat on private land
- efforts to reduce greenhouse gas emissions and reduce the adverse impacts of economic development
- increased protection of the biodiversity of the Great Barrier Reef—the zoning network introduced in 2004 includes the world's largest network of no-take areas (more than 117 000 sq km), which protects representative examples of all 70 identified bioregions, plus many other spatial and temporal measures to increase biodiversity protection.

Our responses to biodiversity conservation are growing more sophisticated and what we have learnt is informing our current approaches. We are placing an increasing emphasis on acting at the right scale, getting the right mix of management within and outside protected areas, using an array of legislative and incentive mechanisms, and developing management processes and systems that promote the sustainable use of biological resources. Now we must improve our understanding of ecosystem resilience and manage for this in an environment that is under pressure from the consequences of human activity, including climate change.

## 1.2 Combining short-term and long-term actions

We can start by identifying and filling the gaps in our knowledge of how our natural ecosystems respond to pressure and change and how to strengthen their resilience, while building the wider community's awareness of how and why conserving biodiversity is critical for the future of Australia.

As individuals and collectively, we also need to make long-term and enduring changes to our behaviour to better conserve our natural environments and ensure that their ecosystem services continue to meet all of society's needs.

### 1.2.1 Making long-term changes

We need to focus on making enduring changes to sustain the integrity of Australia's natural systems in the long term. Central to this strategy are six 'priorities for change' which are:

1. *Building ecosystem resilience*—ensuring that our natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressure, including from climate change.
2. *Mainstreaming biodiversity*—ensuring that all Australians understand how their lives and actions affect biodiversity, and how biodiversity supports them.
3. *Knowledge for all*—improving, sharing and using our knowledge of biodiversity.
4. *Getting results*—improving delivery of conservation initiatives.
5. *Involving Indigenous peoples*—recognising the special relationship of Indigenous peoples with Australia's natural environments, the cultural significance of that relationship and its ongoing importance to the conservation of Australia's biodiversity.
6. *Measuring success*—measuring and reporting the strategy's implementation and effectiveness and being accountable for meeting the targets we set.

Each priority for change is linked to objectives, actions and results. The actions guide the development of biodiversity conservation approaches at national, state, territory and local government levels. Such approaches will include regulations and planning tools, regional natural resource management plans, industry sustainability strategies, management codes and standards, and the corporate plans of individual enterprises, non-government organisations and community groups. The results are the expected 'on-ground' consequences of successful implementation of the actions.

Such actions will help all Australians contribute to meeting this strategy's vision: a future where Australia's biodiversity is healthy, resilient to climate change and valued for its essential contribution to our existence.

### 1.2.2 Priority short-term actions

In total, the strategy contains 20 objectives and 61 actions. All actions are important but those listed in Table 1.1 stand out as priorities for implementation in the first two years.

## Table 1.1 Priority actions for the first two years of the strategy

| Priority short-term actions | Lead/collaboration |
|---|---|
| **Priority for change 1: Building ecosystem resilience** | |
| Action 1.1.2: Prepare and implement plans for biodiversity conservation at all levels (local, regional, state and continental) that maintain ecosystem health and protect threatened and endangered species. | All governments |
| Action 1.1.3: Establish conservation linkages that provide connectivity across bioregions, including at a continental scale. | Partnership between all governments the community and the private sector |
| Action 1.1.5: Establish a national framework for off-reserve conservation. | Partnership between all governments the community and the private sector |
| **Priority for change 2: Mainstreaming biodiversity** | |
| Action 2.1.1: Teach all primary school children about biodiversity and its benefits to their wellbeing and the world at large. | State and territory governments |
| Action 2.1.2: Implement an ongoing national campaign that demonstrates the importance of biodiversity to the sustainability of communities and the quality of our lives. | Australian Government and the community sector |
| Action 2.3.3: Ensure arrangements for emerging markets for carbon and water take account of biodiversity risks and benefits. | All governments and the private sector |
| **Priority for change 3: Knowledge for all** | |
| Action 3.1.1: Assess knowledge needs, identify gaps and set priorities at national, state and regional levels. | All governments |
| **Priority for change 4: Getting results** | |
| Action 4.3.2: Review and reform legislation to improve biodiversity conservation outcomes across all sectors. | All governments |
| **Priority for change 5: Involving Indigenous peoples** | |
| Action 5.1.2: Wherever possible and appropriate, recognise traditional Indigenous knowledge and environmental management expertise, and apply or extend such management for biodiversity conservation. | All governments and indigenous peoples |
| **Priority for change 6: Measuring success** | |
| Action 6.1.1: Build baseline datasets, including key indicators, to measure biodiversity condition and trends over time. | All governments and the science community |
| Action 6.1.3: Implement and maintain a nationally representative set of long-term monitoring protocols and sites. | Partnership between all governments the community and the private sector |
| Action 6.2.2: Incorporate biodiversity and ecosystem services into national accounts and corporate reporting. | Australian Government |

This strategy aims to change the way we do business so that we can respond in a purposeful and coordinated way to the serious present and future challenges facing Australia's biodiversity. It offers sufficient flexibility for many implementation decisions to be made at the local, ecosystem and landscape or seascape scales where landowners, environment managers and scientists have the best grasp of the multiple interactions between the components of biodiversity and external threats.

It is the cumulative impact of many local and regional decisions that will determine whether the decline in Australia's biodiversity is halted and reversed. Thus the strategy is a roadmap to guide action by all levels of government, the community, Indigenous peoples and the private sector to collectively conserve biodiversity.

## 1.3 Implementation

All Australian governments have collaborated to develop this draft strategy, in consultation with community and industry representatives. All Australian governments will take a shared responsibility for achieving its objectives and actions.

For the strategy to succeed, the community, governments, Indigenous peoples and businesses must agree to share responsibility and work together to implement it. The long-term framework of the strategy:

- sets national conservation directions
- broadly identifies the activities and capabilities needed to conserve our biodiversity
- makes clear that all Australians have an active role in protecting biodiversity.

Many of the actions necessary to meet the strategy's objectives will be implemented through strategies and action plans at national, state, territory and local government levels. A list of relevant national and state and territory frameworks, legislation and policies is at Appendix 4.

The kinds of actions required will be determined by place and in the context of other natural resource management issues and needs. However, evidence from past experience tells us that among those actions we will need to:

- secure and enhance critical intact habitats to increase ecosystem resilience
- restore ecological function to critically degraded landscapes through sustainable practices that manage our soil and water resources
- increase the cover of native vegetation wherever feasible to enhance ecological connectivity across fragmented landscapes over time
- build local knowledge and capacity for the long-term stewardship of our environment
- protect our most endangered species and ecological communities.

### 1.3.1 Timeframe

The *Australia State of the Environment 2006* report noted that pressures on Australia's terrestrial biodiversity have been operating over long periods, and that remedial action will take many decades to make a difference. The vision of this strategy must be long enough to allow for and encourage long-term planning and investment, and to see and record the results of conservation efforts.

The strategy has been designed with this long-term vision in mind. However, a medium-term timeframe of 10 years for the strategy itself and short-term, measurable goals will ensure we start to address the problems immediately. We need to commit to act on the short-term, measurable actions (section 1.2.2) in the first two years of the strategy.

### 1.3.2 Monitoring progress

For the strategy to make a real difference, progress needs to be tracked through regular monitoring, and changes implemented when evidence suggests current approaches are ineffective. The elements of the strategy and the ways in which they are implemented need to be monitored in an adaptive and flexible way, so that the strategy can be adjusted in response to new information or changing priorities.

- The NRMMC will monitor the implementation of the strategy and formally review it every five years with the advice of an independent panel.
- All jurisdictions will report annually to NRMMC on actions they have undertaken to implement the strategy.
- NRMMC may, in considering progress in the early implementation of the strategy, request interim independent reviews to identify and address any obstacles to implementation.
- Consolidated annual reports will be published, so the whole community can follow our national progress. This ongoing reporting will be managed centrally by the Australian Government on behalf of the NRMMC.
- The strategy will also be monitored for its effectiveness in changing the way the community, industry and governments understand and address biodiversity conservation issues.

Although it is important to focus on the short to medium-term direction and actions of the strategy, it is its longer-term impacts on conserving Australia's biodiversity that will ultimately determine its effectiveness. Thus, implementation of the strategy will include the development of a long-term monitoring and evaluation framework and the incorporation of relevant actions into existing well-established systems. The information gained from this long-term monitoring framework will be used to track trends in the condition and extent of Australia's biodiversity and to inform future reviews of the strategy.

To ensure that these high priority actions are delivered, annual reporting will focus on the 'priority short-term actions'. However, all actions are important and the mid-term and final reviews will evaluate the overall effectiveness of the strategy and allow for the community to view and respond to the reviews.

Indicative roles and responsibilities are listed in Appendix 1.

# 2 Background

## 2.1 Earlier reviews

Australia's first biodiversity conservation strategy—*The National Strategy for the Conservation of Australia's Biological Diversity* (DEST 1996)—was developed by the Australian and New Zealand Environment and Conservation Council (ANZECC), and endorsed by the Council of Australian Governments. This current document—*Australia's Biodiversity Conservation Strategy*—builds on the 1996 strategy (see Appendix 2), on international commitments, including the United Nations *Convention on Biological Diversity* (see Appendix 3), and on national, state and territory policies developed since then (see Appendix 4).

Since the endorsement of Australia's original strategy in 1996 (DEST 1996), all governments have allocated significant resources to biodiversity conservation. There have been many achievements but the continuing biodiversity decline demonstrates that more work is required.

It is logical to build on the successful work of the past but it is also vital that we recognise what has not worked and the challenges that will confront us in the future. The initial approaches of the 1996 strategy are still important but have been re-cast and advanced here to face today's profound challenges. Appendix 5 discusses changing approaches to decision making for biodiversity conservation.

## 2.2 What is biodiversity?

Biodiversity is the variety of all life forms on earth; it is the different plants, animals and micro-organisms; their genes; and the terrestrial, marine and freshwater ecosystems of which they are a part.

Biodiversity exists at three main levels:

- *genetic diversity*—the variety of genetic information that is contained in all living things and that varies within and between the populations of organisms making up single species or wider groups
- *species diversity*—the variety of species on earth
- *ecosystem diversity*—the variety of the earth's habitats, ecosystems and ecological processes.

For the purpose of this strategy, conservation is an overarching term that means the protection, maintenance, management, sustainable use and restoration of the natural environment.

Sustainable use is the use of components of biodiversity in a way and at a rate that does not lead to the long-term decline of biodiversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

An ecosystem is a natural unit consisting of all plants, animals and micro-organisms in an area, functioning together with all the non-living physical factors, including soil, rocks, minerals, water sources and the local atmosphere. An ecosystem's size is not fixed: it could be the ocean, an entire rainforest or a single backyard.

For more information on the concept of biodiversity see Appendix 6.

## 2.3 Why biodiversity matters

Healthy ecosystems support life on earth and are vital to the wellbeing of present and future generations. Ecosystem services provide life-sustaining benefits and maintain the conditions for life on earth. Green plants produce oxygen and remove carbon dioxide from the atmosphere; bacteria and fungi break down organic matter in the soil; and vegetation cleans and filters water, traps sediment and recycles nutrients. Maintenance of the diversity of animals, plants and micro-organisms is at the heart of a healthy ecosystem.

Biodiversity supports economies and cultures. It forms the basis of our primary production industries, such as agriculture, forestry and fisheries, and provides services to those industries, for example by pollinating plants, contributing to soil health and recycling nutrients. Biodiversity is also the basis for the production of many other important human services such as medicines, and is fundamental to the culture of Indigenous peoples.

Parks, wilderness areas and open spaces offer scenic and peaceful places to relax and exercise, and provide a focal point for community gatherings. Natural systems are the laboratories for scientific research and the basis for recreational activities such as fishing, boating, diving, camping and hiking. The economic and social benefits of biodiversity are considerable: for example, the recreational fishing industry in Australia is worth an estimated $2.9 billion per year. Similarly, national parks are Australia's biggest tourism asset: more than 40% of all international visits include a trip to a national park (Griffin and Vacaflores 2004).

## 2.4 Australia's biodiversity

> Australia is home to between 600 000 and 700 000 species, many of which are found nowhere else in the world. About 84% of plant species, 83% of mammal species, and 45% of bird species are only found in Australia (DEWHA 2008).

Australia is one of the most biologically diverse countries in the world. We have 6.7% of the world's vascular plant species, 7.0% of the world's mammal species, 8.4% of the world's bird species, 3.8% of the world's amphibian species and 17.0% of the world's marine and freshwater fish species. Many of our plant and animal species are endemic to Australia (found nowhere else on earth).

Only about 25% of our species have been formally described. Our knowledge of different species and ecosystems varies according to our interest in them. The species we know best are large and charismatic, or of quantifiable economic importance, public interest or taxonomic interest. Mammals, birds and some groups of plants top the list.

Species we know less about include plants and animals that are small, challenging to collect or identify, found in inaccessible areas (such as marine environments), or lacking in public or obvious economic interest (Groomsbridge and Jenkins 2002; Chapman 2005). For example, we have about 15% of the world's ant species. Ants perform important ecological functions such as pollination, soil aeration, nutrient recycling and water infiltration (Australian Museum 2003). However, only an estimated one-quarter to one-half of the total number of Australian ant species have been described formally. For Australia's fungus species, a group vital for recycling nutrients, the figure is thought to be less than 10% (Raupach et al. 2007).

Appendix 7 shows snapshots of Australia's biodiversity across a range of Australian ecosystems.

## 2.5 Indigenous peoples and Australia's biodiversity

Australia's Indigenous peoples in particular have a complex cultural, spiritual, social and economic relationship with biodiversity, through their relationship with their traditional lands and waters—their country.

As a nation Australia recognises the important role and long history Indigenous peoples have had, and continue to have, in managing Australia's landscapes and seascapes. Indigenous peoples have developed a special knowledge of Australia's biodiversity and they have a particular interest in the conservation and sustainable use of native species and environments. The maintenance of biodiversity on lands and waters over which Indigenous peoples have title, or in which they have an interest, is the foundation of the wellbeing, identity, cultural heritage and economy of Indigenous communities. Appendix 8 discusses Indigenous peoples' relationship to biodiversity in more detail.

Aboriginal rock art at Sacred Canyon, Flinders Range National Parks, South Australia (Photo: South Australian Tourism Commission)

# 3 Making enduring changes

Natural systems must be resilient if they are to adapt to environmental stresses. They need to be able to retain their ecological functions in the face of complex and unpredictable pressures. Their best chance lies in us ensuring that natural systems are protected, restored and connected, and that the major causes of biodiversity decline (Appendix 9) are addressed. To achieve this, greater cooperation is needed among:

- governments at all levels
- the private sector
- the science and technology sectors
- rural, urban and Indigenous communities.

We must also be innovative in how we address the causes of biodiversity decline and emerging threats such as climate change (Appendix 9). We must be flexible in how we deliver conservation initiatives. We need better accounting systems that consider the full value of biodiversity and its contribution to wellbeing and economic prosperity. Greater knowledge will help us make the best choices about where to direct our efforts, and on what geographic scale. Our efforts must also be integrated across tenures and jurisdictions.

We need to connect people back to nature so that they understand and value the importance of biodiversity and can actively participate in its conservation. We also have an obligation to involve Indigenous peoples in every aspect of biodiversity conservation, and to respect their deep spiritual and cultural relationship with landscapes and seascapes.

## 3.1 Overview of priorities for change

*Australia's Biodiversity Conservation Strategy* is based on six priorities for change (Box 3.1), each of which is accompanied by specific objectives and actions.

The six priorities reflect the essential elements of biodiversity conservation that we must address—collectively and urgently—to achieve the strategy's vision and objectives. To conserve our biodiversity effectively, we must accomplish fundamental societal change in each of the six priorities.

### Six priorities for change

| Priority | What the priority entails |
|---|---|
| 1. Building ecosystem resilience | Ensuring that our natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressure, including from climate change |
| 2. Mainstreaming biodiversity | Ensuring that all Australians understand how their lives and actions affect biodiversity, and how biodiversity supports them |
| 3. Knowledge for all | Improving, sharing and using our knowledge of biodiversity |
| 4. Getting results | Improving delivery of conservation initiatives |
| 5. Involving Indigenous peoples | Recognising the special relationship of Indigenous peoples with Australia's natural environments, the cultural significance of that relationship and its ongoing importance to the conservation of Australia's biodiversity |
| 6. Measuring success | Measuring and reporting the strategy's implementation and effectiveness and being accountable for meeting the targets we set |

## 3.2 Objectives, actions and results for each priority

Each priority for change is linked to objectives, actions and results. The 61 actions are indicative: they are intended to guide jurisdictions and other organisations when developing and implementing their own biodiversity conservation approaches. The actions are not intended to exclude any other actions appropriate to a jurisdiction's own circumstances when implementing the strategy. Each action is accompanied by results: the expected 'on-ground' consequences of successful implementation of the actions.

These actions reflect a possible set of options for delivering the outcomes of the strategy. Jurisdictions and other organisations will implement the strategy through their own plans and may develop their own actions appropriate to their circumstances. The strategy has been developed with a long timeframe in mind for those actions that need to continue and evolve over many decades. Other actions need to be implemented within a shorter timeframe.

### 3.2.1 Priority for change 1: Building ecosystem resilience

#### Ensuring that our natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressure, including from climate change

Resilience describes an ecosystem's capacity to adapt to changes and disturbances while maintaining the same basic function, structure and interactions.

We now recognise that ecological systems change naturally, in unpredictable and sometimes unexpected ways. We recognise that attempts to manage change can have surprising and unintended impacts on biodiversity, for example tree planting can lead to reduced water flows, and changing patterns in the management of species that are vulnerable to fire can lead to the spread of fire-resistant vegetation. Thus we must embrace and work with natural ecological variability, rather than attempting to control or reduce such variability. Such an approach promotes and sustains diversity in all forms and at all scales.

To support ecosystem resilience we need to consider how an ecosystem functions now, as well as what its future state is likely to be—especially in a changing climate. The many uncertainties and gaps in our knowledge mean that we need to determine priorities based on a risk-management approach that identifies, analyses, evaluates and deals with the risks.

Ecosystems will need to be resilient to disturbances, both known and unforeseen. We must also recognise that it will not be possible to maintain all ecosystems in their current state.

Parks and reserves play a key role in buffering natural systems against climate change. Therefore, a well-planned and managed terrestrial and marine reserve system is the most effective and immediate strategy to build resilience in a changing climate. Maintaining a comprehensive, adequate and representative reserve system is the best way to secure critical habitats of vulnerable species.

We also need to conserve biodiversity outside the reserve system. This can be done by improving habitat connectivity (see Appendix 10) and sustainable natural resource management practices.

Ex situ conservation (i.e. conservation of biodiversity outside of its natural habitat) can provide important insurance against biodiversity loss and a means to conserve species whose numbers have dwindled in their native habitat. Measures could include seed and gene banks, and living collections in zoos, aquariums and botanic gardens. However, our focus should remain on whole-of-ecosystem conservation, rather than individual species, to help conserve endangered species by improving the health of the ecosystem on which they depend.

## Table 3.1 Priority for change 1: Building ecosystem resilience

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 1.1 Biodiversity is actively managed for its conservation value** | | |
| 1.1.1 Recognise the significance of maintaining and understanding ecological processes, and base the management of Australia's biodiversity on this principle. | Ecological processes are being maintained through biodiversity conservation and management. | All governments, the community and the private sector |
| 1.1.2 Prepare and implement plans for biodiversity conservation at all levels (local, regional, state and continental) that maintain ecosystem health and protect threatened and endangered species. | Each level of government is using biodiversity conservation plans and planning processes that:<br>■ direct and integrate resource allocation<br>■ address the threats to biodiversity<br>■ particularly address the potential impacts of climate change, invasive species, habitat loss, fire, population growth, unsustainable natural resource use and marine pollution. | All governments |
| 1.1.3 Establish conservation linkages that provide connectivity across bioregions, particularly at a continental scale. | Continental-scale linkages and complementary land uses:<br>■ are developed and maintained<br>■ support the ability of species and ecosystems to adapt to changing environments<br>■ provide a buffer against threatening processes. | Partnerships between all governments, the community and the private sector |
| 1.1.4 Continue to support, expand and manage the National Reserve System as a foundation for biodiversity conservation. | A comprehensive, adequate, representative and resilient marine and terrestrial protected area system is resourced and managed to optimise biodiversity conservation. | All governments |
| 1.1.5 Establish a national program for off-reserve conservation. | Biodiversity conservation on land and sea that is not in the reserve system:<br>■ complements and builds on the foundation provided by the reserve system<br>■ supports local communities to adapt to a changing environment. | Partnerships between all governments, the community and the private sector |
| 1.1.6 Maintain and enhance ex situ conservation measures as a last resort for biodiversity conservation. | Ex situ conservation measures:<br>■ have been adequately resourced<br>■ are complementary to in situ measures<br>■ are responsive to the impacts of climate change<br>■ are supported by appropriate taxonomic expertise<br>■ provide insurance against extinction<br>■ include the re-introduction of species into habitats. | All governments |
| **Objective 1.2 The threats to biodiversity are reduced and managed on a long-term basis** | | |
| 1.2.1 Set priorities for the management of threats to biodiversity at a range of scales based on an assessment of risk, and develop innovative programs that use emerging technologies and practices. | Investment in national biodiversity priorities is at scales where collective conservation efforts most effectively address risks posed by threats to biodiversity.<br>Governments, industries and communities use innovative solutions and emerging technologies and practices to address and adapt to changes caused by threats to biodiversity. | Partnerships between all governments, the community and the private sector |

### Case study 1: Reef Rescue (Australian Government)

Reef Rescue is a key element of the Australian Government's more than $2 billion Caring for our Country initiative to restore the health of Australia's environment and build on improved land management practices.

Reef Rescue's objective is to improve the quality of water entering the Great Barrier Reef lagoon by changing land management practices to reduce nutrient, pesticide and sediment runoff from agricultural land.

Queensland agricultural, tourism, fishing and aquaculture industries, Indigenous communities, conservation groups, research organisations and, most importantly, the Great Barrier Reef World Heritage Area will benefit from Reef Rescue's investment of $200 million over five years in actions that protect one of the world's great natural wonders.

The Great Barrier Reef is the world's largest World Heritage Area, and is probably the best-known marine protected area in the world. It is the world's most extensive coral reef system and is one of the world's richest areas in terms of biological diversity.

The reef is threatened by climate change and by increasing agricultural activities and coastal development in the catchments that adjoin the reef.

Reef Rescue consists of five integrated components to achieve its objective:

- Water Quality Grants ($146 million over five years)
- Reef Partnerships ($12 million over five years)
- Land and Sea Country Indigenous Partnerships ($10 million over five years)
- Reef Water Quality Research and Development ($10 million over five years)
- Water Quality Monitoring and Reporting, including the publication of an annual Great Barrier Reef Water Quality Report Card ($22 million over five years).

This program will build on previous work started in 2005 by the Reef Catchments NRM group (formerly Mackay Whitsunday NRM), in conjunction with two peak agricultural organisations, to encourage sustainable farming practices in Queensland coastal catchments bordering on the reef.

This program demonstrates how to build the resilience of an ecosystem particularly vulnerable to climate change.

For more information see www.nrm.gov.au/funding/reef-rescue.html.

### Case study 2: Bounceback (South Australian Government)

Bounceback is a major ecological restoration program that was established in the early 1990s which aims to protect and restore the arid and semi-arid environments of South Australia's rangelands. Bounceback's long-term aim is to protect regionally rare and threatened plant and animal species, such as the yellow-footed rock wallaby, and to reintroduce species that have become locally extinct.

Bounceback operates across a variety of landholdings in the Flinders, Gawler and Olary Ranges. These include national parks, pastoral properties and privately managed sanctuaries. The project currently involves 26 pastoral properties, four private reserves and eight government reserves covering an area of 2.5 million hectares.

The major threats to biodiversity in this region include the loss of native vegetation due to grazing by feral animals and historic grazing by domestic stock; introduced predators; soil erosion; and pest plant infestations.

Bounceback involves a range of activities to address these threats including the control of feral animals and pest plants, targeted revegetation works, regular fauna surveys and vegetation monitoring to assess the effects of grazing management programs. A priority has been to develop partnerships with landholders and other groups to gradually expand the scope and delivery of Bounceback's conservation and land management programs.

Strong community support has been a key to Bounceback's success. To date, successful partnerships have been established with the following groups:

- South Australian Arid Lands Natural Resources Management Board
- Sporting Shooters Association of Australia (Hunting and Conservation Branch)
- Adnyamathanha Aboriginal Community (Nantawarrina Indigenous Protected Area)
- Green Corps
- Conservation Volunteers Australia
- Former Northern Flinders Soil Conservation Board
- Department of Primary Industries and Resources SA
- Universities and Technical and Further Education groups.

A dramatic reduction in grazing pressure has been achieved by controlling rabbits and goats and as the consequence of Rabbit Haemorrhagic Disease (Calicivirus); foxes have been almost eliminated and feral cat populations have been reduced. This has allowed the significant recovery of local native plant and animal communities.

Bounceback continues to provide an integrated approach, based on community and government partnerships, to address ecological restoration at the landscape scale.

For more information see www.environment.sa.gov.au/biodiversity.

### 3.2.2 Priority for change 2: Mainstreaming biodiversity

#### Ensuring that all Australians understand how their lives and actions affect biodiversity, and how biodiversity supports them

Mainstreaming biodiversity is critical to the strategy's success, and will require long-term concerted efforts. As populations grow, the need for individuals to take steps to conserve biodiversity will become increasingly important.

Building awareness is the first step to achieving biodiversity conservation. To conserve biodiversity, all Australians must understand and appreciate that biodiversity is vital to their wellbeing, and actively participate in its conservation. Governments will demonstrate leadership and provide direction but the strategy will only succeed if the responsibility for biodiversity conservation is also accepted and acted upon by all community sectors including business, industry, Indigenous peoples and the general community.

The success of the strategy will depend on developing simple and effective ways of engaging with people, through the formal education system and through more widespread campaigns. Community engagement is particularly important at the local level, where people's actions can be more effective. In addition to an understanding of the importance of biodiversity conservation, communities must be given the knowledge and tools to protect biodiversity.

Institutions need to consider biodiversity issues in major decision-making processes based on:

- tools that allow the costs and benefits of biodiversity to be taken into account on an equal footing with social and economic factors
- regulatory standards that ensure day-to-day decisions about the use of natural resources minimise harmful impacts on natural systems.

Children testing water quality, Coobowie Estuary, South Australia (Photo: D Markovic)

## Table 3.2 Priority for change 2: Mainstreaming biodiversity

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 2.1 Australians understand the importance of biodiversity to their wellbeing and recognise the urgent need for action** | | |
| 2.1.1 Teach all primary school children about biodiversity and its benefits to their wellbeing and the world at large. | Attitudes have shifted so that most Australians understand that biodiversity conservation is fundamental to our national wellbeing. | State and territory governments |
| 2.1.2 Implement an ongoing national campaign that demonstrates the importance of biodiversity to the sustainability of communities and the quality of our lives. | | Australian Government and the community sector |
| 2.1.3 Develop a series of national biodiversity indexes (based on a comprehensive dataset that measures the status of, and trends in, Australia's biodiversity) that is frequently and publicly reported to influence decision making and public opinion. | Use of the biodiversity index is ensuring that Australia's national accounts reflect a balance between economic growth and natural resource loss. | Australian Government lead |
| **Objective 2.2 Responsibility for biodiversity conservation is accepted by business, government and community** | | |
| 2.2.1 Ensure complementary legislative frameworks and approaches across the three tiers of government to conserve biodiversity. | Business, government and the community have accepted biodiversity conservation as a normal element of doing business. | All governments |
| 2.2.2 Develop and adopt tools and processes to ensure that biodiversity is considered in all decision making alongside social and economic factors. | Biodiversity assessment tools are used in all decision making to ensure that biodiversity is considered alongside economic and social factors<br>Governments are using policy tools and instruments to ensure that biodiversity conservation initiatives are market-based where feasible. | All governments and the science sector |
| 2.2.3 Improve community engagement in biodiversity decision making through increased transparency and information sharing. | Communities participate in collective problem solving to conserve biodiversity. | All governments and the community sector |
| **Objective 2.3 Everyone is conserving biodiversity** | | |
| 2.3.1 Promote participation and provide opportunities for everyone to conserve biodiversity. | Communities and individuals are participating in biodiversity conservation activities through:<br>■ volunteering becoming a widespread and accepted community practice<br>■ ensuring local natural resource managers contribute to decisions at the catchment scale. | Partnerships between all governments, the community and the private sector |
| 2.3.2 Develop programs that make biodiversity conservation a mainstream consideration or integral to decision making. | Australians are valuing biodiversity by pursuing ecologically sustainable lifestyles in their:<br>■ 'own backyards'<br>■ ecologically sustainable cities<br>■ pursuit of leisure through ecotourism activities. | Partnerships between all governments, the community and the private sector |
| 2.3.3 Ensure arrangements for emerging markets for carbon and water take account of biodiversity risks and benefits. | Carbon and water markets are designed and implemented to avoid unintended negative consequences for biodiversity. | All governments and the private sector |

### Case study 3: Multicultural communities caring for the coast (Victorian Government)

The Victorian Government through the Coast Action Coastcare Community Program has funded a project to involve multicultural communities in caring for the coast. The project is concerned with getting the Coast Action Coastcare message to new 'coastal people', particularly those who have come to live in the region from overseas. The project covers key messages about caring for the coastal and marine environment, as well as water safety.

Warrnambool is a community of Australians with mainly British or Irish heritage. There is also a relatively large Indigenous community (1% of the population). In recent years there has been a dramatic change in the cultural makeup of Warrnambool, partly as a result of the recent council-led migrant settlement program. These 'new coastal people' are now a significant presence in a rural city the size of Warrnambool.

A community committee was formed to help and support new migrants. One of the group's initiatives was to propose a Multicultural Festival to celebrate Cultural Diversity Week. Integrating the Coast Action Coastcare program into the festival proved invaluable in breaking down communication barriers and starting to educate the new arrivals about coastal issues. Environmental entertainers used nonverbal communication to interact with people from a wide range of cultures at the festival, thus avoiding language barriers.

In the past ignoring new 'coastal people' has caused negative environmental impacts. For instance, dramatic shellfish depletion followed the arrival of Vietnamese and Chilean refugees in some parts of Australia. Collecting shellfish, especially abalone, was part of their cultural traditions and they were unaware of Australian regulations. The number of migrant drownings also suggests that some coastal awareness is vital. There is generally a lack of knowledge, and, in some cases, fear of the marine environment. The guiding principle for this program is education and interpretation of the coast and marine environment.

This project is part of a much larger program concerned with improving the level of support for coast-caring in the local community. Bridges have been formed between the different cultures and coast care issues are now a featured topic of migrant community radio. Other opportunities to involve the 'new locals' in environmental activities are being explored.

This project demonstrates how to develop partnerships with coastal community groups and land managers to achieve conservation and community outcomes.

For more information see www.dse.vic.gov.au/DSE.

## Case study 4: Environmental stewardship (Australian Government)

The Australian Government is providing ongoing support for Environmental Stewardship by committing $42.5 million over four years under its Caring for our Country initiative. Environmental Stewardship aims to improve the quality and extent of high public value environmental assets on private land or impacted on by activities on private land. The high public value assets being targeted are matters of National Environmental Significance under the *Environment Protection and Biodiversity Conservation Act 1999*.

Environmental Stewardship investments will focus on a small number of priority environmental assets in the first four years of operation. The critically endangered White Box, Yellow Box and Blakely's Red Gum grassy woodland and derived grasslands (Box Gum Grassy Woodland) ecological community is the first environmental asset to be targeted.

Box Gum Grassy Woodland occurs as either woodland or derived grassland (a grassy woodland from which the trees have been removed) and has a ground layer of native tussock grasses and herbs. It may also have a sparse, scattered shrub layer. Where a tree layer is present, the dominant species are White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) or Blakely's Red Gum (*Eucalyptus blakelyii*).

Box Gum Grassy Woodland is an important ecological community which provides habitat for at least 19 threatened species, including the Superb Parrot, Swift Parrot and the Tiger Quoll, as well as many other native plants and animals.

Less than five per cent of Box Gum Grassy Woodland remains in good condition, occurring as scattered remnants across its geographic range, which extends from southern Queensland to Central Victoria. Without active management these remnants are at risk.

Environmental Stewardship differs from other Caring for our Country elements by providing long-term payments (up to 15 years) to land managers to protect high value environmental assets on private land. It also uses market-based approaches to achieve value for money outcomes leading to improvements in the condition and extent of targeted environmental assets. Environmental Stewardship supports activities on private land that go beyond the individual land manager's duty of care in conserving environmental assets.

The Australian Government recognises that using market-based incentives such as those under Environmental Stewardship can be an effective way of engaging land managers to protect and maintain environmental assets on private land. There is strong support amongst key stakeholder groups in the Australian community for stewardship payments as a means of protecting biodiversity.

Environmental Stewardship has helped establish a way of delivering environmental outcomes in Australia through market-based mechanisms working with land managers, scientists and the private sector. The program has also helped build the capacity of the private sector to deliver environmental outcomes.

For more information see www.nrm.gov.au/stewardship/index.html.

### 3.2.3 Priority for change 3: Knowledge for all

#### Improving, sharing and using our knowledge of biodiversity

Biodiversity knowledge will become mainstream only when its benefits and values are recognised. We can become better at quantifying these benefits but we must also acknowledge that many benefits are intangible, qualitative and unquantifiable. We need to take these benefits into account in decision making and when informing people about the contribution of biodiversity to their wellbeing. However, our knowledge gaps make it difficult for us to make informed choices about biodiversity conservation priorities. Many natural systems are at risk of further degradation because we do not know enough about their condition or the pressures that are affecting them. Therefore, we must identify and prioritise our knowledge gaps and develop research programs to address them.

Increasing community-wide recognition of Indigenous knowledge and its role in biodiversity conservation is a priority. We must acknowledge and respect the unique and special biodiversity knowledge of Indigenous peoples. By helping to maintain and build this knowledge we can use it more effectively when developing biodiversity conservation management programs.

Although there is still a lot we don't know about Australia's biodiversity, we must make better use of the knowledge we do have by making sure it is nationally consistent and publicly accessible.

Assessing rare and endangered species threatened by invasive blackberries
(Photo: Department of Sustainability and Environment, Victoria)

## Table 3.3 Priority for change 3: Knowledge for all

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 3.1 Knowledge about biodiversity and its scientific, economic, social and cultural importance is improved and made more accessible** | | |
| 3.1.1 Assess knowledge needs, identify gaps and set priorities at national, state and regional levels. | Biodiversity conservation planning across all levels of government is driven by the best available information and prioritised by the latest research. | All governments |
| 3.1.2 Design collaborative programs that target the priorities identified in Action 3.1.1. | Research is re-prioritised according to the needs identified in Action 3.1.1.<br>Our understanding of links between biodiversity, ecosystem services and human wellbeing has improved the way we conserve biodiversity. | All governments, the science and private sectors. |
| 3.1.3 Ensure sufficient scientific expertise to support biodiversity conservation at national and state levels. | Our research and education systems and institutions are appropriately resourced to support future biodiversity conservation knowledge needs. | All governments, the science and education sectors |
| 3.1.4 Improve communication between scientists, policy makers, resource users, landholders and managers. | Up-to-date science is being used to make the best decisions, set priorities and inform conservation policies and programs at all levels.<br>Stakeholders have access to up-to-date science to make decisions. | Partnerships between all governments, the science community, Indigenous peoples, agriculture and tourist sectors |
| **Objective 3.2 Indigenous knowledge of biodiversity is respected and used** | | |
| 3.2.1 Understand and respect Indigenous knowledge of biodiversity and its value, including providing support for the use and maintenance of Indigenous languages as an element of conserving Indigenous knowledge. | Indigenous and non-Indigenous peoples are working in a partnership based on mutual respect and knowledge exchange, and applying the benefits of traditional Indigenous knowledge and values to the conservation of biodiversity. | Partnerships between all governments, Indigenous peoples, the community and the private sector |
| 3.2.2 Improve systems for applying and accessing Indigenous knowledge while respecting cultural values. | Well-resourced systems, which build the capacity of Indigenous peoples to apply their knowledge and the capacity of non-Indigenous peoples to access that knowledge, are operating and improving the conservation of biodiversity. | Partnerships between all governments and Indigenous peoples, the community and the science and private sectors |
| 3.2.3 Assist Indigenous peoples to conserve and revive their knowledge. | Traditional biodiversity-related knowledge has been strengthened and is being used more effectively for biodiversity conservation. | All governments and Indigenous people |

## Case study 5: Corroboree Frog breeding program (Australian Capital Territory Government)

A captive breeding and monitoring program has commenced at Tidbinbilla Nature Reserve for the northern corroboree frog (*Pseudophryne pengilleyi*).

The objective of the program is to maintain a captive colony of northern corroboree frogs as an insurance against extinction in the wild, with the ultimate aim of breeding the species for release to re-establish wild populations. The program is part of the National Recovery Program for corroboree frogs (*Pseudophryne* species) and the ACT Action Plan for the northern species.

Both the northern and southern species of corroboree frogs are small (25–30 mm), distinctively striped yellow and black frogs. Their distribution is restricted to high-altitude waterlogged grasslands, heath, sphagnum moss bogs and adjacent woodlands. In the past two decades populations of both species have declined to precariously low numbers. In the ACT, there are estimated to be less than 200 northern corroboree frogs left in the wild.

The decline of corroboree frogs is most likely part of the world-wide phenomenon of declining frog species, which has been attributed mainly to the spread of the introduced pathogen amphibian chytrid fungus.

The northern corroboree frog is listed as threatened in the ACT, NSW and nationally. In addition to the impact of chytrid fungus, the January 2003 wildfires burnt most of the corroboree frog habitat in the ACT (Brindabella/Bimberi Ranges), although frogs are now using the regenerating areas.

Key partners in this Caring for Country funded program include ACT universities (University of Canberra and Australian National University), Australian zoos (Melbourne and Taronga), NSW Department of Environment and Climate Change, the Corroboree Frog Recovery Team and the Amphibian Research Centre in Melbourne.

This is a good example of collaboration between government and the scientific community to use monitoring and the latest research to recover a species that was initially declining for unknown reasons then under further threat owing to habitat loss caused by intense bushfires.

For more information see www.tams.act.gov.au/live/environment.

Northern corroboree frog (*Pseudophryne pengilleyi*), one of our rarest native frogs. (Photo: S Wilson)

## Case study 6: Monitoring of trends relating to stygofauna (Western Australian Government)

Groundwater fauna, or stygofauna, are small animals which live permanently in underground water in aquifers and caves. Stygofauna are a group of highly diverse, ancient species. Australia, especially the western and south-eastern parts, has recently been recognised as having globally significant stygofaunal diversity, with many new taxa being recently discovered.

Most stygofauna are small crustaceans that are 0.3–10 millimetres in length. Other stygofauna include fish, worms, snails, mites and insects. Stygofauna are often very localised and highly adapted to their particular underground water habitats. While the overall nature and diversity of regional stygofauna crustacean species are reasonably well known, further surveys in particular subregions continue to reveal new taxa, new records and range extensions of already recorded species.

Stygofauna are believed to play a significant role in maintaining groundwater quality. They graze on nutrients and matter percolating down from the ground surface, regulating the concentration of this material in groundwater. They also keep groundwater flowing by maintaining the spaces between soil particles. Threats to stygofauna include changes in water quality and contamination of groundwater, changes to water levels, removal of groundwater, compaction of sediment by heavy equipment and lack of scientific knowledge.

There is currently no state-based legislation covering the conservation of threatened ecological communities in Western Australia (WA). However, an informal, non-statutory process lists some stygofaunal communities as critically endangered and threatened. The stygofaunal communities of most concern are located in the Kimberley, northern Yilgarn and Pilbara regions of WA.

This case study demonstrates the importance of expanding our knowledge of rare or little known components of biodiversity. Further research into the distribution and composition of stygofaunal populations and on-going monitoring of these communities by government and industry is vital in understanding their status, the role they play in groundwater ecology and their potential for recovery from impacts. It is also important that we continue to support taxonomic research to ensure that we have the capacity to accurately identify all the components of our biodiversity.

For more information see www.dec.wa.gov.au/science-and-research/index.html.

*Halosbaena tulki* belongs to a crustacean genus known only from groundwater in north-western Australia, from either side of the North Atlantic (Canary Islands and Caribbean) and Japan. (Photo: D Elford, Western Australian Museum)

### 3.2.4 Priority for change 4: Getting results

#### Improving delivery of conservation initiatives

We know that better-informed, integrated action is needed to conserve biodiversity at the landscape and seascape scales. However, the challenge of getting results remains and several elements are essential if this is to happen.

To maximise biodiversity outcomes with limited resources, investment strategies must be long-term, cost effective and prioritised (Appendix 5). For example, a strategic approach to investment can focus on maintaining the viability and resilience of natural systems at the landscape and seascape scales, rather than on simply remediating problems at the individual species level.

We must develop innovative ways to encourage business and industry to invest in biodiversity conservation. Governments should continue to encourage environmental stewardship through appropriate investment, governance and regulation, and explore new approaches to stewardship. More clarity on public and private sector roles and responsibilities is also needed to integrate our efforts.

We must continue to develop partnerships and build on existing successful arrangements. For example, partnerships between mining organisations and local Indigenous communities to manage revegetation projects and fire regimes can deliver economic and social benefits to both partners, and have positive outcomes for biodiversity. Such partnership efforts need to be coordinated and delivered at appropriate geographic scales.

Volunteers watering plants in a restored area at Crockery Bay, Basham Beach Conservation Park, Port Elliot, South Australia. (Photo: J Baker)

## Table 3.4 Priority for change 4: Getting results

| Actions | Results | |
|---|---|---|
| **Objective 4.1 Investment of resources is long term, strategic and cost effective** | | |
| 4.1.1 Negotiate government agreements to align investment on priority issues. | National, state and local government investment is supporting common biodiversity conservation goals and is complementary. | All governments |
| 4.1.2 Develop clear and agreed priorities to inform long-term investment in biodiversity conservation. | Resources are directed to achieving biodiversity conservation priorities that are based on scientific evidence and developed through consultation and consensus. | Partnerships between all governments, the community and the private sector |
| 4.1.3 Develop innovative ways to encourage business and industry investment in biodiversity conservation. | The private sector is actively taking part in biodiversity conservation. | Partnerships between all governments, the science and private sectors |
| **Objective 4.2 Delivery is targeted and integrated at the appropriate geographic scale** | | |
| 4.2.1 Ensure that consideration is given to undertaking biodiversity conservation projects at the most appropriate scale to maximise outcomes. | Biodiversity conservation projects are undertaken at the most appropriate scale to maximise outcomes. | Partnerships between all governments, the community and the private sector |
| 4.2.2 Coordinate regional and continental-scale conservation efforts. | Complementary rules and principles across jurisdictions inform and improve biodiversity conservation.<br>Agreed governance arrangements are achieving cordinated national conservation efforts. | All governments, the community and the private sector |
| **Objective 4.3 All sectors of the community, including government, industry, non-government organisations and Indigenous Australians, are aligned in their efforts** | | |
| 4.3.1 Clarify roles and responsibilities and develop partnerships with industry, non-government organisations and community bodies to deliver the strategy. | All sectors have a clear understanding of their roles in, and responsibilities for, biodiversity conservation. | Partnerships between all governments, NGOs, the community and the private sector |
| 4.3.2 Review and reform legislation to improve biodiversity conservation outcomes across all sectors. | National, state and territory biodiversity legislation and regulations are complementary and are supporting agreed objectives and principles for biodiversity conservation. | All governments |
| 4.3.3 Review and improve regional models for natural resource management delivery in relation to biodiversity conservation. | Biodiversity conservation has been improved at a regional level. | All governments and the community |
| **Objective 4.4 The community is engaged and has the capacity to act** | | |
| 4.4.1 Cause industry to adopt innovative management and self-regulatory systems that will help conserve biodiversity. | Complementary financial and regulatory systems are operating that support the adoption of innovative industry practices and minimise duplication.<br>Industry sectors are implementing biodiversity management strategies that incorporate innovative conservation measures. | Partnerships between all governments and the private sector |
| 4.4.2 Provide incentives to foster actions beyond 'duty of care' obligations. | Industry and community participation in measures to conserve biodiversity, including stewardship programs, has increased. | All governments |

## Case study 7: Lord Howe Island Biodiversity Management Plan (New South Wales Government)

The Lord Howe Island Biodiversity Management Plan is a threat-based, landscape-scale multi-species recovery plan which sets priorities to conserve and recover biodiversity across the island for the next 10 years. It is intended that the plan will help recover over 330 threatened, endemic and native animals, plants and vegetation communities. The biodiversity management plan (BMP) also constitutes the recovery plan for 30 threatened species.

Lord Howe Island, located approximately 760 km northeast of Sydney, is renowned as a biodiversity hotspot. It is home to over 2000 native species, half of which are found nowhere else in the world. Like other small oceanic islands, Lord Howe Island has suffered significant species loss due to the impacts of human activities and exotic species introductions.

The Lord Howe Island BMP pioneered innovative techniques, including geographic information system-based biodiversity forecasting. These techniques looked at the distribution of plants and animals and the pattern and degree of threats across the landscape, highlighting locations that are either particularly under threat or of high biodiversity significance. This has enabled actions to target particular parts of the landscape, or specific threats that are impacting upon biodiversity.

Major actions include pest plant and animal control and eradication. Other actions identified in the BMP are revegetation, research and monitoring, and improvements in quarantine procedures.

The BMP model is continuing in northeast NSW with the preparation of several plans, namely the Border Ranges Rainforest BMP, which covers both NSW and south-east Queensland, the Central Coast Region BMP and the Northern Rivers Regional BMP.

The Lord Howe Island BMP demonstrates an approach to conserving biodiversity at the most appropriate scale to benefit cost effectively the greatest number of species and ecological communities.

For more information see www.environment.nsw.gov.au/protectedareas/index.htm.

The Lord Howe woodhen (*Gallirallus sylvestris*) is one of the threatened endemic species covered by the Lord Howe Island BMP. (Photo: I Hutton)

### Case study 8: The midlands biodiversity hotspot project (Australian and Tasmanian governments)

The Tasmanian Midlands region is a nationally important 'hot spot' for its unique biodiversity, with over 180 rare and threatened plant and animal species. The main aim of the project was to work with landholders across the Midlands to help them protect the long-term future of native ecosystems with particular attention to threatened species and other special values on their own land. Involvement in the project was voluntary.

The project area covered lowland country (below 700 m) extending from just south of Launceston to just north of Hobart, including the foothills of the Great Western Tiers, Ben Lomond and the Eastern Tiers. Some plants of the Midlands region, such as the Tunbridge buttercup and many species of orchid, are found nowhere else in the world. Threats to the biodiversity of the area centre around habitat loss and degradation from changing land use, climate change, weeds and feral animals.

The first round of the Midlands Biodiversity Hotspot project ran from 2004–07 and was funded by $930 000 from the Australian Government, with a $645 000 matching and in-kind contribution from the Tasmanian Government and other organisations. The project was run by the Southern Midlands Council and supported by Northern Midlands Council, the Tasmanian Department of Primary Industries and Water (DPIW) and the Tasmanian NRM Regions.

Achievements of the project include:

- Successful community engagement in a region that has low levels of formal reservation and low levels of community participation in formal conservation programs.
- The creation of 16 conservation agreements covering 1470 hectares of forest, woodland, grassland and wetland, including 602 hectares of high priority vegetation communities.
- A total of $456 000 in incentive funds and $135 000 in management funds (for weed control and fencing) allocated to landholders.
- Ongoing monitoring and stewardship support of the covenanted areas is provided by DPIW's Private Land Conservation Program.
- Improved knowledge of the natural values of these areas, as relevant data has been collated and stored in the appropriate DPIW databases (e.g. Natural Values Atlas).

The project gave Tasmanian Midlands landholders the opportunity to contribute to the long-term protection and sustainable management of threatened species and their habitats. The project also raised the level of awareness of the whole Midlands community about the special biodiversity resources of the area.

This successful initiative has been built on by the Midlands Biodiversity Hotspots Tender, an Australian Government funded project conducted by the Tasmanian Land Conservancy. The tender process is likely to result in a further 35 new conservation agreements covering more than 8000 hectares, much of which is priority habitat for threatened species.

The project demonstrates how significant results can be achieved at a local scale with the support of the community. For more information see www.tasland.org.au.

## Case study 9: Back on Track (Queensland Government)

The Back on Track species prioritisation framework increases the capacity of the Queensland Government, NRM bodies and communities to prioritise decisions about where to focus action and investment to protect and recover Queensland's threatened biodiversity. The framework enables limited conservation resources for threatened species to be strategically targeted to achieve multi-species and landscape-level outcomes.

This framework prioritises species using multiple criteria, to identify the species that are in trouble and which have the greatest chance of recovery. The framework has been used to assess 4107 plant and animal species from marine, freshwater and terrestrial habitats. The process has identified threats and developed management actions for 285 priority species and these priority actions have been translated into tangible conservation outcomes via landscape-level conservation projects across multiple NRM regions in Queensland. This approach has been adopted in response to the urgent need to address the continuing decline in biodiversity and increasing threat of climate change.

A wide range of experts and NRM stakeholders has been consulted to identify the major threats to each priority species at the NRM region level and the actions required to address these threats. Preference is given to landscape-level actions that will benefit multiple species. Actions are detailed, prioritised and focussed to ensure the best allocation of resources over the following five years.

The resulting lists of priority species, threats and actions have been compiled into Biodiversity Action Plans for each NRM region in the state to guide investment in on-ground action, plans and strategies, community capacity building, and research and monitoring. These plans will be made available to all NRM practitioners through the online Recovery Actions Database.

The Back on Track species prioritisation framework is funded by the Queensland Environmental Protection Agency and the Australian Government.

Significant biodiversity outcomes have been achieved at regional, state and national levels by:

- building relationships with key partners to determine regional species priorities, threats and where to focus investment
- leveraging funding through partnerships with NRM groups and local government to deliver biodiversity outcomes for the state
- directing research priorities to fill information gaps
- intervening early to prevent the need to resort to regulatory approaches to solving issues
- implementing on-ground priority actions, including cross-regional projects such as 'Bringing Back the Beach Scrub' and 'Enhancing Biodiversity Hotspots along Western Queensland Stock Routes'.

The Back on Track species prioritisation framework has improved the delivery of conservation initiatives across the state and increased knowledge of strategic biodiversity issues.

For more information see www.epa.qld.gov.au/nature_conservation/wildlife.

### 3.2.5 Priority for change 5: Involving Indigenous peoples

#### Recognising the special relationship of Indigenous peoples with Australia's natural environments, the cultural significance of that relationship and its ongoing importance to the conservation of Australia's biodiversity

The important role of traditional Indigenous knowledge in contributing to the maintenance of Australia's biodiversity must be actively promoted to the whole Australian community. We also need to ensure that curricula at all levels in Australia promote an understanding of traditional Indigenous knowledge, how it has shaped Australia's environment, and the social and economic benefits of applying it in conjunction with modern management techniques.

Indigenous peoples now hold title or interest over a large and increasing proportion of Australia's lands and waters, including much of the protected area system and many areas of national biodiversity significance. The area of land under Indigenous management is currently 20% but many Indigenous communities remain socioeconomically deprived, with few employment options. Although the natural environment is a major basis for Indigenous culture, community goals for socioeconomic progress and biodiversity conservation on Indigenous lands are not always in harmony. Environmental management and biodiversity conservation can provide significant opportunities for employment, for maintaining culture and for raising living standards in Indigenous communities. The outcomes for biodiversity conservation will be most substantial where there is an equal sharing of knowledge and perspectives, and well-defined biodiversity conservation goals.

The actions and results for involving Indigenous peoples (Table 3.5) relate to the other five priorities for change of this strategy.

Traditional owners working on their country at Mount Willoughby Indigenous Protected Area, South Australia (Photo: I Haškovec)

## Table 3.5 Priority for change 5: Involving Indigenous peoples

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 5.1 Building ecosystem resilience by protecting habitat and reducing the impacts of threats** | | |
| 5.1.1 Support and resource Indigenous engagement in preparing and implementing plans for biodiversity conservation at all levels (see Objective 1.1.2). | Indigenous peoples are supported and resourced to engage in preparing and implementing bioregional-scale plans and their unique aspirations for conserving biodiversity are acknowledged in biodiversity conservation plans at all levels. | All governments and Indigenous peoples |
| 5.1.2 Wherever possible and appropriate, recognise traditional Indigenous knowledge and environmental management expertise, and apply or extend such management to biodiversity conservation. | Indigenous knowledge and management practices are respected, applied and extended, where appropriate, to develop a more distinctively Australian approach to biodiversity conservation. | All governments and Indigenous peoples |
| 5.1.3 Expand the Indigenous Protected Area system, and extend opportunities for employing Indigenous peoples as environmental managers for biodiversity conservation outcomes. | Areas of high biodiversity value on Indigenous lands are managed for biodiversity outcomes.<br>Indigenous peoples actively participate in environmental management for biodiversity conservation, and this activity forms a major employment component that contributes significantly to the wellbeing of Indigenous communities. | Partnerships between all governments, Indigenous peoples, the community and the private sector |
| 5.1.4. Implement appropriate collaborative management of existing protected areas with significant Indigenous interests. | Existing protected areas with Indigenous interests are managed effectively for biodiversity conservation with appropriate benefits for Indigenous owners, landholders or custodians. | Indigenous people in partnership with all governments |
| **Objective 5.2 Mainstreaming biodiversity, ensuring that all Australians understand how their lives and actions affect biodiversity, and how biodiversity supports them** | | |
| 5.2.1 Inform all Australians about Indigenous peoples' biodiversity values, rights and interests at all levels within the community, education and industry sectors. | Recognition of the key role of Indigenous peoples in conserving biodiversity is a core component of all biodiversity programs. | All governments in partnership with Indigenous peoples |
| 5.2.2 Ensure that biodiversity conservation outcomes are considered in planning for development on lands and waters owned or managed by Indigenous peoples. | National biodiversity conservation priorities and outcomes are facilitated through socioeconomic development in Indigenous communities. | All governments in partnership with Indigenous peoples and the private sector |
| 5.2.3 Develop processes that help displaced Indigenous peoples re-connect with their environmental knowledge and management skills, and with their culture. | Custodial transfer of Indigenous knowledge to help biodiversity outcomes and spiritual and physical health among displaced Indigenous people is enhanced. | All governments in partnership with Indigenous people |

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 5.3 Improving, sharing and using our knowledge of biodiversity for all** | | |
| 5.3.1 Reverse the ongoing erosion of Indigenous environmental knowledge. | Indigenous environmental knowledge is increasingly respected, recorded, transferred between generations and more broadly applied to environmental management. | Indigenous peoples in partnerships with all governments |
| 5.3.2 Resource Indigenous peoples' participation in biodiversity research (links to Objective 3.2). | | All governments in partnership with Indigenous people |
| 5.3.3 Support Indigenous peoples' access and connection to their country to ensure Indigenous biodiversity-related knowledge and practices are maintained. | Governments recognise and support Indigenous peoples' access and connection to their country and have adopted this aspiration in relevant management plans.<br>Other stakeholders acknowledge Indigenous peoples' connection to the land and cooperate where possible to assist this relationship. | Partnerships between all governments, Indigenous peoples, the community and the private sector |
| 5.3.4 Develop programs to support Indigenous communities to pass their knowledge on to younger community members. | Programs are in place to support Indigenous communities to pass their knowledge on to younger community members. | All governments in partnership with Indigenous people |
| 5.3.5 Recognise and respect Indigenous environmental knowledge including protocols relating to gender-specific knowledge and practices. | Policy and protocols are in place to recognise and respect Indigenous environmental knowledge including protocols relating to gender-specific knowledge and practices. | Indigenous peoples in partnerships with all governments |
| 5.3.6 Support training programs that allow Indigenous land and sea managers to complement their existing knowledge with western science and management practices. | The benefits of traditional Indigenous and scientific management approaches are combined for better biodiversity outcomes. | All governments in partnership with Indigenous people |
| 5.3.7. More effectively inform the broader Australian community about Indigenous environmental knowledge and management practices. | Indigenous environmental knowledge is included widely in school and university curricula, and in training for natural resource managers. | Indigenous peoples in partnerships with all governments |
| **Objective 5.4 Getting results by improving arrangements for effective delivery of conservation initiatives** | | |
| 5.4.1 Establish programs to train biodiversity policy makers and program deliverers to improve their understanding and awareness of Indigenous culture. | Biodiversity decision makers at all levels, particularly at the management level, are culturally aware, ensuring cultural competency in all decisions. Decision makers at every level are experienced in cultural competency. | All governments in partnership with Indigenous peoples |

| Actions | Results | Responsibilities |
|---|---|---|
| 5.4.2 Promote and resource Indigenous representation on various biodiversity decision-making forums and in environmental management generally. | Biodiversity decision-making forums include adequate representation of Indigenous peoples and Indigenous peoples form an increasing component of Australia's environmental managers. | All governments |
| 5.4.3. Develop novel, innovative and culturally appropriate approaches to funding of biodiversity management on Indigenous lands and seas, including in payments for environmental services, carbon and water trading, and flexible working conditions. | Resourcing for environmental management on Indigenous lands and seas is substantially increased and developed in a manner that best meets cultural requirements. | All governments in partnership with Indigenous peoples |
| 5.4.4 Encourage partnerships between Indigenous organisations and other biodiversity stakeholders. | Biodiversity conservation initiatives are resourced and undertaken to foster partnerships between Indigenous organisations and other biodiversity stakeholders. | Indigenous peoples in partnerships with all governments, the community and the private sector |
| **Objective 5.5 Measuring and reporting implementation and success of the strategy** | | |
| 5.5.1 Develop tools and techniques to account for the value of biodiversity and ecosystem services, specifically including Indigenous knowledge of biodiversity in baseline datasets where appropriate and available | Indigenous knowledge of biodiversity is valued as part of biodiversity management by being included in tools and techniques used to account for the value of biodiversity. | Indigenous peoples in partnerships with all governments |
| 5.5.2 Design appropriate measures of environmental outcomes of Indigenous environmental management practice and employment, and assess and report against those measures | Improved environmental outcomes are demonstrated and make a positive contribution to socioeconomic conditions in Indigenous communities. | Indigenous peoples in partnerships with all governments |

## Case study 10: Lake Condah—restoration through partnerships (Australian and Victorian governments)

The Australian and Victorian governments are providing funds to restore and manage Lake Condah in the Budj Bim area of south-western Victoria. Some of the funding will come from the Australian Government's Caring for our Country initiative, through the Indigenous Protected Area (IPA) program. The funding will help revitalise the biodiversity and ecology of the area and enable restoration of the Indigenous eel trapping and harvesting systems. Additional benefits from the restoration of Lake Condah will flow to the community and the local economy through the development of sustainable primary industries and cultural tourism.

The Lake Condah area (Budj Bim), located about 40 km north of Portland, is an ancient volcanic landscape characterised by major wetlands such as Lake Condah. The major threats to the wetlands are changes in water flows, reduction of water quality due to agricultural activities, and introduced plants and animals. The area is immensely important to its traditional owners the Gunditjmara people and is nationally recognised for its archaeological, cultural and environmental significance. The Victorian Volcanic Plains bioregion is rated as a very high priority for the creation of new conservation reserves under the Interim Biogeographic Regionalisation for Australia because currently only 1.3% of the region is protected.

The Winda Mara Aboriginal Corporation, for the Gunditjmara people, launched the Lake Condah Sustainable Development Project in 2002. The major goals of the project include restoration of Lake Condah, the restoration of the Lake Condah Church and gaining World Heritage listing for the Budj Bim landscape. Tyrendarra IPA, 20 km south of Lake Condah, was officially declared on 12 December 2003.

The restoration project involves a partnership between the Gunditjmara people, the Australian Government, the Victorian Department of Sustainability and Environment, Glenelg Hopkins Catchment Management Authority, Parks Victoria and Southern Rural Water through the Lake Condah Facilitation Group established in 2004.

The development of a 'whole-of-government' or multi-agency approach has focussed agency involvement with the project, clarified processes and departmental requirements to achieve the mutual objectives.

The Lake Condah Sustainable Development Project demonstrates the important role that local Indigenous communities and their traditional environmental knowledge can play in developing and implementing plans for biodiversity conservation at a landscape scale.

For more information see www.environment.gov.au/heritage/places.

### 3.2.6 Priority for change 6: Measuring success

#### Measuring and reporting the strategy's implementation and effectiveness and being accountable for meeting the targets we set

If the strategy is to be effective, we must monitor and evaluate progress on implementation of the actions. We can then adjust programs and policies to accommodate changing circumstances and make use of up-to-date knowledge. This will be particularly important when dealing with adaptation to climate change, because the precise impacts and consequences are unknown.

We must consolidate and build on our existing knowledge of biodiversity, so that we can accurately measure trends over time through audit and reporting processes, such as state of the environment reporting. Developing mechanisms that will incorporate biodiversity—and the value and benefits that it provides—into national accounts and markets is another essential step.

We will also need to monitor whether community awareness and understanding of biodiversity conservation is changing the way we manage our natural resources. If it is not, we will need to readjust our engagement and awareness-raising processes accordingly.

Finally, we need to be explicit about which long-term outcomes the strategy is trying to achieve. These outcomes will provide the basis for measuring the strategy's objectives.

Catchment officer at Cattai National Park, NSW, developing a spatial database to link on-ground works with priorities for future action (Photo: J Baker)

## Table 3.6 Priority for change 6: Measuring success

| Actions | Results | Responsibilities |
|---|---|---|
| **Objective 6.1 A robust, long-term national monitoring, evaluation and reporting framework is established and linked to state of the environment reporting.** | | |
| 6.1.1 Build baseline datasets, including key indicators, to measure biodiversity condition and trends over time. | All levels of government are using nationally consistent baseline datasets linked to state of the environment reporting that:<br>■ include key indicators<br>■ measure biodiversity condition and trends over time<br>■ are used to inform and help fine tune policy. | All governments and the science sector |
| 6.1.2 Improve information infrastructure to support baseline datasets. | A well-resourced information infrastructure is enabling the effective sharing of data across all jurisdictions and natural resource management groups as well as internationally. | All governments and the science sector |
| 6.1.3 Implement and maintain a nationally representative set of long-term monitoring protocols and sites. | Long-term monitoring sites are reflecting a cross section of representative ecosystem types and are connected to a national and global monitoring system.<br>Outputs from sites are being used to fine tune policy and are linked to state of the environment reporting. | Partnerships between all governments, the community and the private sector |
| **Objective 6.2 Biodiversity and ecosystem services are integrated into national accounts and markets** | | |
| 6.2.1 Develop tools and techniques to account for the value of biodiversity and ecosystem services. | Quantitative and qualitative indicators are being used to compare the value of biodiversity and ecosystem services to other alternatives (e.g. the economic and social value of a development). | All governments and the science community |
| 6.2.2 Incorporate biodiversity and ecosystem services into national accounts and corporate reporting. | Impacts on biodiversity and ecosystem services are being considered alongside other economic and social impacts.<br>All sectors of the economy are making more effective decisions about biodiversity conservation and sustainable development. | Australian Government to lead |
| **Objective 6.3 Community awareness and behavioural change regarding biodiversity is measured over time** | | |
| 6.3.1 Undertake systematic time-series surveys through the Australian Bureau of Statistics to measure community awareness of the need for biodiversity conservation, associated behavioural change and engagement in biodiversity conservation. | Decision makers are informed of, and act on, levels of public awareness of biodiversity.<br>Australians and the nation's decision makers are fully informed of the importance of, and their role in, biodiversity conservation. | Australian Government to lead |
| **Objective 6.4 Biodiversity conservation programs and actions are effective and measured over time** | | |
| 6.4.1 Monitor and evaluate the effectiveness of programs and actions at regional, state and national levels. | Programs and actions at all levels (spatial and jurisdictional) are being regularly monitored and reported. | All governments |
| 6.4.2 Cause practitioners to modify and change practices as a result of monitoring the effectiveness of programs. | Adaptive management techniques have been applied at all levels of biodiversity conservation delivery and practice. | Partnerships between all governments, the community and the private sector |
| 6.4.3 Monitor and report on the effectiveness of the strategy at five-year intervals. | Existing processes, such as state of the environment reporting, include information that can be used to assess the effectiveness of the strategy. | All governments |

### Case study 11: Park monitoring (Northern Territory Government)

The establishment of national parks or other conservation reserves is a critical component of biodiversity conservation; however, establishment alone does not provide for conservation security.

To deliver good conservation outcomes for national parks, we need to know what biodiversity exists in parks, how it is faring, and how it should best be managed. To these ends, a comprehensive and integrated biodiversity monitoring program has been developed across three large national parks: Kakadu, Litchfield and Nitmiluk.

This robust and integrated monitoring program is fundamental in the joint management of these parks, all of which are situated in the Top End of the Northern Territory. The program is based on agreed commitments and management planning that stipulate the maintenance of biodiversity and, in the case of Kakadu, an obligation under World Heritage agreements to maintain heritage values. Without detailed monitoring it is not possible to measure performance towards such commitments, or to improve management in the face of threats, particularly fire and climate change.

This program uses a large series of permanent plots (133 in Kakadu, 41 in Litchfield and 46 in Nitmiluk), in which vegetation and vertebrate fauna are systematically monitored at five-year intervals. The monitoring program is aimed at the assessment of impacts of fire regimes and management, because fire is a particularly important process in this region. For each plot, a detailed fire history is recorded and used to inform changes in vegetation or fauna over successive monitoring periods.

Sampling of the plots is a collaborative and challenging exercise. Park rangers and Indigenous traditional owners work on the monitoring with biologists and managers from the Northern Territory Department of Natural Resources, Environment, the Arts and Sport, and Parks Australia (Australian Government).

In the 15 years since its establishment, the monitoring program has provided clear information showing decline in some fire-sensitive heath lands, localised expansion of some rainforest patches, increases and decreases in forest stand basal areas dependent upon fire history, region-wide increases and decreases in some plant species, and overall decline in native mammal fauna in part related to fire history. These results are regularly reported back to park managers and serve to re-direct park management priorities and practice.

Measuring performance, particularly on this scale, provides invaluable information about ecological responses to park management practices.

For more information see www.nt.gov.au/nreta/wildlife.

# Appendixes

# Appendix 1 Roles and responsibilities for implementing the strategy

The strategy is designed to provide a road map for all groups that are currently involved in conserving biodiversity. For the strategy to be truly effective all Australians must understand the intrinsic value of Australia's biodiversity so that they can share in the responsibility for protecting our biodiversity.

The sections below outline the broad roles and responsibilities of different groups—all of whom are important to the success of the strategy—in implementing the strategy.

## A1.1 Indigenous peoples

About 20% of Australia's land is managed by Indigenous communities, and these communities need to be central and active partners in the long-term conservation of biodiversity.

## A1.2 General community

For this strategy to be effective, all Australians need to want, and be prepared, to contribute personally to biodiversity conservation. This would involve learning more about how to live sustainably; for example, by supporting, joining or forming groups concerned with issues such as conserving particular species or areas, reducing their ecological footprint and living more sustainably.

## A1.3 Natural resource management regional bodies

Bodies managing the 56 natural resource management regions that cover all of Australia need to participate in planning, coordinating and monitoring biodiversity as part of broader natural resource management programs. In some jurisdictions, they already implement programs associated with biodiversity conservation. This strategy provides regional bodies with clear guidance on agreed national priorities. It can be used to develop and implement strategic plans and to identify new investment opportunities and partnership arrangements for biodiversity conservation.

## A1.4 Non-government organisations

Non-government organisations, such as peak environmental, Indigenous and industry groups, have considerable local knowledge and expertise in conservation management. They also have effective formal and informal information networks that offer an important mechanism for improving Australia's biodiversity knowledge.

## A1.5 Private sector

The private sector includes the fisheries, forestry, agriculture, tourism, financial, and land and urban development industries. These sectors are influential in determining the nature of most development and investment decisions that affect private lands and the ocean. Enduring partnerships with the private sector will help to ensure that common biodiversity conservation objectives and investments are understood and coordinated.

## A1.6 Research and education communities

Implementing the strategy will require the best available scientific expertise and knowledge. Governments have well-established links with the research community and this strategy provides an opportunity to strengthen these partnerships in specific scientific and technical areas that will be required for effective implementation. Establishing practical partnerships with educators and communicators will also be valuable in increasing the community's awareness and understanding of Australia's biodiversity and its role in our society.

## A1.7 International and national

Australia is party to various international treaties and bilateral agreements dealing with the different components of biodiversity conservation (Appendix 2). These agreements impose particular obligations and require a range of actions to be undertaken to address particular matters of concern to the international community. This strategy meets one of Australia's specific obligations under the United Nations *Convention on Biological Diversity*, and supports the clear alignment of national priorities and outcomes with ongoing international efforts to conserve biodiversity.

## A1.8 Australian Government

The Australian Government is responsible for managing Australia's international border; this includes regulating the import and export of animals and plants, and substances and items made from them. It also manages Commonwealth lands, such as defence establishments and Commonwealth national parks, and administers the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act, among other things, protects matters of 'national environmental significance', such as listed threatened species, ecological communities and wetlands of international importance.

The Australian Government is also responsible for the oceans between the limit of state and territory managed waters (within three nautical miles of their coasts) and the 200 nautical mile boundary of Australia's exclusive economic zone. The long-term protection of biodiversity in these waters is being secured through the establishment and management of Marine Protected Areas.

The Australian Government provides significant investment in biodiversity conservation, including through the Caring for our Country initiative. This strategy will guide and help prioritise the Australian Government's investments.

## A1.9 State and territory governments

The state and territory governments have primary constitutional and legal responsibility for the management of land, water and biodiversity within their jurisdictions. All states and territories have established legislation, policies, strategic planning frameworks and management approaches for managing and protecting biodiversity (Appendix 3).

One of the primary purposes of this strategy is to agree on a set of objectives and clear outcomes that will support state and territory governments to align their specific priorities and investments with a broader national context.

## A1.10 Local government

Local initiatives are important for achieving ecologically sustainable development. Local government is a valuable and ongoing contributor to efforts to conserve biodiversity through its role in local and regional planning and, increasingly, through its role in environmental management, monitoring and reporting. Local government engagement in the strategy will, in general, be managed through the relevant state and territory government mechanisms.

# Appendix 2 Foundations of the strategy

## A2.1 Background to the strategy

The United Nations *Convention on Biological Diversity* (CBD) is a global agreement addressing all aspects of biodiversity—namely, genes, species and ecosystems. Article 6 of the CBD commits parties to develop national strategies, plans or programs for the conservation and sustainable use of biodiversity, and to, as far as possible, integrate biodiversity conservation into broader policies and programs.

In 1996, Australia's first national biodiversity strategy—*National Strategy for the Conservation of Australia's Biological Diversity* (DEST 1996)—was prepared by the Australian and New Zealand Environment and Conservation Council (ANZECC) and endorsed by the Council of Australian Governments. The strategy fulfilled Australia's obligations under the CBD.

Australia's 1996 biodiversity strategy addressed six 'themes', covering terrestrial and, to a limited extent, marine[2] and other aquatic (freshwater) biological systems. These themes were:

- conservation of biological diversity across Australia
- integrating biological diversity conservation and natural resource management
- managing threatening processes
- improving our knowledge
- involving the community
- Australia's international role.

The strategy also outlined a series of priority actions for implementation by 2000 and 2005.

## A2.2 Earlier reviews of the strategy

The 1996 biodiversity strategy required a five-yearly review of the strategy's implementation. In June 2001, ANZECC systematically assessed the extent to which the strategy's objectives had been achieved. The review found that some advances had been made (e.g. the adoption of ecologically sustainable wildlife management practices and the implementation of sustainable forestry management practices).

[2] The treatment of marine issues was limited to fisheries.

However, several of the strategy's objectives had not been fully met, including:

- recognition of the contribution of Indigenous peoples to biodiversity conservation
- adoption of ecologically sustainable practices in fisheries, agricultural and pastoral management
- management of threatening processes
- effective controls on the clearance of native vegetation.

Reasons why these objectives were not met included an incomplete knowledge of Australia's biodiversity, the long timeframes required to see change, competing priorities and the difficulty of objectively measuring performance and assessing progress.

To address these gaps, ANZECC developed the *National Objectives and Targets for Biodiversity Conservation 2001–2005* (DEH 2001), which set objectives and targets for 10 priority outcomes. These objectives and targets were endorsed by the Australian Government; the states of Victoria, New South Wales, South Australia and Western Australia; and the Australian Capital Territory.

## A2.3 Second five-year review of the strategy

A National Biodiversity Strategy Review Task Group was set up in 2006 under the Natural Resource Management Ministerial Council (NRMMC), which superseded ANZECC, to manage the second five-yearly review of the strategy. The NRMMC consists of the government ministers from the Australian Government, state and territory governments, and the New Zealand Government who are responsible for primary industries, natural resources, environment and water policy.

The task group consisted of members from state and territory governments, the Australian Government, the Bureau of Meteorology, and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The task group reviewed the strategy by:

- seeking feedback on the original strategy through consultation with the community, including Indigenous peoples, and with key stakeholders across Australia in face-to-face meetings (supported by the circulation of a discussion paper), workshops, focus groups and phone interviews; discussions focused on issues of importance to each group
- seeking feedback on the original strategy, and on challenges and opportunities for biodiversity conservation, from different levels of government, including through committees with responsibility for a diverse set of environment issues and natural resource management responsibilities
- reflecting on the effectiveness of the *National Objectives and Targets for Biodiversity Conservation 2001–2005* (DEH 2001) and lessons learnt from the implementation of the strategy

- commissioning research into
  - the community's understanding and awareness of the importance of biodiversity
  - the consistency between the goals of the national biodiversity policy (the original strategy and national objectives) and state/territory and industry biodiversity strategies.

A Biodiversity Decline Working Group was established in 2004 to report to the NRMMC on the underlying causes of decline in terrestrial biodiversity in Australia. In 2005, the working group reported that they had identified three broad issues as the main threats to biodiversity, and as areas where strategic investment would lead to long-term improvements to biodiversity assets: loss of habitat values and ecosystem function; spread of invasive species; and climate change (Biodiversity Decline Working Group 2005).

A second Biodiversity Decline Working Group was established in 2006 by the NRMMC to report on the underlying causes of decline in marine biodiversity in Australia. In 2008, a report was tabled at the NRMMC that identified five key threats to marine biodiversity: unsustainable resource use; climate change; land-based impacts; marine invasive species; and pollution (Marine Biodiversity Decline Working Group 2008).

The task group also examined a number of reports, developed through various national, state and territory processes, on the condition of Australia's biodiversity. Two of these processes are discussed below.

### State of the environment reporting

State of the environment reporting, at the national, and state and territory level, provides information about biodiversity conditions, trends and pressures for the Australian continent, the surrounding seas and Australia's external territories. The reports are prepared every five years, so far in 1996, 2001 and 2006 (State of the Environment Advisory Council 1996; Australian State of the Environment Committee 2001; Beeton et al. 2006). Where possible, the reports are based on data and information gathered and interpreted against environmental indicators.

### Land and water resources audits

In 1997, the National Land and Water Resources Audit (NLWRA) was established to provide baseline assessments of Australia's natural resources as a basis for improved decision making in natural resource management. An Australian terrestrial biodiversity assessment was carried out by the NLWRA in 2002. The NLWRA had a particular focus on coordinating national collations of accessible information on Australia's natural resources.

Table A2.1 lists key events and processes that informed the development and review of the original strategy, and assisted in the development of this revised strategy.

## Table A2.1 A chronology of key events and processes that informed the development of the strategy

| Date | Key events and processes |
|---|---|
| 1993 | Australia ratifies Convention on Biological Diversity |
| 1996 | All Australian governments endorse the *National Strategy for the Conservation of Australia's Biological Diversity* (DEST 1996) |
| 1996 | First *Australia: State of the Environment* report (State of the Environment Advisory Council 1996) |
| 1997 | National Land and Water Resources Audit established |
| 2001 | ANZECC *Review of the National Strategy for the Conservation of Australia's Biological Diversity* (ANZECC 2001) |
| 2001 | *National Objectives and Targets for Biodiversity Conservation 2001–2005* (DEH 2001) endorsed by the Commonwealth, New South Wales, Western Australia, South Australia, Victoria and the Australian Capital Territory |
| 2001 | Second *Australia State of the Environment* report (Australian State of the Environment Committee 2001) |
| 2002 | First *Australian Terrestrial Biodiversity Assessment* (Sattler and Creighton 2002) |
| 2005 | *A National Approach to Biodiversity Decline* (Biodiversity Decline Working Group 2005) |
| 2006 | Establishment of the National Biodiversity Strategy Review Task Group |
| 2006 | Third *Australia State of the Environment* report (Beeton et al. 2006) |
| 2006 | Circulation of the *Review of the National Strategy: Background Paper* |
| 2008 | *A National Approach to Addressing Marine Biodiversity Decline* (Marine Biodiversity Decline Working Group 2008) |

# **Appendix 3** International context

Conservation of biodiversity is a global concern and national action is needed to support international cooperation. Australia can do much to conserve its own biodiversity, and at the same time contribute to the conservation and ecologically sustainable use of biodiversity at the domestic and global levels. We participate in the development and implementation of a large number of international agreements—bilateral and multilateral—related to environment management and conservation.

The 1996 strategy was developed to fulfil Australia's international obligations under the United Nations *Convention on Biological Diversity* (CBD), which seeks to sustain the diversity of life on earth. The CBD represents an international recognition that biodiversity is globally important, intrinsically valuable and vital to human activity and the wellbeing of present and future generations. It has three main objectives:

- the conservation of biological diversity
- the sustainable use of its components
- the fair and equitable sharing of benefits arising from genetic resources.

The CBD was formalised at the Earth Summit in Rio de Janeiro in June 1992, a major international gathering of nations and non-government organisations. The summit focused on the environment, conservation, sustainable development and wise use of biodiversity, with the aim of gaining international agreement on how to act on these important issues.

The CBD has been signed by 194 of the world's 198 governments, including Australia. It obliges all signatories to develop a national biodiversity strategy that is consistent with the CBD's three objectives. In 2002, parties to the CBD made an additional commitment 'to achieve by 2010 a significant reduction of the rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth'.

Other international multilateral instruments relating to biodiversity that Australia is party to include:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS/Bonn Convention)
- International Convention for the Regulation of Whaling (ICRW)
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
- United Nations Framework Convention on Climate Change (UNFCCC)
- Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)

## Table A3.1 International policies, multilateral agreements, bilateral agreements and memoranda of understanding to which Australia is a party

| Year | Policies, multilateral agreements, bilateral agreements and memoranda of understanding |
|---|---|
| 1946 | International Convention for the Regulation of Whaling |
| 1959 | The Antarctic Treaty |
| 1971 | Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) |
| 1972 | Convention for the Conservation of Antarctic Seals |
| 1973 | International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) |
| 1973 | Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) |
| 1975 | Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) |
| 1976 | Convention on Conservation of Nature in the South Pacific (Apia Convention) |
| 1979 | Convention on the Conservation of Migratory Species of Wild Animals (CMS/Bonn Convention) |
| 1981 | Japan–Australia Migratory Bird Agreement (JAMBA) |
| 1982 | United Nations Convention on the Law of the Sea (UNCLOS) |
| 1982 | Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) |
| 1986 | Convention for the Protection of the Natural Resources and Environment of the South Pacific (SPREP) |
| 1988 | China–Australia Migratory Bird Agreement (CAMBA) |
| 1991 | Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) |
| 1992 | Rio Declaration on Environment and Development |
| 1992 | Convention on Biological Diversity (CBD) |
| 1993 | Agreement for the Establishment of the Indian Ocean Tuna Commission |
| 1992 | United Nations Framework Convention on Climate Change (UNFCCC) |
| 1994 | Convention on the Conservation of Southern Blue Fin Tuna |
| 1992 | United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa |
| 1997 | International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries |
| 1998 | Kyoto Protocol to the UNFCCC |
| 1999 | International Plan of Action for the Conservation and Management of Sharks |
| 1999 | International Plan of Action for the Management of Fishing Capacity |
| 2001 | Agreement on the Conservation of Albatrosses and Petrels |
| 2001 | International Convention on the Control of Harmful Anti-Fouling Systems on Ships |
| 2001 | Indian Ocean–Southeast Asian Marine Turtle Memorandum of Understanding |
| 2003 | Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean |
| 2004 | Convention for the Control and Management of Ships' Ballast Water and Sediments |
| 2006 | The Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East Asian–Australasian Flyway (Flyway Partnership) |
| 2007 | Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA) |

# **Appendix 4** Australian frameworks, policies, legislation and reports

Table A4.1 National frameworks, policies, legislation and reports

| Year | Framework/policy |
|---|---|
| 1908 | *Quarantine Act* |
| 1975 | *Great Barrier Reef Marine Park Act 1975* |
| 1980 | *Antarctic Treaty (Environment Protection) Act 1980* |
| 1981 | *Environment Protection (Sea Dumping) Act 1981* |
| 1981 | *Antarctic Marine Living Resources Conservation Act 1981* |
| 1984 | National Conservation Strategy for Australia |
| 1987 | *Sea Installations Act 1987* |
| 1991 | *Fisheries Management Act 1991* |
| 1992 | National Forest Statement |
| 1992 | National Strategy for Ecologically Sustainable Development |
| 1992 | Intergovernmental Agreement on the Environment |
| 1993 | *Native Title Act 1993* |
| 1994 | *Wet Tropics of Queensland World Heritage Area Conservation Act 1994* |
| 1994 | Council of Australian Governments Water Reform Framework |
| 1995 | Commonwealth Coastal Policy |
| 1996 | National Strategy for the Conservation of Australia's Biological Diversity |
| 1996 | Australia: State of the Environment report |
| 1996 (onwards) | Threat abatement plans (various) |
| 1997 | Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia (JANIS criteria) |
| 1997 | Wetlands Policy of the Commonwealth Government of Australia |
| 1997 | *Natural Heritage Trust of Australia Act 1997* |
| 1997 | National Weeds Strategy |
| 1998 | Quarantine Proclamation 1998 |
| 1998 | National Water Quality Management Strategy |
| 1998 | National Oceans Policy |
| 1998 | National Greenhouse Strategy |
| 1998 | Guidelines for Establishing the National Representative System of Marine Protected Areas |
| 1999 | National Local Government Biodiversity Strategy |
| 1999 | National Framework for the Management and Monitoring of Australia's Native Vegetation |
| 1999 | National Principles and Guidelines for Rangeland Management |

| Year | Framework/policy |
|---|---|
| 1999 | *Environment Protection and Biodiversity Conservation Act 1999* |
| 2001 | National Objectives and Targets for Biodiversity Conservation 2001–2005 |
| 2001 | Coastal Catchments Initiative |
| 2001 | National Approach to Firewood Collection and Use in Australia |
| 2001 | Australia State of the Environment report |
| 2001 | Biodiversity Conservation Research: Australia's Priorities |
| 2002 | *Regional Forest Agreements Act 2002* |
| 2002 | National Framework for Environmental Management Systems in Australian Agriculture |
| 2002 | National Framework for NRM Standards and Targets (NRMMC 2002) |
| 2003 | Framework for a National Cooperative Approach to Integrated Coastal Zone Management |
| 2003 | Native Fish Strategy for the Murray-Darling Basin 2003–2013 |
| 2004 | National Water Initiative |
| 2004 | National Biodiversity and Climate Change Action Plan 2004–2007 |
| 2004 | Great Barrier Reef Marine Park Zoning Plan |
| 2005 | Farm Forestry National Action Statement |
| 2005 | Directions for the National Reserve System—a Partnership Approach |
| 2006 | Australia State of the Environment report |
| 2007 | Australian Weeds Strategy |
| 2007 | Australian Pest Animal Strategy |
| 2007 | *Water Act 2007* |

## Table A4.2 State and territory frameworks, policies, legislation and reports

| Jurisdiction | Framework/policy | Legislation |
|---|---|---|
| Australian Capital Territory | ACT Nature Conservation Strategy (1991) | *Nature Conservation Act 1980*<br>*Environmental Protection Act 1997* |
| New South Wales | NSW Biodiversity Strategy (1999)<br>2007–2008 NSW Biodiversity and Climate Change Adaptation Framework | *Threatened Species Conservation Act 1995*<br>*Threatened Species Conservation Amendment Act 2002* |
| Northern Territory | Northern Territory Parks and Conservation Masterplan (draft) | *Territory Parks and Wildlife Act 1977*<br>*Territory Parks and Wildlife Conservation Act 2000*<br>*Territory Parks and Wildlife Conservation Amendment Act 2006* |
| Queensland | Queensland Biodiversity Policy Framework (2003) | *Nature Conservation Act 1992*<br>*Wet Tropics World Heritage Protection and Management Act 1993*<br>*Vegetation Management Act 1999*<br>*Marine Parks Act 2004*<br>*Environmental Protection Act 1994* |
| South Australia | No Species Loss—A Nature Conservation Strategy for South Australia 2007–2017 | *National Parks and Wildlife Act 1972*<br>*Native Vegetation Act 1991*<br>*Natural Resources Management Act 2004*<br>*Proposed new biodiversity conservation legislation* |
| Tasmania | Tasmania's Nature Conservation Strategy (2002–2006)<br>Tasmanian Regional Forest Agreement (1997) | *Threatened Species Protection Act 1995*<br>*Nature Conservation Act 2002*<br>*Forest Practices Act 1985*<br>*Environmental Management and Pollution Control Act 1999*<br>*National Parks and Reserves Management Act 2002* |
| Victoria | Victoria's Biodiversity Strategy (1997)<br>Victoria's Native Vegetation Management—a Framework for Action (2002) | *Flora and Fauna Guarantee Act 1988*<br>*Planning and Environment Act 1987*<br>*Wildlife Act 1975*<br>*Environment Effects Act 1978*<br>*Environment Protection Act 1970* |
| Western Australia | A 100-year Biodiversity Conservation Strategy for Western Australia: Blueprint to the Bicentenary in 2029 (draft) | *Wildlife Conservation Act 1950—to be replaced by the proposed Biodiversity Conservation Act* |

# **Appendix 5** Approaches to decision making

## A5.1 Introduction

Decision making for the conservation and management of biodiversity has become increasingly sophisticated. There has been a move from the ad hoc towards more systematic decision making in conserving and managing biodiversity. New tools and methods have increased our ability to be more efficient, for example, improved computational power to analyse data, and modelling approaches to compare management scenarios and evaluate their potential effectiveness. The most suitable approach to the conservation and management of biodiversity will depend on many factors, including which biodiversity is being targeted and the geographic and temporal scale being considered. There can be a range of possible responses, which will be constrained by the state of knowledge and the availability of resources. In any place, there may be many biodiversity problems that might merit attention but are potentially in competition for finite resources.

## A5.2 Knowledge and uncertainty

Adequate knowledge is often limited in decision making and uncertainty is pervasive in terms of our confidence in what we know, what it is possible to know and the real outcomes of the decisions that we make with this knowledge. Our knowledge of those species, ecological communities, ecosystems or areas that are to be protected; the relative importance of events, processes or species that threaten these entities; and the best ways to ensure their continued persistence and maintain their viability or condition, is incomplete. The complexity of open natural systems is a challenge to our understanding. Despite a body of work, there are still important gaps in, for example, our understanding of the constituent parts, their relationships, and to what threshold a system can be perturbed and still maintain its resilience and continue to perform the same functions. Often, decisions may need to be made relatively quickly in this environment of uncertainty, with the available time not permitting extensive deliberations in decision making.

Work is under way to address some of these gaps; the scope includes improving our knowledge of biodiversity and its roles and relationships, cost-effective allocation of resources for investment performance in biodiversity outcomes, how threats impact valued biodiversity and suitable management strategies. Along with filling in the knowledge gaps, research is also being directed towards decision making itself and trying to answer questions such as:

- How can we make the best decisions possible with the available information?
- How do we best consider the uncertainties and risks associated with the decisions?

- How do we consider ecological, social and economic information together?
- What are the trade-offs being made in decision making?
- How can we learn from experience and improve our decision making?

## A5.3 Decision-making approaches

There is now a better understanding that biodiversity is not static but dynamic in space and time and that we are prioritising, conserving and managing this biodiversity under changing conditions. There is better definition of the problems, questions and issues being addressed and an improved focus on the outcomes desired, along with a consideration of the steps required to achieve the long-term outcomes. Faced with difficult choices in allocating priorities in complex systems, biologists and others have proposed a range of decision rules to assist in biodiversity conservation:

- *Triage*—Attention is directed to problem cases where investment is most likely to be successful. These may not necessarily be the cases that are most threatened. It does not imply that the species or ecological communities which do not receive investment or the same level of investment are less important, just that they have been judged to be less responsive to intervention.
- *Threatened species and ecological communities*—A legislatively enshrined system directs resources to the most threatened species and ecological communities—those that are most likely to disappear in the absence of immediate help.
- *Biodiversity hotspots*—Recognition and priority management is directed to areas that are rich in biodiversity and may include a concentration of endemic species (this may overlap with 'distinctive species').
- *Distinctive species*—We look after species that are in evolutionary terms most distinctive, that is with the greatest genetic differences from other species (e.g. many endemic species).
- *Keystone and ecological engineer species*—Some species are disproportionately important and their loss is likely to cause reverberations across a much broader suite of biodiversity.
- *Human-centric species*—Species humans have an affinity for or can make some use of.
- *Representation*—Healthy examples of all Australian environments and the biota they support are maintained through a comprehensive, adequate and representative National Reserve System. Not all identified occurrences of important biodiversity can be placed in reserves, and substantial occurrences of highly valued biodiversity occur on private land. Governments are creating incentives to make it attractive to land managers to deliberately manage for biodiversity and maintain these values through mechanisms such as stewardship and covenant schemes.
- *Site irreplaceability (a measure of uniqueness)*—An approach that focuses only on species diversity may mean that the species, ecological communities, habitats or ecosystems that occur only in areas that do not support high biodiversity

may not be adequately conserved, so a consideration of irreplaceability may be required (e.g. the arid zone of Australia has low diversity but high importance). Also required is consideration of how vulnerable these sites are, or may become, to determine whether immediate action is required.

- *High-quality sites*—Selecting and maintaining healthy, intact and resilient systems, and managing threats so that they stay within limits that systems can tolerate, can be a cost-effective way to maintain biodiversity.
- *Ecosystem services approaches*—Such approaches would seek to integrate the ecological, social and economic dimensions of natural resource management, as well as to conserve biodiversity. They would identify and classify the ways people value biodiversity and the benefits people derive from biodiversity; describe and communicate those benefits in ways people can understand; and deal with crucial aspects of managing biodiversity so that it continues to deliver its ecosystem services.
- *International importance*—Recognition and prioritised management is directed to internationally important areas or species such as Ramsar wetlands, World Heritage national parks, international biodiversity hotspots and migratory species.
- *Systematic conservation planning*—A number of systematic steps are taken, including: involving stakeholders, establishing context, identifying goals, compiling biological and socioeconomic data, setting conservation targets with expert judgment, undertaking analysis to identify the highest priority conservation areas (tenure neutral), applying conservation action and maintaining values, and monitoring established conservation areas (Cowling and Pressey 2003; Cowling et al. 2003).

Conservation and management of biodiversity also increasingly includes decision-making elements such as scale, connectivity, resilience, adaptability and the ability of some ecosystems to transform into a new ecosystem ('transformability'). There is a movement towards recognition of a more holistic management approach (e.g. at the landscape level) that focuses on what contributes to the problem, rather than managing the symptoms of the causal factors.

There is merit in all these approaches, and there have been attempts to work out priorities using a range of approaches simultaneously. These varying perspectives on how to prioritise investment in biodiversity conservation are important.

However, perhaps more fundamental is the recognition that all Australian landscapes, seascapes and species are sustained by an array of ecological processes whose functioning determines the health and composition of all ecological communities and, indeed, the productivity and use of lands and waters. These ecological processes are the foundation of Australia's biodiversity and thus merit a greater conservation management focus.

The strategic question is also affected by scale; what might seem to be the most pressing priority at a local scale does not necessarily contribute to priorities at the regional, national or international scales. The reverse also applies.

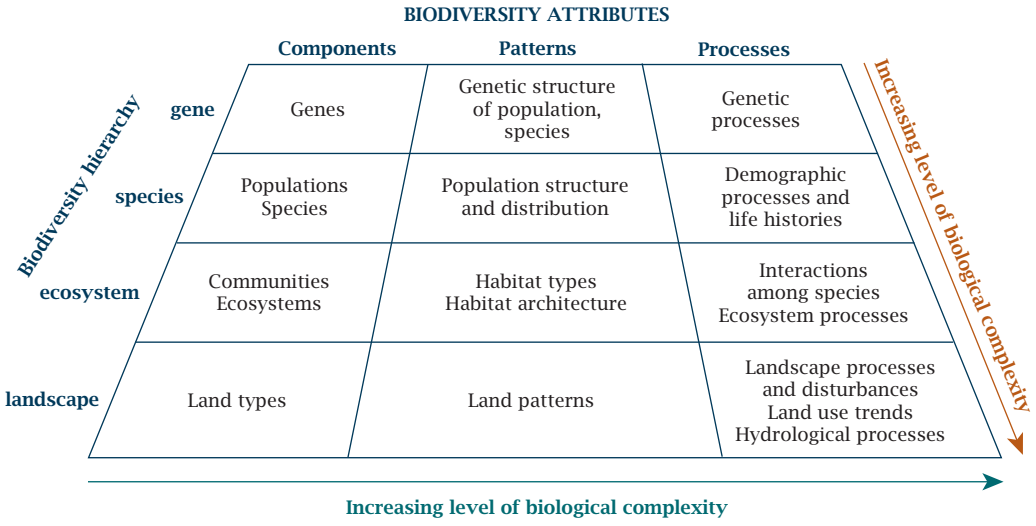
# Appendix 6 What is biodiversity?

This appendix expands on the definition of biodiversity given in Chapter 2. The three main levels that make up biodiversity—genes, species and ecosystems—can also be described in terms of their attributes:

- *components*—the identity and variety of the genes, species and ecosystems
- *patterns*—the spatial distribution of genes, species, habitat and other resources at a range of scales from small patches to landscapes, including
  - whether different forms of genes are distributed evenly throughout populations, landscapes and larger scales, or whether some genotypes are becoming isolated
  - whether habitat is complex or simple in terms of the species, growth forms and non-living resources present
  - whether habitat is distributed evenly or unevenly, or is connected or disconnected throughout landscapes
- *processes*—ecological and evolutionary processes whereby genes, species and ecosystems interact with one another and with their environment.

Figure A6.1 illustrates the attributes of the biodiversity hierarchy. Together, the components, patterns and processes in ecosystems determine the ecosystems' structures and the functions they perform, including those that maintain the ecosystems and those that humans value.

Figure A6.1 Attributes of the biodiversity hierarchy (adapted from Peck 1998)



# **Appendix 7** Snapshots of Australia's biodiversity

## A7.1 Australian Alps

Alpine herb fields above the treeline in the Australian Alps, Victoria (Photo: TJ Ierino and DEWHA)

The Australian Alps stretch along the southeast of Australia through Victoria, New South Wales and the Australian Capital Territory. This is the only mainland area of Australia with an alpine zone where snow cover persists for several months of the year. Despite representing less than 1% of Australia, this unique landscape is considered to be of national and international significance (Kirkpatrick 1994).

The Australian Alps contain the most significant extent of alpine communities in mainland Australia, and the area is identified as a centre of vascular plant endemism. The Alps contain 14 wetlands of national significance, 78 types of ecosystems (23 identified as threatened) and more than 20 state or nationally listed vulnerable or endangered species. Approximately 1.6 million hectares of the Australian Alps are protected in more than 11 different parks and reserves, including Kosciuszko National Park, which covers 690 000 hectares.

In general, the Australian Alps can be considered to be in good condition. However, a number of threats have a negative effect on the environment (Williams and Wahren 2005; ANRA 2007). These include:

- invasive species
- grazing
- changing fire regimes
- increasing fragmentation of ecosystems
- loss of remnant vegetation
- climate change
- pressure from tourism.

Climate change is considered likely to have the most severe and long-term impact on biodiversity in the Australian Alps and it is the threat least able to be affected by management (Williams and Wahren 2005). The low altitude of the Australian Alps—just over 2000 m at their highest point—means that the alpine zone cannot contract to higher regions of the mountains as the climate warms. Temperature increases could, therefore, result in the severe reduction or loss of alpine ecosystems in Australia (Williams and Wahren 2005).

## A7.2 Temperate woodlands, grassy woodlands and grasslands

Woodlands and grassy woodlands are broadly categorised ecosystems that are generally described as containing widely spaced trees with crowns that are not touching, with grassy or shrubby understoreys. Grassy woodlands often form a continuum with temperate grasslands. These ecosystems occur in a wide arc from Adelaide in South Australia to Armidale in New South Wales and in the southwest of Western Australia.

Temperate woodlands, grassy woodlands and grasslands are the most highly modified ecosystems in Australia. Threats include:

- habitat modification and fragmentation
- altered fire regimes
- invasive species
- climate change.

Eucalypt woodlands form a transitional zone between the higher rainfall forested margins of the continent and the arid interior. They are widespread throughout the mountain ranges and plains of the Great Dividing Range in eastern Australia and east of the coastal ranges in the southwest of Western Australia. Box woodlands, named after the dominant box eucalypt tree species, once covered about 10 million

hectares of southeastern Australia. Temperate woodland is one of the most extensively cleared and modified ecosystem types in Australia, particularly in the agricultural zones of eastern Australia and in the southwest of Western Australia. In many regions, only small isolated fragments remain, often along creeks, road verges and rocky outcrops.

Native temperate grasslands are naturally treeless ecosystems dominated by native tussock grass genera such as *Themeda* (kangaroo grasses), *Danthonia* (wallaby grasses), *Poa* (tussock grasses) and *Stipa* (spear grasses). They also contain many other species including sedges, rushes, heaths, daisies, lilies and orchids. These native grasslands were once widespread in the temperate regions of southern Australia and at the time of European settlement covered an estimated 250 000 hectares. Extensive areas of grasslands have been cleared and replaced by exotic pasture species. Most of the remaining areas have been modified by grazing, weed invasion, changing fire regimes and fertiliser application. Today, less than an estimated 1% of the pre-European grassland extent remains in moderate to good condition (Carter et al. 2003).

Temperate eucalypt woodland in the Blue Mountains, New South Wales (Photo: M Fagg, Australian National Botanic Gardens)

## A7.3 Forests

Tall open eucalypt forests in Tasmania (Photo: M Fagg, Australian National Botanic Gardens)

Australia has 147 million hectares of native forest, 15% of which is protected in formal nature conservation reserves. Australia's native forests contain thousands of animal and vascular plant species, tens of thousands of fungi, lichens and non-vascular plant species, and more than 100 000 invertebrate species. Biodiversity is particularly high in Australia's rainforests, which also contain a large number of endemic species.

Of Australia's forest-dwelling species, 1287 are listed as vulnerable, endangered or threatened and are protected under Commonwealth legislation. These species mainly include vertebrates and vascular plants, reflecting our better understanding of these groups. Our lack of knowledge about fungi, lichens, non-vascular plants and invertebrates inhibits the identification of threatened or endangered species in these groups.

Australia's native forest biodiversity faces several threats, many of which are interrelated. These include:

- habitat modification
- invasive species
- ecologically unsustainable resource use
- altered fire regimes
- climate change.

Invasive species are one of the main threats to Australia's terrestrial and aquatic biodiversity. While it is difficult to determine the extent and percentage of affected forests, many introduced animals, plants, insects and pathogens can affect keystone species, placing the species-rich forest environment at risk. Feral pigs degrade habitat by digging up soil and forest litter, causing erosion and spreading weeds, which compete with regenerating forest plants. Weeds such as lantana, blackberry and bridal creeper are common forest invaders that reduce biodiversity in Australia.

In northern Australia, the introduction of exotic pasture grass species that produce high fuel loads can significantly alter fire regimes, leading to intense, destructive fires that kill trees and may alter the species composition in affected ecosystems.

## A7.4 Coasts

Mangroves, a crucial coastal ecosystem for marine biodiversity, at Jervis Bay, Australian Capital Territory (Photo: M Williams and DEWHA)

Coastal ecosystems are very important for marine biodiversity because many marine species have a life cycle that includes an inshore larval stage. Mangroves, salt marshes and seagrass beds are particularly crucial ecosystems, acting as nurseries and feeding grounds for many marine and migratory species. Australia's coastal environment also provides significant economic benefits by supporting recreation, tourism, fishing and aquaculture.

Australia's coastal habitat is under increasing pressure from urban development and expansion. This is particularly the result of the 'sea change' phenomenon, in which people move from the city to the coast in search of a more relaxed lifestyle. Around 77% of coastal development in Australia has occurred since 1980 (Beeton et al. 2006).

The major threats to coastal ecosystems, which are particularly intensive around urban coastal areas, are:

- urban development
- agriculture
- pollution
- climate change.

Mangroves and salt marsh communities are declining in many areas along the Australian coast as they are cleared for development. If the trend continues, large areas of coastal habitat will be lost. For example, by the year 2050, 42.3% of the New South Wales–Queensland coastline from Nowra to Noosa is expected to be urbanised (Beeton et al. 2006). This will result in the loss of many of Australia's temperate and tropical coastal ecosystems, and will increase stress on the remaining habitat.

Coastal water quality is being affected by the continuing spread of towns and settlements and by pollution from nutrients, sediments and chemicals that drain into the sea from agricultural catchments and sewage treatment plants. Increasing levels of these pollutants in waters adjacent to the coast are having a localised impact on coastal and estuarine systems, especially seagrass beds.

## A7.5 Oceans

The diversity and extent of Australia's oceans makes us one of the most important marine biodiversity jurisdictions in the world. Australia's oceans cover 14 million square kilometres and contain 11% of the world's known marine species (PMSEC 1995). We know very little about the marine species and ecosystems across this vast area, leaving us uncertain about their status. This uncertainty will be exacerbated by climate change, which is predicted to cause significant changes to marine ecosystems worldwide.

Australia's marine environment is under pressure from threats such as:

- unsustainable fishing practices
- pollution and habitat disturbance
- invasive species
- climate change.

The distribution of species such as kelps, seagrasses, and a range of fish and seabirds is changing as a result of these threats. Monitoring of the Great Barrier Reef (Queensland) and Ningaloo Reef (Western Australia) indicates that deterioration of these areas is due to coral bleaching, fishing, sedimentation and pollution from shipping (Marine Biodiversity Decline Working Group 2008).

The marine environment makes a major contribution to the nation's wealth through tourism, fisheries, oil and minerals, and other industries. The Great Barrier Reef and other regional attractions are worth around $6 billion a year to Australia's tourism industry. Australia's fisheries are among the most diverse in the world and they are a source of recreation, income and significant wealth in many coastal regions.

Apart from those species subject to commercial fishing, we know very little about marine species distribution and abundance. The 2006 Bureau of Rural Sciences fishery status reports (BRS 2006) state that of the 97 commercial fish stocks managed by the Australian Government, 19 are considered to be overfished and/or subject to overfishing. Recreational and illegal fishing also places significant pressure on marine species populations.

A school of snapper in Australia's ocean territory (Photo: Paradise Ink)

## A7.6 Rivers, wetlands and floodplains

Rivers, wetlands and floodplains are highly diverse, productive ecosystems that provide many important ecosystem services. The health of many of Australia's aquatic ecosystems has declined significantly since European settlement. The impacts of climate change will exacerbate existing threats (Beeton et al. 2006). For example, long-term drought conditions will place additional pressures on Australia's already stressed river systems.

A tropical wetland near the Adelaide River, Northern Territory (Photo: M Fagg, Australian National Botanic Gardens)

The major threats to Australia's wetlands include:

- altered flow regimes as a consequence of drainage, irrigation and river regulation
- grazing and trampling by cattle and sheep
- tourist and recreational development
- urban development and pollution, including disposal of saline groundwater and discharge from sewage treatment facilities
- inundation resulting from storm surge and sea level rise
- climate change.

River regulation and altered flow regimes have had a significant impact on freshwater aquatic ecosystems, particularly by reducing the frequency and size of flooding events that many native species depend on for food, habitat, breeding and dispersal. River regulation and eutrophication (increased nutrient levels) have also resulted in an increase in algal blooms which produce toxic chemicals and reduce light and dissolved oxygen levels in water.

In comparison to terrestrial species, few freshwater aquatic species are listed as threatened or endangered. This difference reflects a lack of knowledge of freshwater aquatic biodiversity, rather than indicating healthier ecosystems. This lack of knowledge hinders effective management of these environments.

The loss and degradation of wetlands not only affects biodiversity; wetlands also play a vital role in cleaning and filtering water. A recent study of the water filtration services of permanent Murray River wetlands in South Australia has indicated that they provide more than $7000 worth of water purification per hectare per year (Schmidt 2007).

## A7.7 Rangelands

The Musgrave Range from Mount Connor, South Australia (Photo: A Fox)

More than 75% of Australia is broadly defined as rangelands. This includes a diverse group of relatively undisturbed ecosystems such as tropical savannas, woodlands, shrublands and grasslands. Rangelands extend across low rainfall and variable climates, including arid, semiarid and some seasonally high rainfall areas. The rangelands are home to many of Australia's Indigenous peoples and are culturally important to most Australians.

From an ecological perspective, 53 of Australia's 85 bioregions have rangelands, covering a huge diversity of habitats and communities. Climatic variability is the defining characteristic of the rangelands: rainfall varies greatly from year to year, season to season and place to place, forming a barrier to intensive agricultural development. The dominant land use is grazing on native pastures. The rangelands also generate revenue through mining and tourism.

Impacts on rangelands result from:

- inappropriate fire regimes
- the spread of invasive species
- unsustainable grazing regimes
- water extractions and diversions
- climate change.

Fire, as a recurrent disturbance, plays a significant role in the ecology of the rangelands. The interaction between fire and biodiversity at any specific location is shaped by the fire regime: the extent, seasonality, frequency, intensity and patchiness of fires. At the landscape scale, no single fire regime will be universally 'good' for all species; some species can be extremely resilient to changes in fire regime, while others are highly sensitive to quite subtle changes. If the fire regime changes substantially from the one in which a particular ecosystem evolved, impacts will be felt on individual species and on the ecosystem as a whole.

Despite pressure from altered fire regimes and other threats, and their characteristically infertile soils, the rangelands still contain relatively intact ecosystems. However, the rangelands have suffered greater biodiversity loss over the past two centuries than any other part of Australia. The greatest decline has occurred in sandy and stony desert ecosystems, in which about 33% of mammal species are locally extinct.

# **Appendix 8** Indigenous peoples and Australia's biodiversity

## A8.1 Indigenous biodiversity values

### Country, kinship and cultural protocols

Indigenous peoples' biodiversity values are part of a complex, cultural relationship between Aboriginal and Torres Strait Islander peoples and their country (traditional lands and waters) throughout Australia, not just in the remote northern and central regions. For coastal Indigenous peoples, their country includes both landscapes and seascapes that, under customary law, are owned and managed as a unified whole.

A feature of all Indigenous cultures in Australia is that key environmental elements (e.g. animal and plant species, waterways, weather events, tidal currents or celestial bodies) occupy kin relationships with local traditional owners. Hence, a tree, bandicoot, turtle, fish, flower, mangrove worm, wind, river or phase of the moon may be referred to as brother, sister, father, mother's brother etc. by particular individuals according to local customary law, lore and practice.

Complementing the kinship system, each traditional owner group or clan typically identifies with one or more environmental element, usually referred to as a totem. In this way, a particular animal or plant species, tidal current, wind direction etc. is identified with a particular clan. Often, special cultural protocols apply for how clan members should interact with their totem; such protocols may include restrictions on whether a totemic species can be hunted or consumed, when and by whom. In coastal areas, strict cultural protocols prohibit the mixing of food species taken from marine and terrestrial environments.

Throughout the diversity of Indigenous cultures in Australia, specific cultural protocols apply for women's and men's business. These protocols relate to the ways Indigenous peoples interact with, use and manage Australia's biodiversity and they are important considerations when consulting or negotiating with Indigenous groups and communities about biodiversity management.

Kinship, totems and protocols are expressions of the inclusiveness of the relationship between Indigenous peoples and their environments: people are an integral part of the landscapes and seascapes, which in turn are integral parts of Indigenous cultures.

## Indigenous knowledge

Indigenous knowledge of the environment and biodiversity—sometimes referred to as traditional Indigenous knowledge, traditional ecological knowledge, traditional biodiversity related knowledge or simply Indigenous knowledge—represents the accumulated knowledge, understanding and skills of particular Indigenous groups and individuals. Indigenous knowledge is an integral part of the complex cultural, spiritual, social and economic relationship between people and their country. The scope of Indigenous environmental knowledge includes:

- a system of classifying animals and plants, including language names and the ecological and cultural relationships between particular species; Indigenous classification systems have some similarities to and some differences from Western scientific classification systems
- an understanding of the anatomy, life cycle, habitat, food requirements and behaviour of individual species
- the seasonal availability of species, including the ecological indicators associated with seasonality (e.g. the flowering of particular species of plants indicates the arrival of migratory species of fish, birds or other animals)
- cultural protocols and practices associated with particular species, habitats or places (e.g. the restrictions on who can hunt or collect particular species and in what season, or cultural prohibitions on the mixing of terrestrial and saltwater foods)
- the creation stories about why things are the way we experience them today.

While many aspects of Indigenous knowledge are held by all members of a group, some specialised knowledge is held only by women or only by men, or only by individuals who have achieved particular initiation status within the group.

Indigenous knowledge is owned by the Indigenous peoples who hold the knowledge, and is protected by traditional intellectual and cultural property rights and protocols. Ownership and control of Indigenous knowledge also applies to the use of Indigenous language names for plants and animals, the use of which requires authorisation by the appropriate Indigenous group.

## Indigenous use and management of biodiversity

Indigenous use of biodiversity is closely related to Indigenous environmental management. Indigenous peoples' access to, and presence on, country and their use of the biodiversity resources of country are regarded as essential elements of management of country. For this reason, dispossession or removal of Indigenous peoples from their traditional country and restrictions on access to various land tenures (e.g. national parks and pastoral leases) impact on the capacity of Indigenous peoples to maintain, apply and transmit traditional Indigenous knowledge and management practices. Indigenous groups throughout Australia also recognise that continued access to and management of their traditional country improves the health of their people: Healthy Country, Healthy People (Putnis et al. 2007).

Indigenous use of biodiversity differs between the diverse Indigenous cultures throughout Australia but includes use as food, shelter, clothing, arts, craft, ornaments, tools and weapons, as well as for cultural and spiritual practices, and for trade and traditional exchange of goods and resources within and between groups.

Indigenous management of country, including biodiversity, varies between Indigenous groups but generally includes the following practices:

- *site management*—caring for particular places of cultural or economic importance, e.g. keeping waterholes or sacred sites clean
- *species management*—e.g. performing ceremonies or undertaking other cultural practices to ensure the wellbeing of particular species
- *limited entry and access*—enforcing cultural protocols regarding who can access particular locations on land and sea for hunting, gathering and collecting environmental resources
- *seasonal use of particular species*—as dictated by customary law and practice and guided by particular ecological events (e.g. the flowering of indicator plant species)
- *closed areas (or 'poison country')*—areas of land or sea to which entry is restricted or forbidden; such areas typically exist on all clan estates, resulting in a network of culturally maintained biodiversity refuge areas
- *selective take of particular species*—based on, for example, the size, gender, health of the animal or plant
- *use restrictions*—based on the totemic relationship, age, gender, or initiation status of individual traditional owners
- *fire*—used for hunting, cooking, signalling, ceremony and for maintaining and cleaning country.

The extent to which this suite of Indigenous environmental management practices continues today varies from location to location. These practices are also increasingly complemented by contemporary cultural and natural resource management practices undertaken by Indigenous land and sea management agencies and ranger groups, often in collaboration with government agencies and research institutions. Some of these practices are outlined below.

### Indigenous biodiversity rights and interests

Indigenous biodiversity rights and interests include those recognised as components of local customary law of a particular traditional owner group, as well as those rights and interests recognised under legislation relating to native title, other forms of statutory land rights, environmental and natural resource management legislation, protected area management and cultural heritage management.

Indigenous environmental rights and interests may include:

- hunting, fishing and collecting of species
- access to country (including within protected areas)
- use of species and habitats for economic, ceremonial, spiritual and other cultural purposes
- responsibility for caring for country (including species and habitat management)
- decision making about country—often referred to as 'speaking for country'
- controlling access to country; a key cultural protocol and practice is the need for outsiders to ask permission to access traditional owners' country, whether or not traditional ownership is acknowledged under Australian law
- controlling access to, and use of, Indigenous knowledge.

## A8.2 Recognition of Indigenous biodiversity values in policy and legislation

### Convention on Biological Diversity

The *Convention on Biological Diversity* (CBD) is the most important international legal instrument that recognises indigenous peoples' knowledge and use of biodiversity. The CBD also recognises the dependence of many indigenous communities on biological resources and parties to it, including Australia, have committed to:

- respect, preserve and maintain indigenous knowledge, innovations and practices with respect to biodiversity—Article 8(j)
- support the continuation of customary use of biodiversity by indigenous peoples—Article 10(c)
- exchange publicly available information on biodiversity, including indigenous knowledge, and to find ways of incorporating indigenous knowledge and indigenous technologies into environmental management—Articles 17 and 18.

### Other international instruments

Several other international legal instruments support indigenous peoples' cultural, spiritual, social and economic relationships with biodiversity and land and sea environments. These instruments include the World Heritage Convention and the Convention on the Elimination of Racial Discrimination.

*National Strategy on the Conservation of Australia's Biodiversity*

The Australian Government responded to its obligations under the CBD by releasing the *National Strategy for the Conservation of Australia's Biodiversity* (DEST 1996), which set out goals, principles, objectives and actions for the effective identification, conservation and management of Australia's biological diversity. Principle 9 stated:

> 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 Indigenous knowledge of biological diversity.

*Environment Protection and Biodiversity Conservation Act 1999*

The Australian Government's environment legislation, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) includes objectives of:

- recognising the role of Indigenous peoples in the conservation and ecologically sustainable use of Australia's biodiversity
- promoting the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

Specific programs and other initiatives that have been established by the Australian Government to meet these objectives include the Working on Country Program, the Indigenous Protected Area Program, the Indigenous Land Management Facilitators Program, Indigenous involvement in regional natural resource management and the joint management of national parks established on Indigenous-owned land.

## A8.3 Indigenous engagement in biodiversity management and research

Many Indigenous communities, groups and individuals participate in a variety of biodiversity management and research initiatives that combine customary Indigenous knowledge and practices with contemporary management frameworks and Western science. These initiatives include management of protected areas, regional natural resource management, recording traditional Indigenous knowledge, Indigenous land and sea management initiatives, and fisheries management.

Many of these contemporary arrangements involve partnerships between Indigenous peoples and government agencies, research institutions and other organisations. While such partnerships are generally beneficial to both parties and to biodiversity management, they can also mean some loss of Indigenous cultural authority and autonomy. Contemporary cultural and natural resource management activities by Indigenous peoples also benefit non-Indigenous people or organisations that may hold title over Indigenous peoples' traditional country.

### Management of protected areas

The extent of Indigenous involvement ranges across a spectrum from a minor advisory role in many national parks and marine parks, to joint management of some national parks, through to Indigenous sole management of Indigenous protected areas. Recognition of Indigenous interests in marine protected area management is generally less developed than in terrestrial national park management, reflecting the generally weaker overall recognition of Indigenous rights and interests in the sea than on land.

### Regional natural resource management

Indigenous participation in regional natural resource management varies from consultation in some regions to major Indigenous engagement in planning and implementation in others. In some natural resource management regions Indigenous groups have developed their own cultural and natural resource management plans and smaller scale country-based plans as their preferred mechanisms for engaging with and benefiting from the natural resource management planning process.

### Recording traditional Indigenous knowledge

Several innovative projects have been initiated by Indigenous peoples and organisations in recent years (e.g. the Traditional Knowledge Recording Project initiated by Kuku Thaypan elders on Cape York) using digital video and computer technology to document Indigenous knowledge and practices relating to caring for country, including biodiversity management.

### Indigenous land and sea management initiatives

Over the last 10–15 years, many Indigenous communities and organisations have established their own land and sea management agencies, ranger units and regional alliances, such as the North Australian Indigenous Land and Sea Management Alliance. Indigenous-controlled environmental management agencies enable Indigenous peoples to implement their own cultural protocols for managing country, including respect for the specific cultural authority and roles of women and men, for example through employing both female and male rangers.

Other initiatives include partnerships with research institutions to share knowledge about and to monitor biodiversity. Examples of projects that combine Indigenous knowledge and Western science include: satellite tracking of marine turtles, feral animal and weed control, photo-monitoring of habitat changes, tourism management, biodiversity surveys on land and sea, waterhole management, cultural mapping of country (landscapes and seascapes), and fire planning and burning.

### Fisheries management

Fisheries legislation throughout Australia now acknowledges the existence of Indigenous fisheries, alongside the commercial and recreational fisheries which have more longstanding recognition. Coastal Indigenous groups are seeking a greater role in fisheries management consistent with their customary responsibilities to manage their sea country and their customary marine resources. Assessments of fisheries management undertaken by the Australian Government under the EPBC Act provide an opportunity to assess, monitor and alleviate the impacts of commercial and recreational fisheries and other marine resource use activities on Indigenous fisheries resources.

## A8.4 Indigenous peoples' concerns about biodiversity conservation

From the earliest days of British colonisation and settlement of Australia, Indigenous peoples have resisted, protested and expressed their concern about the environmental destruction that accompanied the colonial frontier and continues into the 21st century. These concerns continue to be expressed during environmental reviews and impact assessments and through natural resource management planning processes throughout Australia. Loss of species and habitats has severe cultural and economic impacts for Indigenous peoples in addition to their concern for the wellbeing of country.

In recent years this long history of advocacy for the protection of country has led to the establishment of Indigenous land and sea management agencies and ranger groups actively involved in managing country. Indigenous groups in remote areas of Australia are keen to ensure that their environments are spared the severe impacts that have occurred in the more settled areas of Australia. In the more settled areas Indigenous groups and organisations are also strengthening their involvement in looking after their traditional lands and waters through their own organisations and in partnership with government agencies, natural resource management groups and others. In these areas Indigenous peoples are engaged in rehabilitating degraded environments as well as protecting and managing the remaining healthy ecosystems.

# Appendix 9 Threats to biodiversity

## A9.1 Climate change

> Many Australian species are at risk from rapid climate change because they are restricted in geographical and climatic range (Hennessy et al. 2007).

Australian average temperatures have increased by 0.9ºC since 1950 (CSIRO and Australian Bureau of Meteorology 2007). Regardless of future human actions, the inertia in the climate system means that the earth will experience further warming of at least 0.4°C. Because global emissions are tracking at or near the upper limit of the suite of projections developed by the Intergovernmental Panel on Climate Change (IPCC) (Raupach et al. 2007) there is a real risk that global mean temperatures will rise by more than 2°C, a level that may be the threshold of 'dangerous climate change'. Climate change is also causing oceans to rise and to become warmer and more acid, and is altering wind and rainfall patterns.

Climate change impacts such as ocean warming and acidification and sea-level rise make it more urgent to understand more about our environment so that we can manage it more effectively.

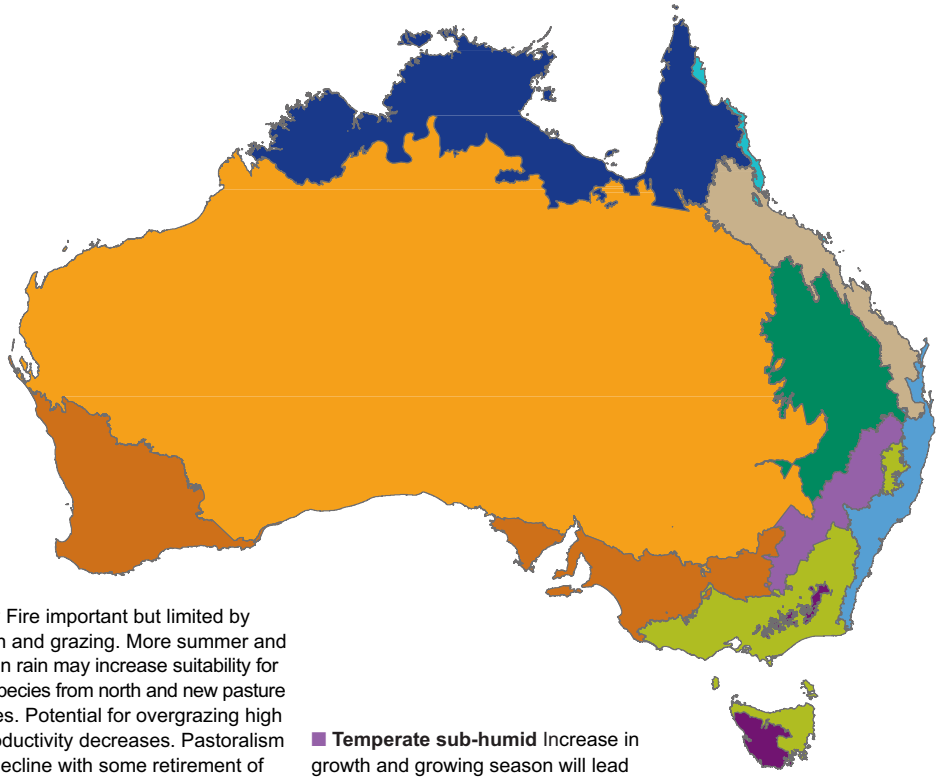
The IPCC Fourth Assessment Report (IPCC 2007) notes that significant loss of Australian biodiversity is projected to occur by 2020 in ecologically rich sites, including the Great Barrier Reef and the Queensland Wet Tropics. Other sites at risk include the Kakadu wetlands, southwest Australia, sub-Antarctic islands and alpine areas. Changes in Australian species and some ecosystems have already been detected that are consistent with recent changes in temperature, rainfall and sea level have already been detected (Dunlop and Brown 2008).

Even under the most modest climate change scenario, impacts on biodiversity will increase through most of this century. Formation of new ecosystems, abrupt changes in ecosystem structure and functioning, and surprising, unexpected outcomes are likely to become more common. Coupled with the existing pressures on biodiversity, these climate-related complications will challenge our existing approaches to conservation.

Climate change brings particular challenges that require us to re-examine our traditional approaches to biodiversity conservation. 'Business as usual' is clearly no longer an option if we are to halt biodiversity decline at local, national and international scales.

One of the first challenges we face is the need to re-examine our objectives for biodiversity conservation. There is often an underlying assumption that we must preserve what is there now. In a rapidly changing environment, attempting to maintain the status quo will not work. Environments will change; some species will be lost and others will not persist in their current locations (Figure A9.1).

## Figure A9.1 Agro-climatic zones with key issues for biodiversity resulting from likely effects of climate change (Adapted from Dunlop and Brown 2008)



**Dry** Fire important but limited by growth and grazing. More summer and autumn rain may increase suitability for new species from north and new pasture species. Potential for overgrazing high as productivity decreases. Pastoralism may decline with some retirement of drying areas. Reduced ground and surface water would have big impact on agriculture and refuge-dependent native flora and fauna.

**Mediterranean** Increased fire frequency and changed seasonality and intensity. Change in vegetation structure from forest and woodland to shrubland and grasslands. Significant landuse changes, conversion of pasture and wetlands to crop. Increased variability, more opportunists, semi arid and weedy species. Impact on wetlands, rivers, dams and groundwater.

**Cold wet** Reduced snow cover and duration. Upward migration of species and ecosystems, some higher elevation species lost. Drying of wetland areas. Fire impacts on forests, woodlands.

**Temperate cool season wet** Change in fire frequency and intensity affecting structure and composition. Changed growing season and reduced (possibly) growth. New species establish (especially weeds) from agriculture and gardens. Change in seasonality of rainfall affects winter annuals. Conversion of grazing into cropping. Fragmentation limits distribution changes. Major water extraction issues. Drying out of wetlands.

**Temperate sub-humid** Increase in growth and growing season will lead to changes in structure for new species, (winter growing grasses, year-round growth, summer-active species). Increased fire frequency and intensity leading to greater fire management and weed establishment. Intensification of land use possible. Stress on water resources likely, possibly leading to demand for more storages.

**Sub-tropical moist** Increases in fire frequency, intensity and extent: rainforests and wet sclerophyll at risk. Big issues for agriculture and human settlement. Local extinctions in fragmented systems. Sea level rising in coastal areas.

**Sub-tropic sub-humid** Some increases in summer-active species and declines in winter species. Increased fire frequency, with more litter and hotter temperatures, but offset by wetter summer. Big issues for changes in landuse; seasonal changes, possible conversion of crop to grazing and abandonment. Changes in seasonality of river flows; increased demand for more dams.

**Tropical warm-season moist** Increasing fire major issue for composition, structure and function, especially rainforests. Pressure from agriculture and human settlement. More intense cyclones leading to structural change and establishment opportunities for weeds. Expansion of horticulture and possibly sugar and biofuels. Species near tops of mountains may be severely affected, but tolerance largely unknown.

**Tropical wet** Increased risk of fire in rainforests, seasonal drying, and intensity of storms and cyclones affecting floristics, structure and function. Threat to tropical higher altitude mountain species.

**Tropical warm-season wet** Change in fire seasonality and frequency. Spread of exotics from north during wet season. More intense storms. Saltwater incursions into freshwater swamps. Push for agriculture but limited.

Boundaries for this map are adapted from IBRA 6.1 Regions and Subregions (DEWHA 2008).
The bioclimatic regions were sourced from Dunlop and Brown 2008 who adapted Hobbs and McIntyre 2005.
These regions are based on patterns of seasonal plant growth.

Planning approaches that include managing for uncertainty will be critical. Significant uncertainties still surround critical areas of climate change science, such as the impacts on water resources and water availability. A greater emphasis on risk management and adaptive management approaches is essential. To do this successfully, we will need high-quality information based on monitoring and experimentation. We will also need to learn to accept some initial failures in policy and management approaches to deal with such a complex stressor as climate change. However, 'failures' are only true failures if we don't learn from them, adapt our approaches and do better the next time.

Conservation connectivity and building resilience will be key strategies to ensure that natural systems have the capacity to adapt to shifting climatic zones. Securing and enhancing critical intact habitats through the National Reserve System is the most important and immediate step we can take to increase ecosystem resilience (Taylor and Figgis 2007). Restoring habitat connectivity through restoration and revegetation on private lands and linking with core protected areas will also be important adaptation strategies.

Botanic gardens, zoos, seed banks and gene banks will have an increasing role to play in ex situ conservation mechanisms for species that may not be able to survive in the wild. For some species, this may be the only means of survival in the short to medium term.

## A9.2 Invasive species

> The cost of weeds to Australian agriculture now exceeds $4 billion a year. The cost to the environment is thought to be of at least a similar magnitude (Sinden et al. 2004).

Invasive species include introduced weeds, feral animals, insects and other invertebrates, marine pests, diseases, fungi and parasites. Such species continue to be a major cause of pressure on Australia's biodiversity. For example, there are 150–250 known introduced marine species in Australian waters, most of which have been introduced through the discharge of ballast waters (Hayes et al. 2005). Similarly, weeds place significant pressure on natural systems and have invaded most ecosystems, particularly those that are already fragmented or degraded.

Feral animals such as rabbits, goats, cattle, buffalo, pigs, donkeys, horses and camels degrade terrestrial habitats by intensive or selective grazing. All of these species also compete with native animals for food and habitat, and those that have hoofs compact the soil, contributing to erosion and making it difficult for native plants to grow. Feral cats, dogs and foxes are major predators of native animals.

The economic impact of introduced marine pests is significant. The International Maritime Organisation has estimated that marine pests cost the world tens of billions of dollars every year. The cost imposed by invasive marine species in Australia has not been quantified but their impacts on local biodiversity and estuarine and marine industries, such as commercial fisheries and aquaculture, are considerable.

Freshwater fish and other species introduced to Australia for fishing or released from private aquaria place significant pressure on native fish through predation and competition. Pathogens introduced with these invasive species also impact on native fish, although the extent of the impact is poorly understood.

It would be preferable to rid Australia of the worst invasive species but this is generally not achievable. Instead, management of invasive species focuses on reducing their impacts as cost effectively as possible and on preventing new incursions. This approach means that control is targeted, for example, to protect a threatened native species. However, interactions between native species and invasive species are often hard to measure and can have unforeseen consequences (e.g. population explosion of another previously suppressed invasive species). For example, removing rabbits can result in a rapid increase in weeds, which in turn affects native vegetation. This situation can complicate decisions about controlling invasive species.

Another factor related to invasive species is the use of biotechnology and other new techniques used in plant and animal breeding (e.g. production of genetically modified organisms). Although these technologies offer us opportunities for changes in the ways we produce food and use agricultural land, they also carry risks. Because of the rapid pace of technological change it is important for countries to establish rigorous, science-based regulatory frameworks to manage the introduction of new forms of biotechnology.

There are gaps in our national approaches to dealing with invasive species, particularly in the detection and coordinated response to species that mainly affect the environment. Invasive species are usually generalists so they are well placed to adapt to a changing environment. They can dominate ecological niches when native species are placed under stress.

Trends in globalisation, trade and travel present a particular challenge in dealing with biosecurity issues that may affect biodiversity. Despite stringent quarantine requirements and protocols there is still a risk that invasive species may enter our environment. Dangers include ocean species caught in ship ballast water; and insects, spiders and reptiles transferred via cargo crates and other commercial packaging.

Climate change is already increasing the impact of invasive species on biodiversity. For example, rabbits, regarded in the 1970s as climatically marginal at 1370 metres, now have to be controlled by the National Parks and Wildlife Service in Perisher Valley, an altitude of 1800 metres (Green and Pickering 2002). A major issue will be managing species that could potentially become invasive with climate change, for example ornamental plants, fish or other animals; commercial species; and diseases or pathogens.

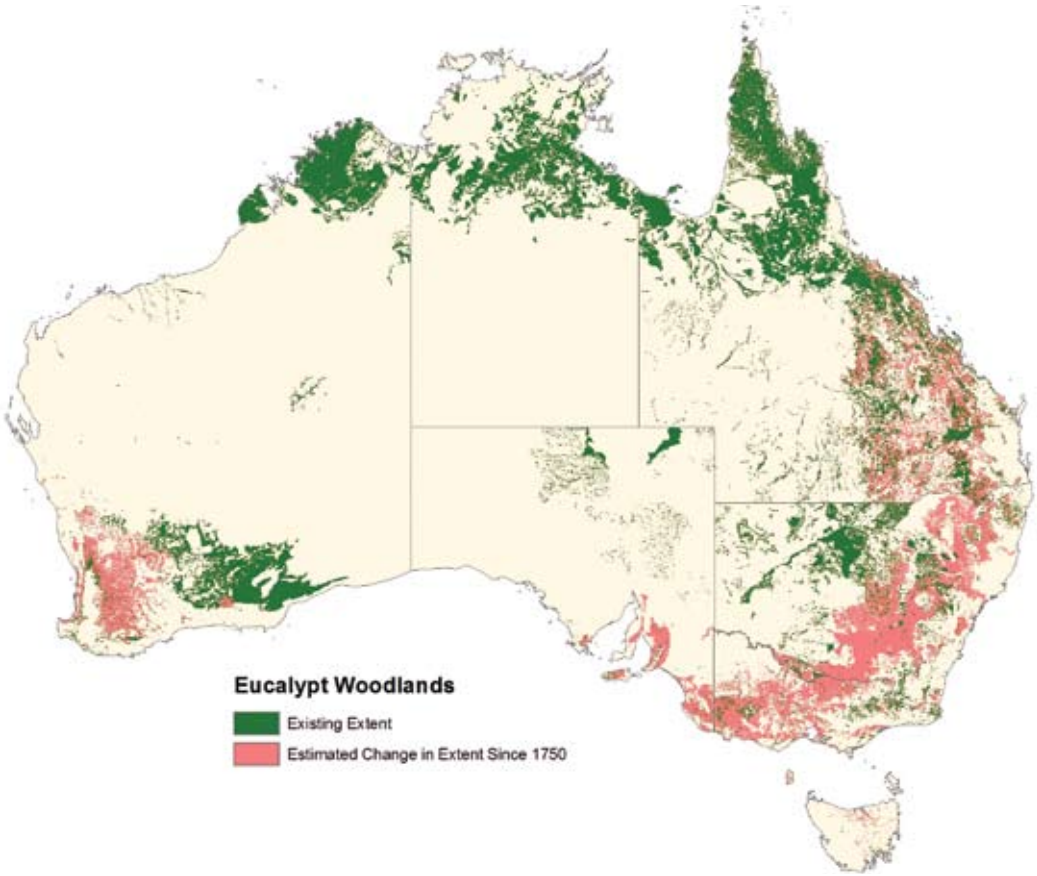
## A9.3 Loss and fragmentation of habitat

Around 13% of Australia's original native vegetation has been cleared since European settlement. Much that remains is degraded and fragmented (Cofinas and Creighton 2001).

Loss and fragmentation of habitat due to land clearance and other human-related disturbances is a significant threat to the long-term survival of Australia's biodiversity. Despite broad-scale clearance controls, native vegetation is still being cleared for housing and other urban development around Australia, particularly along the coastline, as well as for agriculture and dam construction. Figure A9.2 shows changes in one major vegetation group since 1750.

The consequences of habitat fragmentation are far reaching and well established. For example, plant and animal species are less resilient to external pressures when the ecological communities of which they are a part are restricted to small, isolated pockets. Biodiversity is quickly lost from these small remnants, and the species that persist are increasingly vulnerable.

Figure A9.2 Eucalypt woodlands showing estimated change since 1750



## A9.4 Unsustainable use of natural resources

> Some people believe, on environmental grounds, that Australia's current human population (estimated as 19.4 million in August 2001) is too high. Others believe that the environmental effect of population growth can be managed (Australian State of the Environment Committee 2001).

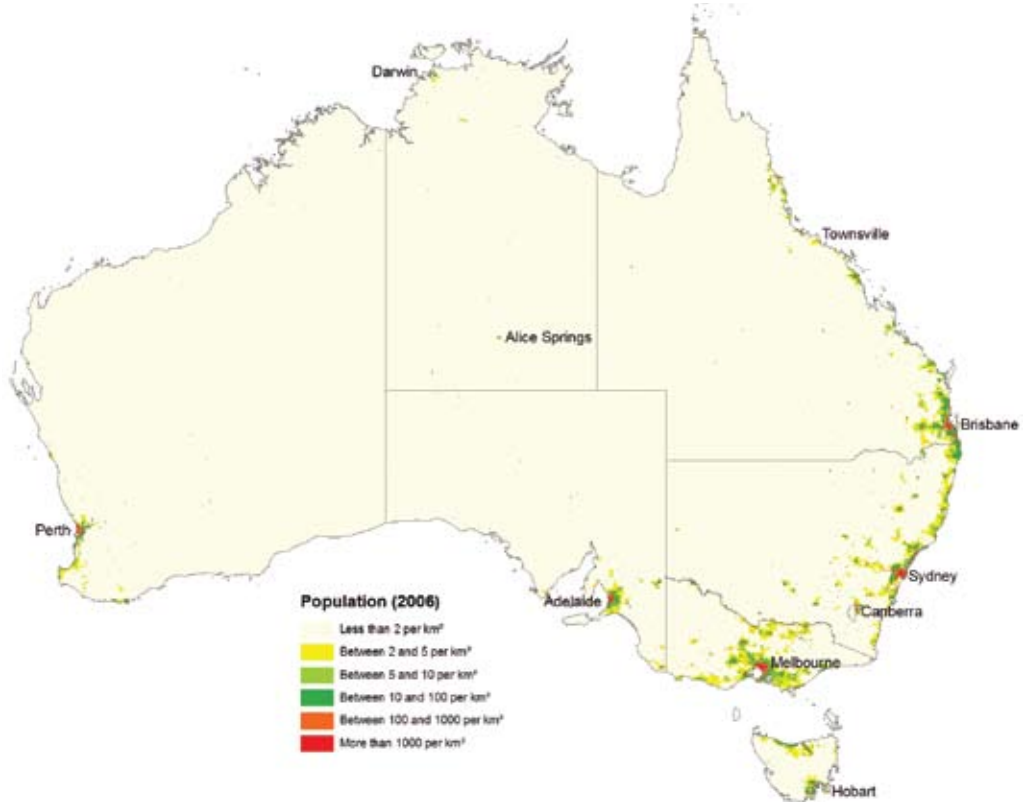
By world standards, Australia has a relatively low human population density, due mainly to our relatively infertile soils and the large extent of arid and semiarid lands. However, although the bush and outback remain enduring elements in our national psyche, we are now one of the most urbanised countries in the world. In some regions, particularly along the coastal strip and around capital cities, increasing population growth and urban expansion is causing significant and unsustainable pressures on natural systems. This growth is often occurring without systematic and long-term planning and without regard for maintaining environmental values.

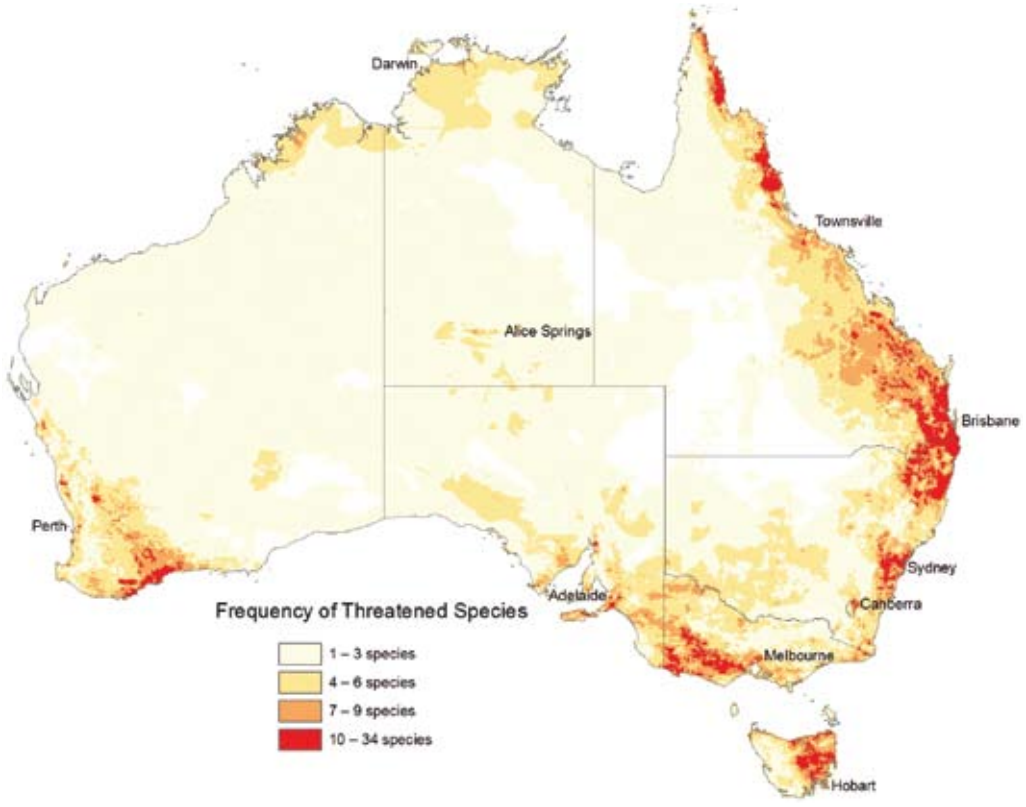
Australia's ecological footprint, a measure of our consumption of natural resources relative to how much is available, is one of the highest in the world. In the past, we have paid little attention to monitoring the environmental impacts of urban expansion. More recently, concerns about the growth of Australia's larger cities have led to greater attention to urban design and planning, and the development of strategies to minimise urban sprawl (Beeton et al. 2006).

The release of pollutants into the environment from urbanisation and from agricultural runoff can kill organisms outright, degrade habitats and disrupt ecological processes. These impacts can occur in areas of high biodiversity value, such as reefs and mangroves (Australian State of the Environment Committee 2001; Beeton et al. 2006), or in important aquatic ecosystems, such as the Murray-Darling Basin, where they cause extensive algal blooms (Australian State of the Environment Committee 2001).

Continued urban expansion and increasingly intensive agricultural practices create serious issues for biodiversity conservation. Additionally, there is a correlation between urban expansion and areas of high conservation value (Figure A9.3). Our challenge will be to design cities that are more sustainable so that we can accommodate population growth without increasing our ecological footprint and to ensure that urban and coastal development, including the sea-change phenomenon as the Australian population ages, is achieved in a sustainable way.

Figure A9.3 Human population density and geographical spread of threatened species (as listed under the EPBC Act)



## Marine issues

> Australia is probably the world's most important jurisdiction for marine biodiversity but our oceans, coasts and estuaries are at risk of serious degradation because of the pressures on them, including fishing, population growth and urbanisation, pollution, mining, tourism, species invasion from ballast waters, and climate change (Beeton et al. 2006).

Pollution is a major threat to marine and coastal waters (and to other aquatic ecosystems, discussed in A9.5 below). The major marine pollutants are oil, sewage, suspended sediments, marine debris, chemicals, radioactive waste, eutrophication and thermal pollution. These originate from land- and marine-based activities such as shipping, oil and gas exploration, stormwater runoff and poor land management practices.

Pollutants have a range of impacts on biodiversity in the marine environment, through degradation of habitats; changes in the distribution and density of species; increasing levels of contaminants in some species (which have impacts throughout the food chain); and loss of top-order predators.

There is a lack of scientific knowledge about the long-term impacts of marine pollution on marine species and ecosystems. There is also a lack of industry and community awareness and a lack of understanding of the value of marine biodiversity, the sources of marine pollution and the actions that could be undertaken by individuals and industries to reduce marine pollution.

We need better integration of government and industry actions to change practices that are producing marine pollution and to combat existing pollution problems (e.g. oil spills and increasing levels of plastic debris in the world's oceans).

The unsustainable use of natural resources has been identified as a particular problem for the marine environment (Marine Biodiversity Decline Working Group 2008). Destructive fishing practices—which include overfishing, poisoning, use of explosives and benthic trawling—both commercial and recreational, are placing pressure on the sustainability of marine biodiversity. A lack of reliable data makes it difficult to know the actual level of destructive fishing practices. However, for Australian Government-managed fisheries, it is known that 19 out of a total of 97 fish stocks are overfished and/or subject to overfishing (BRS 2007).

In addition, illegal, unreported and unregulated fishing (i.e. fishing that does not comply with national, regional or global fisheries conservation and management obligations) within and beyond the Australian Fishing Zone threatens the Australian harvest of fish stocks and the long-term viability of fishing industries and communities.

Because Australia's marine waters are comparatively low in productivity, fishing and the other uses of marine biodiversity resources can only be undertaken at relatively low levels if these resources are to be sustainable. We need to develop and expand plans that address the impacts of fishing on marine biodiversity, for example bycatch action plans, recovery plans, threat abatement plans and national plans of action. Effective conservation of marine biodiversity and habitats must be recognised as essential for sustainable marine resource management.

We also need better national and international cooperation to control illegal, unreported and unsustainable fishing which threatens the long-term health of Australia's marine biodiversity.

## A9.5 Changes to the aquatic environment and water flows

> Altered flow regimes have resulted in the loss of 90% of floodplain wetlands in the Murray-Darling Basin (Beeton et al. 2006).

Biodiversity in aquatic ecosystems in Australia is under threat from the combined effects of river regulation, overallocation of water for irrigation, pollution, agriculture and habitat degradation. Natural patterns of wetting and drying have been altered and the frequency and magnitude of floods have changed. Significant numbers of floodplain wetlands across Australia have been lost as a result.

Across Australia, urban development has resulted in the widespread loss of wetland biodiversity, including a decline in the number of waterbirds and native fish. Populations of frogs, which are very sensitive indicators of aquatic health, have also declined significantly over the past decade, with 27 species of frogs listed as vulnerable (Beeton et al. 2006).

Riparian habitat fringing rivers and streams has also declined as a consequence of changed water flow regimes. River red gum communities along the length of the River Murray are severely degraded due to reduced flooding. One-third of river length in Australia has lost 20–100% of the aquatic invertebrates that would normally occur there.

Rivers, wetlands and other aquatic environments have also been significantly affected by pollution from a range of sources, including sewage inflows, livestock grazing along watercourses, excessive applications of fertilisers and pesticides, vegetation clearance, gully and streambank erosion, major water-supply reservoirs and farm dams. Excess nutrients, primarily phosphorus and nitrogen, were a major water-quality issue in about 60% of basins assessed by the National Land and Water Resources Audit in 2001 (Beeton et al. 2006).

The impacts of aquatic pollution include a decline in the distribution and abundance of aquatic invertebrate populations, an increase in fish kills and an increase in the incidence of toxic blue-green algal blooms.

The *Australia State of the Environment 2006* report notes that the 2001 and 2003 bushfires in southeastern Australia led to massive inputs of sediment and nutrients to rivers and reservoirs in affected catchments, with consequent impacts on water quality. Recovery from this natural disaster could take many years (Beeton et al. 2006).

A number of Australia's rivers are still relatively pristine because they are either not suitable for dam construction or they are located in less populated mountain areas or northern tropical regions. There is growing concern that these rivers, particularly those in tropical Australia, may come under increasing pressure as sources of water to support irrigation development are exhausted in southern Australia (Beeton et al. 2006).

The pressures on stressed aquatic ecosystems will always be exacerbated by long-term drought. Climate change is expected to exert further stress as rainfall patterns change.

## A9.6 Changing fire regimes

> Fires have a fundamental and irreplaceable role in sustaining many of Australia's natural ecosystems and ecological processes…but if they are too frequent or too infrequent, too severe or too mild, or mistimed, they can erode ecosystem 'health' and biodiversity (Beeton et al. 2006).

Fire has been present in Australian ecosystems for millions of years, and our native plant species, including eucalypts and acacias, have evolved in a fire-prone environment.

Indigenous peoples arrived tens of thousands of years ago and began using fire to manage the landscape. Burning regimes used by Indigenous peoples are not thought to have caused evolutionary changes to Australian ecosystems but may have had a major impact on the distribution of vegetation communities.

Fire regimes changed again with European settlement, when settlers used fire extensively for clearing land and creating 'green pick' for stock. Following devastating bushfires in the 1850s, 1910–20s and 1939, a fire suppression and protection approach was gradually adopted, particularly in forested areas. The cessation of the burning practices used by Indigenous peoples exacerbated the impacts of these fires on natural systems.

The change in intensity and frequency of fires in Australia since European settlement has dramatically affected vegetation composition and structure across the nation, which in turn has affected the habitat of native animals.

We are unlikely to be able to 'restore' past fire regimes and biodiversity is likely to change in future in response to changing fire regimes. For example, climate change will alter the frequency of high-fire-danger weather and the intensity, frequency and seasonality of fires, leading to changed and often more intense fire regimes in the long term (Hennessy et al. 2005).

Most states and territories are managing fire by developing various forms of landscape and fuel management planning and zoning. However, current management strategies may become less applicable as fire regimes change in response to climate change.

# Appendix 10 Conservation connectivity

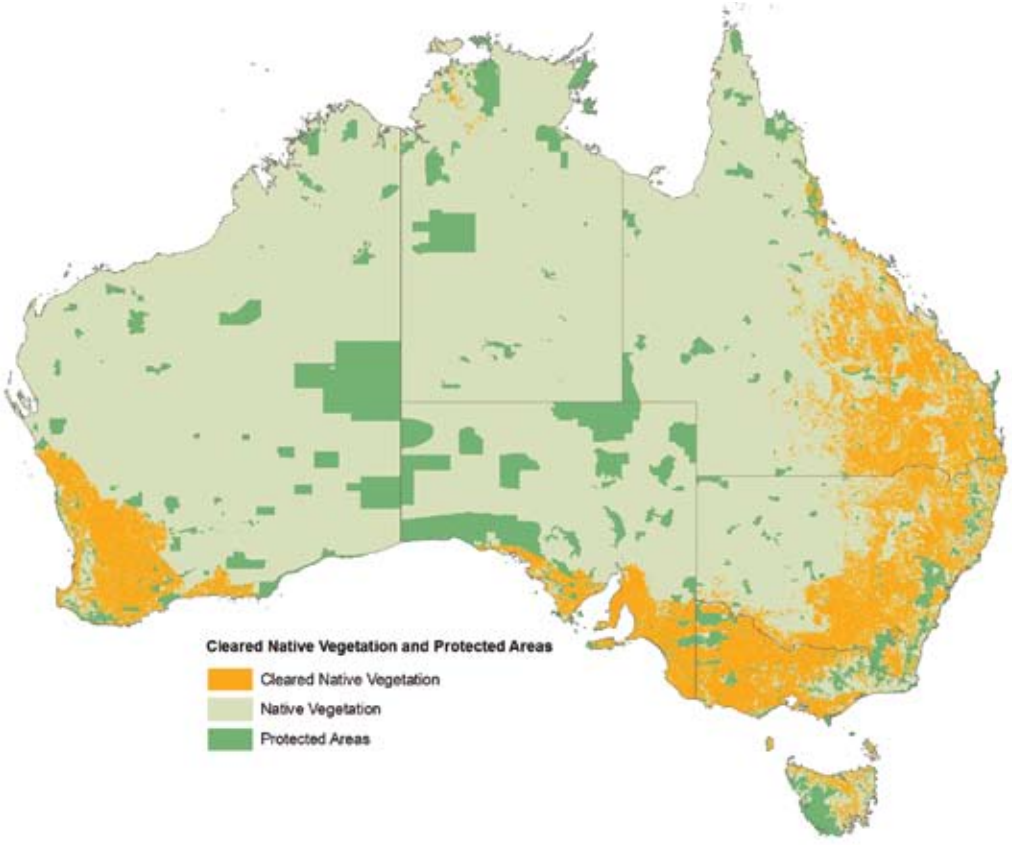
Conservation connectivity is a management approach that focuses on the maintenance and restoration of functioning natural ecosystems across landscapes, bioregions, state and territory boundaries, and marine areas. This requires systematic conservation planning that:

- identifies management responses at multiple scales and across different tenures
- uses whole-of-landscape or whole-of-seascape approaches
- takes into account the dynamics of climate change.

## A10.1 Terrestrial connectivity

Given the role of climate in influencing the geographic ranges of species and assemblages, a risk management approach should consider the potential for climate change to trigger shifts in the distributions of habitats and species across the Australian continent. The potential for such shifts depends in part on the connectivity between habitats and in part on the ecological attributes of the species. At a continental

Figure A10.1 Cleared native vegetation and protected areas[3]




[3] Protected areas includes government reserves, Indigenous Protected Areas and private reserves.

scale, habitat connectivity is lowest in the intensive agricultural zones (Figure A10.1), around regions of high human population density, and in areas where the highest number of threatened species occur (Figure A9.4).

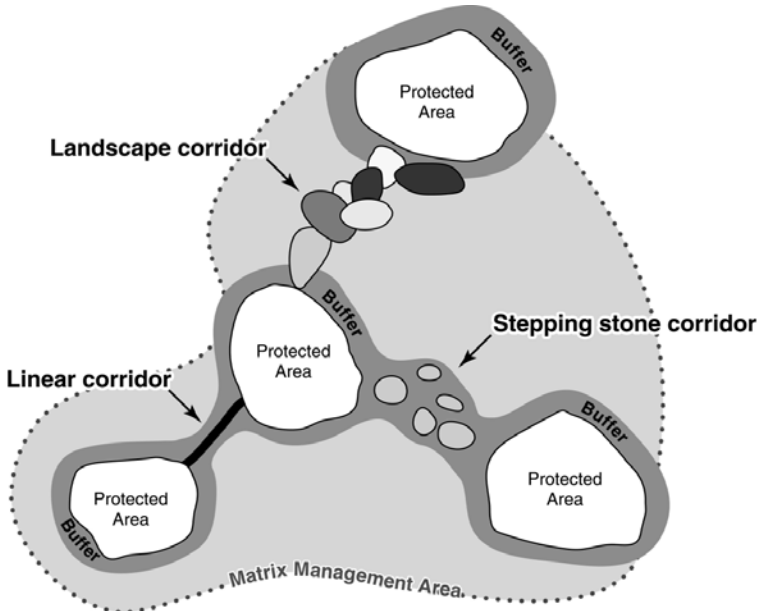
The most effective way to reinstate the connectivity of habitats and thus increase the potential for adaptive changes in ecosystems is through revegetation and habitat restoration at the appropriate scales, whether this be local, regional or continental.

In this context ecological connectivity includes the use of habitat restoration works (e.g. replanting riparian or grassland habitats), creating corridors (e.g. between nearby remnant habitats in good condition) and other complementary land uses (e.g. establishing permanent buffers between paddocks) that as a whole will help to retain biodiversity and key ecological functions across landscapes.

This is a complex process that will require an integrated and collaborative approach across public and private lands to ensure the long-term viability of species and ecological communities.

Connectivity is built around core habitats (also known as refugia), some of which are protected in reserves. These habitats are linked and buffered across different land uses in ways that maintain critical ecosystem processes and thereby strengthen the resilience of landscapes.

Figure A10.2 Conceptual spatial planning for terrestrial connectivity conservation

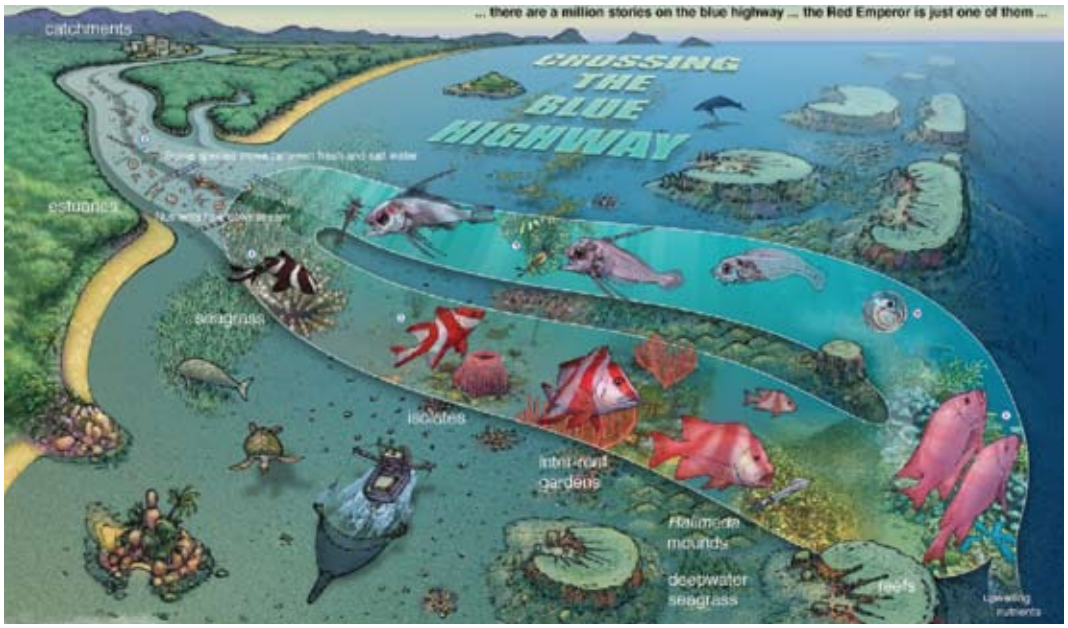



Connectivity is not just about corridors but includes both small patches and larger distinct areas, including core protected areas, areas managed for conservation, the broader landscape in which these areas exist, and remnant native vegetation outside reserves that provides habitat and serves as stepping stones and linear corridors to aid the movement of species. (Source: Mackay et al. forthcoming)

## A10.2 Marine connectivity

Connectivity is also important in improving biodiversity conservation outcomes in the marine environment. Important marine connectivity factors include the circulation of water and nutrients, the configuration of benthic habitats (including marine vegetation) and ecological links between pelagic and benthic environments. The connections between terrestrial catchments, coastal environments and the ocean are also important (Figure 10.3).

### Figure A10.3 Crossing the blue highway



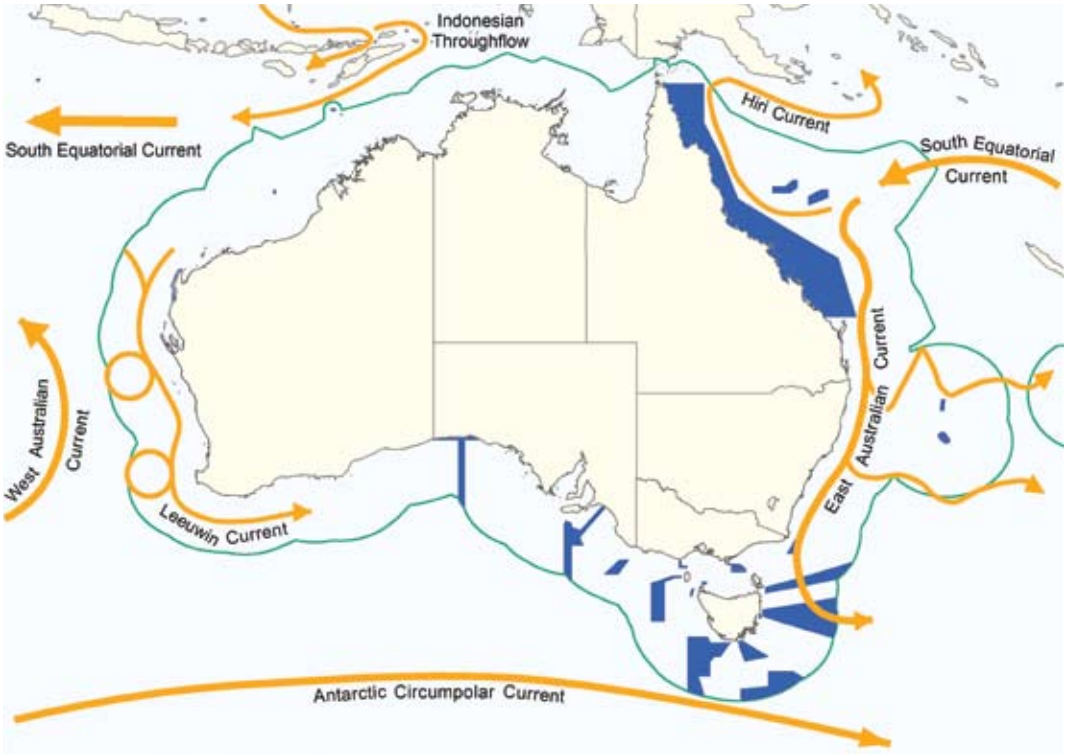

The interconnectedness of waterways is crucial to the movement of many species—for example, red emperor (*Lutjanus sebae*), eels (*Anguilla* spp.), mangrove jack (*Lutjanus agentimaculatus*) and mud crabs (*Scylla serrata*)—which, at different stages of their growth and development, use different habitats in the system that stretches from catchment to reef. Any change in the natural habitat, such as pollution or habitat destruction, can have dramatic effects elsewhere in this interconnected system. (Source: ©Russell Kelley russellkelley@mac.com and the Australian Coral Reef Society)

The major currents connect one part of the ocean with another and provide transport pathways between distant locations for organisms that lack the ability to move independently (including a wide variety of marine invertebrates and the larval and juvenile stages of many other marine species).

Under the Australian federal system of government, the states and territories have primary responsibility for waters within three nautical miles of their coasts. The Australian Government has responsibility for waters between the state limit and the 200 nautical mile limit of the Australian Exclusive Economic Zone.

The current Australian Government marine bioregional planning process will create a comprehensive and representative marine protected area system for Commonwealth waters. The expanding state marine reserve networks are being developed to protect areas of significant coastal biodiversity and will complement reserves in Commonwealth waters (Figure A10.4).

Figure A10.4 Connectivity in the marine environment




Commonwealth marine reserves and major ocean currents in Australian waters. The expanding state and territory marine reserve network also contributes to biodiversity conservation in Australian waters. (Source: DEWHA)

# Glossary

**Adaptation**—Responses that decrease the negative effects of change and capitalise on positive opportunities associated with impacts.

**Australian intergovernmental processes**—Environment and natural resources ministerial councils provide the principal means for governments to identify and respond to biodiversity concerns at the national level. These councils provide a vehicle for regular and structured discussions and for the design and implementation of agreed, shared actions for addressing specific issues associated with biodiversity conservation. Ministerial councils will be regularly informed of progress against this strategy and may, from time to time, agree to changes in priority or introduce new specific actions in response to new information.

**Benthic zone**—The ecological region at the lowest level of a body of water, including the sediment surface and some subsurface layers.

**Biodiversity** (biological diversity)—Variability among living organisms from all sources (including terrestrial, aquatic, marine and other ecosystems and ecological complexes of which they are part), which includes genetic diversity, species diversity and ecosystem diversity.

**Bioregions**—Large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features, and plant and animal communities.

**Climate change**—Change in the climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is, in addition to natural climate variability, observed over comparable time periods.

The Intergovernmental Panel on Climate Change definition refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). It can be due to natural internal processes or external forces or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

**Conservation**—In relation to biodiversity, conservation is the protection, maintenance, management, sustainable use, restoration and improvement of the natural environment; in relation to natural and cultural heritage, conservation is, generally, keeping in safety or preserving the existing state of a heritage resource from destruction or change.

**Conservation connectivity**—A management approach that focuses on the maintenance and restoration of functioning natural ecosystems across landscapes and marine areas, and requires systematic conservation planning that:

- identifies management responses at multiple scales
- uses whole-of-landscape or whole-of-seascape approaches
- takes into account the dynamics of climate change.

Connectivity is built around core habitats (also known as refugia), some of which are protected in reserves, which are linked and buffered across different land uses and marine and coastal zones in ways that maintain critical ecosystem processes and thereby strengthen the resilience of biodiversity.

**Ecological communities**—Assemblages of native species that inhabit particular areas in nature.

**Ecological footprint**—A way to measure how much energy and natural resources a community uses, by measuring how much land and water are needed to produce its ongoing requirements.

**Ecosystem—**A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

A community of organisms, interacting with one another and with the environment in which they live (e.g. a lake, forest, grassland or tundra). Such a system includes all abiotic components such as mineral ions, organic compounds, and the climatic regime (temperature, rainfall and other physical factors). The biotic components generally include representatives from several trophic levels: primary producers (autotrophs, mainly green plants); macroconsumers (heterotrophs, mainly animals), which ingest other organisms or particulate organic matter; and microconsumers (saprotrophs, again heterotrophic, mainly bacteria and fungi), which break down complex organic compounds upon death of the above organisms, releasing nutrients to the environment for use again by the primary producers.

**Ecosystem approach**—An approach that integrates management of land, water and living resources or ecosystems to promote conservation and sustainable use in an equitable way. It takes into account the delicate and complex relationships between the organisms and physical processes that constitute an ecosystem, including humans and their wellbeing. Under an ecosystem approach, individual management decisions must not compromise the productivity and functioning of the ecosystem as a whole.

**Ecosystem resilience**—The 'resilience' of an ecosystem refers to its capacity to adapt to changes and disturbances, yet retain its basic functions and structures. A resilient ecosystem can adapt to shocks and surprises, and rebuild itself when damaged. Resilient systems are more open to multiple uses and are more able to recover from management mistakes.

**Ecosystem services**—Functions of natural ecosystems that maintain the atmosphere; provide clean water; control soil erosion, pollution and pests; pollinate plants; and provide many other essential processes. The functioning of natural ecosystems provides services essential to human survival. Collectively, these services maintain the earth in a state that can support life.

**Ecologically sustainable use**—The use of a species or ecosystem within the capacity of the species, ecosystem and bioregion for renewal or regeneration.

**Endemic**—Having a natural distribution confined to a particular geographic region.

**Environment—**Includes ecosystems and their constituent parts, including people and communities; natural and physical resources; the qualities and characteristics of locations, places and areas; and their social, economic and cultural aspects.

**Eutrophication—**The ecological changes that result from excess levels of nutrients in waterways, wetlands and coastal environments, often resulting in prolific aquatic plant growth and algal blooms. Nitrogen and phosphorus are usually the most important nutrients that influence this process but other micronutrients can also play a role.

**Generalist species—**Are those species that can thrive in a variety of environmental conditions and make use of a range of resources.

**Invasive species**—A species occurring as a result of human activities beyond its accepted normal distribution, which threatens valued environmental, agricultural or personal resources by the damage it causes.

**Keystone species**—A species that has a disproportionate effect on its environment relative to its abundance. Such species affect many other organisms in an ecosystem and help to determine the types and numbers of various other species in a community. An ecosystem may experience a dramatic shift if a keystone species is removed, even though that species was a small part of the ecosystem in terms of its biomass or productivity.

**Landscapes**—All the natural features of land or territory encompassed in a single view (e.g. fields, hills, forests and water), which distinguish one part of the earth's surface from another.

**Market-based instruments and trading-based schemes**—Market-based instruments are regulations that encourage behaviour through market signals rather than through explicit directives. Trading-based schemes are a subset of market-based instruments that focus on instruments involving trading. They include cap and trade schemes, auctions and information disclosure. However, they do not include taxes and subsidies.

**National Reserve System (NRS)**—Australia's network of protected areas, conserving examples of our unique landscapes, native plants and animals for future generations. The reserve system includes more than 9000 protected areas and is made up of national parks, Indigenous lands, reserves run by non-profit conservation organisations, and ecosystems protected by landholders on private properties.

**Naturalised**—An organism freely reproducing in an area outside its natural range.

**Intergovernmental Panel on Climate Change (IPCC)—**The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP). It was established to provide decision makers and others interested in climate change with an objective source of information about climate change.

**Rangelands**—Areas in Australia that extend across low-rainfall and variable climates, including arid, semiarid and some seasonally high-rainfall areas. The term includes a diverse group of relatively undisturbed ecosystems such as tropical savannas, woodlands, shrublands and grasslands. More than 75% of Australia is broadly defined as rangelands.

**Resilience—**see Ecosystem resilience.

**Revegetation**—The planting of native species in areas that have been cleared or highly modified. The mix of species may not be the same as originally occurring in that patch of vegetation.

**Species**—A taxon comprising one or more populations of individuals capable of interbreeding to produce fertile offspring.

**State of the environment reporting**—A process that provides a scientific assessment of environmental conditions, focusing on the effects of human activities, their significance for the environment and societal responses to the identified trends.

**Vascular flora**—Plants containing vascular tissue; includes ferns, gymnosperms (conifers and cycads in the Australian context) and flowering plant species.

# Abbreviations

| | |
|---|---|
| ANRA | Australian Natural Resources Atlas |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| BMP | biodiversity management plan |
| BRS | Bureau of Rural Sciences |
| CAPAD | Collaborative Australian Protected Areas Database |
| CBD | Convention on Biological Diversity |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DEH | Department of the Environment and Heritage |
| DEST | Department of the Environment, Sport and Territories |
| DEWHA | Department of the Environment, Water, Heritage and the Arts |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| IPA | Indigenous Protected Area |
| IPCC | Intergovernmental Panel on Climate Change |
| NLWRA | National Land and Water Resources Audit |
| NRM | natural resource management |
| NRMMC | Natural Resource Management Ministerial Council |
| NVIS | National Vegetation Information System |
| OECD | Organisation for Economic Co-operation and Development |
| PMSEC | Prime Minister's Science and Engineering Council |
| UNEP | United Nations Environment Programme |

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