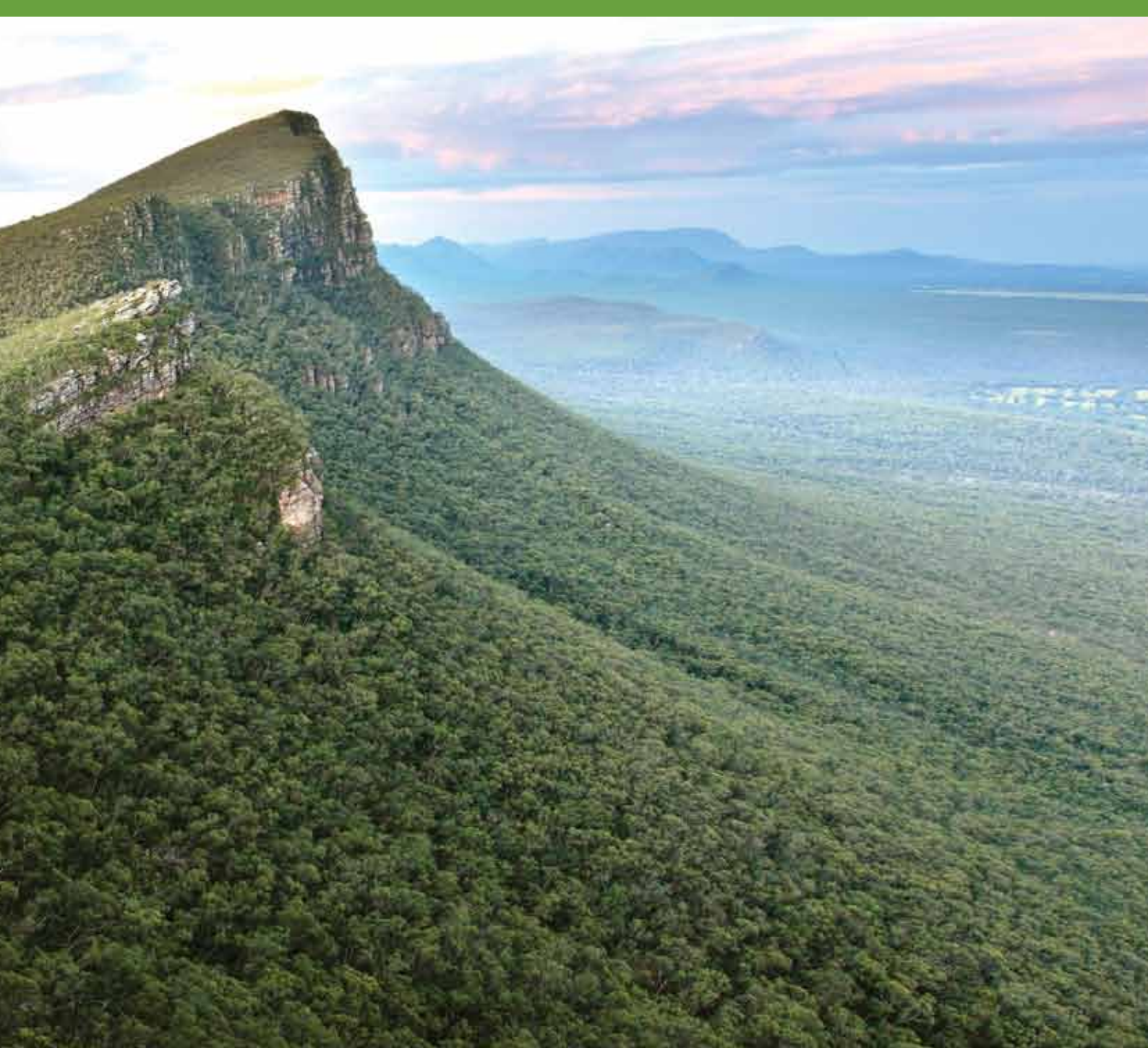




■ Sentinel Peak, Grampians, Victoria
Photo by Michael Boniwell

Summary





Headlines

Our environment is a national issue requiring national leadership and action at all levels.

There have been significant advances in many aspects of environmental management over the past decade, but management approaches and responsibilities are often fragmented across Australian, state and territory, and local governments. This can hamper our ability to address the legacies of past pressures like land clearing, ongoing pressures like invasive species, and emerging challenges like climate change. National leadership and commitment, together with the cooperation and coordination of all governments and stakeholders, including the Australian community, are important foundations for the future of Australia's environment and heritage.

Effective environmental management requires adequate information.

Knowledge and information systems are the basis for sound adaptive management. That is, we need to understand the state and trends of our environment, the impacts of the pressures on our environment and the impacts of our management strategies, so that we can progressively adapt and improve those strategies. Long-term collection of national data on trends of many aspects of the environment is currently limited, which severely constrains the ability of Australian governments to develop and enact evidence-based environmental policy. A new national initiative—the National Plan for Environmental Information—offers the opportunity to address this serious deficiency.

Earth is warming, and it is likely that we are already seeing the effects of climate change in Australia. As the driest inhabitable continent, Australia is particularly vulnerable to climate change.

Although Australia's climate is naturally highly variable, evidence—which continues to accumulate—shows that temperatures are increasing and rainfall distribution patterns are changing. Models project that, by 2030, average annual temperatures across Australia are likely to increase by 1 °C (above 1990 temperatures). Drying is likely in southern areas of Australia. Climate change will profoundly change the Australian environment, presenting widespread and significant risks to our ecosystems, native vegetation, water security, agricultural production systems and coastal communities.

Early action by Australia to reduce emissions and to deploy targeted adaptation strategies will be less costly than delayed action.

Major reductions in greenhouse gas emissions are urgently needed, both nationally and internationally, to minimise the level of climate change. Per person, Australia's emissions are the largest of any country in the Organisation for Economic Co-operation and Development (OECD). The *Fifth national communication on climate change* sets out the Australian Government's strategic approach to climate change. Such an overarching strategy, implemented at all levels of government via a range of policies, plans and programs, is essential if we are to succeed in limiting climate change and addressing key areas of vulnerability through adaptation.



The goal of life is living in agreement with nature.

Zeno, in *Lives of eminent philosophers*, Diogenes Laertius, 3rd century AD

Ambient air quality and air pollution management in Australia's urban centres are generally good, but the impact of urban air quality on health is still a matter of serious concern.

National health-based standards are rarely exceeded for prolonged periods, and very high levels of pollution are usually associated with short-lived extreme events such as bushfires and dust storms. There is clear evidence that periods of poor urban air quality impact adversely on human health (particularly on the health of susceptible individuals). Some 3000 deaths were attributable to this cause in 2003—nearly twice the national road toll.

Pressures of past human activities and recent droughts are affecting our inland water systems.

In northern and remote Australia, human impacts have not significantly affected ecosystem function; in most southern regions, inland water ecological processes have changed substantially since settlement, and ecosystem function is significantly affected. The populations of many native species have declined. During the past decade (more in some areas), the southern half of the continent experienced a drought of unprecedented duration and extent, which dramatically changed inland water environments, and there is evidence that this partly reflects a changing climate.

Meeting our water needs will be a critical challenge.

Demands for water will increase as Australia's population grows, and withdrawing water changes our inland water ecosystems. However, increased demand could be met without taking much more

fresh water out of the environment (but potentially with other environmental costs, including increased energy use associated with desalination or wastewater recycling). Reduced water use will also play a part—Australia's water consumption fell 25% from 2004–05 to 2008–09. Climate change poses the largest future threat to our inland water systems. Current water-sharing rules tend to favour water entitlement holders over environmental flows in dry times.

Australia's land environment is threatened by widespread pressures.

Invasive species, inappropriate fire patterns and grazing are having a significant impact on much of our land environment. Grazing is Australia's most widespread land use and its environmental impact appears to be mixed, with impacts diminished in some regions but increased in others since widespread monitoring began in 1992. The areas managed for conservation and by Indigenous Australians have expanded (each now more than 20% of Australia's land area). Land clearing is slowing, but still averaged around 1 million hectares per year during 2000–10. The legacy impacts of land clearing are substantial, with loss and fragmentation of native vegetation. The extent of land clearing is now balanced by that of regrowth, although the character of regrowth is different from that of the original vegetation.





Threats to our soil, including acidification, erosion and the loss of soil carbon, will increasingly affect Australia's agriculture unless carefully managed.

Acidification and erosion currently affect large areas, although wind erosion has decreased in response to better agricultural practices. In 2001, it was estimated that soil acidity affected 50 million hectares of surface layers and 23 million hectares of subsoil layers, estimated to cost \$1.585 billion per year in lost agricultural production. Soil carbon is central to maintaining soil health, and can also be a significant source or sink for greenhouse gases, depending on land management.

The overall condition of the Australian marine environment is good, but integrated management will be key to the future conservation of our ocean resources.

Nearshore marine areas adjacent to intensive settlement have suffered the most from human activities; open ocean conditions are generally good. However, the pressures on all these areas are increasing, and the early warning signs of degradation are becoming commonplace in a number of ecosystems and habitats. An integrated national system of multilevel governance for conservation and management would enable the natural wealth of our oceans to be maintained in the face of challenges, and would reward us with healthier oceans and increasing economic returns.

The ocean climate is changing and we will need to adapt.

There are likely to be major impacts in the coming decades from increasing sea level, increased incidence and severity of extreme weather events, altered ocean currents, changing patterns of biodiversity, and changing productivity. In particular, ocean acidification will have a major impact on marine ecosystems, since it can affect

the base of marine food webs by diminishing the ability of planktonic organisms, which are food for many other organisms, to form shells.

The Antarctic environment is showing clear signs of climate change, which is likely to have profound effects on Antarctic species and ecosystems.

The East Antarctic Ice Sheet is losing ice at its coastal fringes—about 60 billion tonnes each year since 2006. The loss is occurring at an increasing rate and may contribute significantly to sea level rise. The upper layers of the Southern Ocean have warmed by 0.2 °C since the 1950s. This rate of warming is faster than elsewhere in the world. Warmer waters enable alien species to extend their range southward. Invading species are likely to outcompete, and perhaps replace, native species. Antarctic vertebrates, including seabird, penguin, seal, whale and numerous fish species, are highly specialised to survive in the Antarctic. It is not known whether they can adapt to new conditions arising from climate change, and it is likely that some species will not survive the coming decades.

Our unique biodiversity is in decline, and new approaches will be needed to prevent accelerating decline in many species.

Many of Australia's species, and even whole groups of species, are unique to this continent, and Australia is identified as one of the world's 'megadiverse' countries. However, there have been major declines in many components of biodiversity since European settlement, and data on pressures suggest that many species continue to decline, despite promising investment to address these pressures. Australian governments and nongovernment organisations are trialling new approaches to managing ecological systems. This includes supporting connected corridors of vegetation, which have the potential to make major advances in conserving our biodiversity.





Our extraordinary and diverse natural and cultural heritage is currently in good condition, but is threatened by natural and human processes, and a lack of public sector resourcing.

Australians place a high value on our rich natural, Indigenous and historic heritage. However, our heritage lists and protected areas do not include all of the places with heritage value, nor are they truly representative. Although the processes used to protect and manage Australian heritage are internationally recognised, some are cumbersome and under-resourced. Comprehensive assessments, more flexible approaches and better resourcing are needed to support conservation.

Australia's built environment faces many pressures and consumes significant natural resources, although consumption may be slowing.

The majority of Australians (87% in 2006) live in urban areas. An increasing need for urban space and buildings, increasing traffic congestion and increasing consumption are affecting the livability and environmental efficiency of the built environment. Traffic congestion, in particular, is of growing concern. However, growth in traffic may be levelling and use of public transport is increasing. Emerging evidence suggests that energy and water use may be slowing due to improved technology and better recognition of the need to reduce human environmental impact.

Coastal regions bring together many of the issues affecting other parts of the environment, and coordinated management will be needed to mitigate pressures.

Our coasts, as well as being some of our most iconic natural areas, are some of Australia's most heavily settled areas. Pressures include urban expansion and the cumulative effects of small developments. Some trends, such as expansion of conservation and Indigenous areas and improvements in land-management practices, are acting to reduce some pressures. Climate change will have a major impact on our coasts, particularly through sea level rise. The implementation of recommendations from *Managing our coastal zone in a changing climate: the time to act is now* would support a more strategic approach to managing coastal resources. The Australian Government has now noted or agreed in principle to most of these recommendations and appears set to take action on many.

Australians cannot afford to see themselves as separate from the environment.

The Australian environment is precious. Our ecosystems, biodiversity and heritage are vulnerable to the choices we make. At the same time, we depend on them for our survival and wellbeing. Our ecosystems, and the biodiversity they support, provide services that are fundamental to human life, such as regulation of the atmosphere, maintenance of soil fertility, food production, filtration of water, and pest control. The major future drivers of change—climate change, population growth, economic development and associated consumption of natural resources, as well as the pressures that these drivers place on the environment—will need to be managed carefully if our society is to achieve a sustainable relationship with the Australian environment.



*The balance of nature
is not a status quo;
it is fluid, ever shifting,
in a constant state of
adjustment.*

Rachel Carson,
Silent spring, 1962



■ Snow gums, Mt Buffalo, Victoria
Photo by Mark Gray



Summary

The 2011 State of the Environment (SoE) report aims to give Australians the best possible and clearest answers to three basic questions:

- What is the current condition of the Australian environment?
- What are the risks the Australian environment faces and are we doing enough to protect it?
- Where is the Australian environment headed?

Much of Australia's environment and heritage is in good shape, or improving. Other parts are in poor condition or deteriorating. Some of the pressures on our environment arise from past decisions (or even just bad luck) that have left an ongoing legacy of impact. Our changing climate, and growing population and economy are now confronting us with new challenges.

The consequences of our past environmental and heritage management are reflected in a number of environment indicators that continue to cause concern. Introductions of feral animals and weeds, widespread land clearing, the drainage of wetlands, intensive harvesting of fish stocks and a host of other past actions will continue to exert pressures on our environment regardless of environmental policies and management that now prohibit or minimise such actions, and regardless of our management of the drivers of climate change, and growing population and economy. For example, if we did not add one more person or business to the nation, the ongoing impacts of feral goats, rabbits, cane toads, land clearing and vegetation dieback would continue to be significant.

In general, environmental and heritage management in Australia reflects a sound understanding of this historical context, and translates into environmental and heritage planning with clear intent. Future environmental impacts are not necessarily based on historical relationships between growth and resource use, biodiversity loss or environmental degradation. There is evidence that we have the means to disconnect, at least to some degree, the relationship between growth and environmental impact that has been seen in the past. While our population and economy have continued to expand, we are no longer subjecting the continent to wholesale land clearing or unmitigated industrial pollution, and sea-floor trawling is now limited. We no longer develop water resources without any reference to the needs of the environment. We attempt to recognise and protect Indigenous heritage. And although we have had only limited success in controlling introduced weeds and pests, we now take biosecurity very seriously so that we might not have as many new pests to deal with.

However, the resources required to reverse or reduce historical impacts are in many cases beyond the means of even a wealthy nation like Australia. Conservation investments and interventions tend to focus on our environmental and heritage assets that are of greatest value and under greatest threat. With this focus, significant restoration of the environment towards its pre-settlement condition will continue to be elusive.

If we consider the major environmental challenges we now face, the most confronting is the prospect of

a changing climate. This is, in part, because climate is such a direct and pervasive driver of environmental response, in part because global warming is something beyond our near-term or local control, and in part because of the uncertainties of scientific prediction and global policy. Climate change is now widely understood as a prime risk to both our environment and our society, and is clearly a major item on our national agenda. The Climate Commission's (2011) report, *Climate science, risks and responses*, makes the reality, certainty and implications of our changing climate clear and immediate. These implications extend to regional security and threats to our export markets.

The growth in global greenhouse gas emissions since 2005 is tracking above the middle of the Intergovernmental Panel on Climate Change's (2000) scenario range. There is also a very large amount of inertia in the atmospheric–oceanic system, which will drive climate change for centuries to come, even if global mitigation efforts dramatically reduce emissions. Together, these factors mean that we are facing climate consequences for the foreseeable future. Key sectors of the Australian environment are vulnerable to relatively small increases in temperature or drying, or to projected increases in sea level. We note the evidence that early action by Australia to reduce emissions and to deploy targeted adaptation strategies will be less costly than delayed action. To the extensive analyses and national dialogue on this issue, we will only add that we can expect to be surprised by both the vulnerability and the resilience of different parts of our environment and heritage.

The other major drivers that put our environment and heritage at risk are the impacts of population and economic growth. These drivers are much more under our influence. More people and more economic activity may mean more resource use, but the actual impact on the environment depends on where and how the growth occurs, and how we live our lives. Australia is making progress in lowering per-person water use and landfill waste. There is strong evidence that, while our economy has grown, we are generating more wealth per unit of water or energy used. But if we are to succeed in meeting even the least ambitious greenhouse gas emission reduction targets, we need to achieve far more substantial reductions in the energy intensity of our economy.

Australia will continue to do what we can to redress the legacy of our mixed history of environmental and heritage management, while ensuring we mitigate or wisely adapt to the ongoing drivers of climate change, population growth and economic growth. To support this, we will need to choose our environmental (and sustainability) indicators with equal wisdom. These indicators need to measure the effects and effectiveness of our current and future approaches to environmental sustainability to allow us to improve our strategies.

Assessing the state of Australia's environment is inherently difficult. Australia is a big country, with a wide variety of ecosystems and heritage. There are many unconnected means by which we gather and store information on our environment, and accessing this information at a national scale is tremendously complicated and not always possible. These are the challenges faced by every SoE report, and why many of the assessments made in this report are indicated as uncertain and in some cases not possible. We look forward to continuing progress towards improved environmental information systems across jurisdictions, industries and communities. Although there will always be a call for more measurement and new understanding of our environment and heritage, there is also great value latent in the information we have already collected if we can access it more efficiently and effectively.

But although more and better information is essential, it is not all we need to meet our challenges. What is clear from this report is that the complexity of environmental management in a changing world demands a more integrated approach to planning, and management focused on achieving and maintaining the environmental values.

The difficulties we face with a national SoE report in terms of inadequate data are in part a symptom of a lack of national coordination. Australia is a federation with nine major jurisdictions and hundreds of local authorities, plus thousands of individual government departments and nongovernment organisations. The responsibility for environmental governance is shared among the three Australian levels of government, and with the community and the private sector. Furthermore, jurisdictional divides establish precise spatial boundaries of control, each with their own focus and purposes. Developing and implementing integrated approaches to address common objectives can therefore be challenging.

However, the Australian environment crosses these boundaries, and its management needs rarely reflect our organisational and administrative structures. Nor do national territorial boundaries limit Australia's environmental obligations under international treaties and agreements, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), China Australia Migratory Bird Agreement, Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar), International Convention for the Regulation of Whaling and the United Nations Convention on the Law of the Sea.

Because of this complexity, the Australian Government has an important national role to play in environmental management. This role is leadership—partly through the government's own actions and partly through national coordination. This leadership extends to priority setting, funding and handling of policy on national issues; coordination of programs, information gathering and sharing; and coordination of guidelines and standards. National programs such as the Murray–Darling Basin Plan, Caring for our Country and the National Reserve System are also important in providing overarching systems for particular aspects of our environment. The prognosis for the environment at a national level is highly dependent on how seriously the Australian Government takes its leadership role.

Four trends in environmental management stand out over the past decade. The first is that the Australian Government has exerted stronger leadership on a number of important environmental issues, such as biodiversity conservation and water governance. The second is that the Australian, and state and territory governments have given much greater emphasis to regional-scale environmental management, complementing the roles of different levels of government and of community-based organisations such as Landcare. The third is the use by governments of an array of market-based mechanisms to complement regulation as a means of realising environmental goals. Finally, Indigenous Australians have become more formally involved in the management of their land and sea country.

These trends in environmental management will influence the future condition of the Australian environment. The current state and trends and the outlook over the coming decades vary for different dimensions of our natural and cultural environments.

Indigenous land and sea management

Indigenous land and sea management, also referred to as 'caring for country', includes a wide range of environmental, natural resource and cultural heritage management activities undertaken by individuals, groups and organisations across Australia.

These activities have their origins in the holistic relationship between traditional Aboriginal and Torres Strait Islander societies and their customary land and sea estates—or 'country'—that have existed for at least 50 000 years. In recent decades, stimulated in part by the return of significant areas of land to Indigenous ownership from the late 1970s onwards, Indigenous communities, groups and organisations have increasingly become engaged in land and sea management. This has been either through employment in government agencies, such as national parks and natural resource management organisations, or, increasingly, by establishing their own land and sea management agencies and ranger groups.

All levels of governments, recognising the high biodiversity and other environmental values of Indigenous management lands, have responded to caring for country initiatives through funding, partnerships and other support. The Australian Government provides significant investment through the Working on Country Program, which supports the employment of approximately 600 Indigenous rangers nationwide, and the Indigenous Protected Area Program, which supports Indigenous groups to establish protected areas on their own country to contribute to national conservation goals.

Indigenous land and sea management initiatives are contributing to a developing conservation-based economy with significant social, health and cultural benefits, especially in remote regions. Ongoing financial support and some institutional reform, including greater recognition of Indigenous management of sea country, will be required to enable these opportunities to reach their full potential. Challenges will include coordinating traditional land and sea practices with strategies to meet the new pressures facing land and sea country.



Atmosphere

Over the relatively short span of 250 years, and for the first time in human history, we have changed and are continuing to change the composition of the atmosphere on a global scale. Levels of carbon dioxide, the most important greenhouse gas, have increased by around 39% above pre-industrial levels, principally due to burning fossil fuels. This has led to a clearly defined trend of increasing average global temperatures, and there is growing evidence of consequent changes in the complex interlinked atmospheric, oceanic and terrestrial processes that shape climate at global, continental and regional scales.

For Australia, as the driest inhabitable continent (with a climate characterised by high levels of variability), climate change poses a clear and present threat. Although projections of Australia's future climate at national and regional scales are still uncertain, the most recent comprehensive review of modelling outcomes shows that a continuing, spatially variable rise in temperatures across the continent is highly likely. Projections of rainfall are more variable, but half of the 23 models considered by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Meteorology show an increase in annual and summer rainfall in northern Australia, while nearly all show a decrease in winter rainfall in the south-west and along the south coast.

In addition to the risks of increasing temperatures, and changes in rainfall amount and seasonality, a key risk associated with climate change is the likelihood of more frequent and more severe extreme weather events, such as floods, droughts and heatwaves. Such primary atmospheric

risks in turn generate a broad series of secondary and tertiary risks, including increased mortality and morbidity due to heatwaves and spread of disease vectors, reduced stream flows and groundwater recharge, reduced soil moisture and loss of topsoil, and changes in habitat with attendant risk to biodiversity. An increase in bushfires is also likely.

Depletion of the stratospheric ozone layer, particularly in the form of the seasonal 'ozone hole' over Antarctica, remains of concern, as the ozone layer limits the amount of harmful ultraviolet light reaching the lower layers of the atmosphere. Since peaking in the mid-1990s, levels of stratospheric chlorine and bromine from chlorofluorocarbons and other ozone depleting substances (ODSs) have decreased and are continuing to decrease. However, the latest World Meteorological Organization *Scientific assessment of ozone depletion* (2010) cautions that '... ozone depletion will continue for many more decades because several key ODSs last a long time in the atmosphere after emissions end'. This has important implications for the climate, since all ODSs (except methyl bromide) are powerful greenhouse gases and recovery of the ozone layer is expected to interact with climate change through a complex series of linkages.

Ambient (outdoor) air quality in Australia's major urban centres is generally good. National health-based standards are rarely exceeded for prolonged periods, and poor air quality is usually associated with short-lived extreme events such as bushfires and dust storms that generate very high levels of particle pollution. Despite substantial growth in population, expansion of industry and greatly increased use of motor vehicles, levels of carbon monoxide, lead, nitrogen dioxide and sulfur dioxide have declined in urban areas over the past 10 years. By contrast, levels of particles and the secondary pollutant ozone have not decreased. Monitoring results continue to show that peak ozone levels occasionally exceed the standards in some centres, and standards for particle pollution are often exceeded for short periods in most metropolitan cities. Despite a generally favourable situation, research in Australia and overseas has shown that urban air pollution continues to be a significant cause of death and illness in the community. By one estimate, there were some 3000 deaths in Australia due to urban air pollution in 2003—nearly twice the national road toll.

Prospects of achieving significant reductions in peak levels of particles and ozone will be influenced by a range of factors, including continued tightening of vehicle emission standards, availability and reliability of public transport, increased take-up of cleaner forms of production, continued expansion of major cities, rising temperatures, and more frequent extreme events associated with climate change.

Given the high proportion of time most Australians spend indoors, it is surprising that Australian data on indoor air quality are relatively scarce and that there are no specific national guidelines for indoor air quality. Although government intervention to improve indoor air quality has increased during the past decade, such action has focused on smoking bans in public venues and in workplaces, leaving the domestic environment largely unregulated.



Inland water

Using water from our environment is fundamental to our sustainability as a society. We have had an ambitious decade of water policy reform, with all states and territories committing to the principles of the National Water Initiative. This initiative is designed around a market, regulatory and planning-based system to manage surface water and groundwater resources for rural and urban use in a way that optimises economic, social and environmental outcomes. This commitment includes provision of adequate water for sustaining the environment.

Most of the current impacts on Australia's inland water environments result from our historical legacy of land-use change, pest and weed introductions, and water resource development. Although there is only limited capacity to reverse many historical impacts, there is reason to believe that projected population and economic growth can be significantly

decoupled from future pressures on our inland water ecosystems: Australia is using less water, and while Australia's rising population will increase demand for urban water, this is likely to be met without taking proportionately more fresh water out of the environment.

During the past decade (longer in some areas), the southern half of the continent experienced a drought of unprecedented duration and extent. This dramatically changed the character of inland water environments. Except for the south-west corner of the continent, the drought ended in late 2010 with widespread flooding. The recovery of river and wetlands ecosystems following these floods will provide crucial insights into how inherently resilient these systems are—if this recovery is appropriately monitored.

With some additional management intervention and investment, the inland water environment is likely to remain in generally good condition in northern Australia, and poor but potentially improving condition across much of the south, with only limited regions with continuing serious deterioration. The principal risk to inland environmental health that remains poorly mitigated is the likelihood of a drying climate for our southern catchments; current water allocation rules tend to favour water entitlement holders over environmental flows in dry times.



Land

The situation and outlook for the land environment are mixed. Although we have made progress in many aspects of managing Australia's land environment, the trends for many indicators of land environmental values remain adverse, and are likely to be exacerbated by climate change.

Although vegetation and soils are in relatively good condition across large areas of Australia, this is not the case in much of the intensive land-use zone where agricultural production is concentrated, nor in some parts of the rangelands. The rate of land clearing, one of the most significant pressures on the land environment, averaged around 1 million hectares per year in 2000–10. By the end of the decade, the continental extent of land clearing was balanced by the extent of regrowth—although the character and values of the two forms of vegetation are often different. The impacts of other landscape-scale pressures—principally invasive species, and inappropriate fire and grazing regimes—are increasing in many areas. In agricultural systems, loss of soil carbon, and soil acidification and erosion, are problematic and may have major impacts on production.

Livestock grazing is the most extensive of Australia's land uses, practised across 55% of the continent. The conservation and Indigenous estates have continued to expand; each now represents more than 20% of Australia's land area. The effectiveness of management has improved for most land uses, particularly for those that are most intensive, but needs to improve further in many land-use systems to protect and sustain their environmental values. The expansion of human settlements, and of new forms of mining, are having locally significant impacts in those regions where they are concentrated.

Some governance and institutional arrangements for the land environment have changed substantially during the reporting period, but remain suboptimal in a number of important respects. Levels of investment in management of the land environment, in research and development, and in knowledge and information systems that enable good land management are significant but still inadequate.

Climate change is expected to have profound effects on the land environment, particularly on native vegetation and production systems. Some native vegetation communities are likely to disappear, others will change substantially in extent and composition, and novel ecosystems will arise. Impacts on production systems are likely to be mixed, but generally adverse.



Marine environment

Australia's oceans and coastal marine ecosystems are overall in good condition and have experienced only gradual decline, although there are many local coastal areas where ecosystems are in poor or very poor condition as a result of local pressures. Indeed, some of the world's worst examples of impacts from pollution can be found in Australian waters. Australia is world leading in many areas of marine management, but low levels of pressures have allowed environmental resilience to remain high in many regions. Now, there are strong signals that many of our marine systems and resources have reached their finite limit and pressures are building to levels where impacts can be easily seen in many of the regions.

Nearshore development is proceeding quickly, replacing vegetated landscapes with hard surfaces that interrupt wetland functions and estuarine flows. Land-based sources of pollution and expanding pressure on coastal lands continue to be a significant concern, despite strong improvements in land-use planning and the management of many point sources of pollution. Fishing has reduced most populations of sought-after species to low levels, mainly in previous decades. The maintenance of these low population levels by present-day management policies probably has significant flow-on consequences for the resilience and persistence of marine biodiversity in all inshore waters. The major looming threat for our oceans and coastal waterways is the changing global climate, which is creating significant changes in ecosystems, biodiversity, shorelines and coastal lands. It threatens our wealth generation from the oceans, and the existence of our coral reefs at their present-day scale and grandeur. A proliferation of oil and gas exploration and extraction, together with the new energy and water systems, and other shoreline industries, brings not only important initiatives in wealth generation, but also a major new set of risks to our waters that will require intensive strategic and regional management.

Regionally, the north-west is beginning to come under intense development pressure from the resource extraction sectors (oil and gas, mining, fishing, shipping). The marine values and assets of the north region remain relatively pristine, although, even there, mining and river damming are growing pressures. The south-east region remains under the greatest stress, with a legacy of impacts from a wide variety of sources, and is suffering the greatest impacts from changing climate—the East Australian Current is changing its pattern of extension into Tasmanian waters with the intensification of gyres and increases in temperature.

The interaction of accelerating changes in the climate with existing land uses, fishing systems, shoreline industries and new risks is presenting ocean management with unprecedented challenges. There is a plethora of responses to this situation, many of which are achieving good outcomes; some are reducing pressures, and holding ecosystems and biodiversity in good condition. However, the evidence is that our management systems are still too fractured, weakly coordinated and poorly integrated to halt the accelerating degradation of the unique values of our oceans and coastal ecosystems. The early signals of such decline are now evident across a number of areas of our coastal waters. Perhaps the most critical challenge of all now confronts us—our ability to design and deliver good, effective and efficient governance to address the known threats and accelerating risks to our unique marine environment.



Antarctic environment

Although a long distance away from Australia and the rest of the world, Antarctica is under the influence of human activities just like any other continent. Australia operates four permanently

occupied Antarctic bases (three on the continent and one at subantarctic Macquarie Island). About 4000 people work on the continent each year, and 53 650 people (including crew) visited Antarctica, mainly the Antarctic Peninsula, in 2010–11. All human activities are strictly regulated and are subject to the Antarctic Treaty, as well as Australian legislation. Most human activities and environmental impacts are concentrated in the very limited ice-free areas, which make up only approximately 0.4% of the entire southern continent. Human presence also impacts species that use these limited areas as important growth and breeding sites.

Antarctica is changing. The rate of change varies around the continent, but some areas—for example, the Antarctic Peninsula—are changing very quickly. The most important factors contributing to this change are climate change, the occurrence of extreme events and human impacts. East Antarctica, where Australia operates, has so far changed comparatively slowly but it, too, is getting warmer. There is still little understanding about how various factors may interact. For example, recent research has discovered a link between the ozone hole and the rate of warming in East Antarctica. While the ozone hole exists, clouds forming as part of the processes that create the thinning of ozone appear to shield the continent from warming. Predictions are that a recovery of the ozone layer will significantly increase the rate of warming. A key activity of the Australian Antarctic bases is research to assess the impact of climate change on the Antarctic environment and its ecosystems. It will also be important to understand the wider implications of Antarctic changes, as the atmospheric and oceanographic processes of Antarctica are important drivers for the weather in the Southern Hemisphere.

The rate at which the physical environment of the region is changing appears to be faster than the rate at which organisms, especially those of a higher order, can adapt to the changes. Although many uncertainties still exist, some populations are changing in size. Not all populations are decreasing, but, in the long term, they may be outcompeted by species that can adapt to the changing ecosystems or be replaced by species whose range is now extending from warmer climates into the Antarctic region. It is likely that some Antarctic species will not survive the coming decades.





Biodiversity

Biodiversity in Australia has declined since European settlement. This decline is seen in all components of biodiversity—genes, species, communities and ecosystems—and the evidence from pressures suggests that many components of biodiversity continue to decline. This trend is variable, because components of biodiversity appear to be persisting well in some areas, especially where human impacts are minimal, but declining significantly in others. Declines have historically been greater in southern Australia than in the north; however, recent reports of significant declines in small mammals and birds in northern Australia suggest that at least some components of biodiversity in the north are less secure than previously thought.

Long-term collection of data on trends in biodiversity and their implications is very limited, and most jurisdictions are unable to draw detailed conclusions about the state or trends of major animal and plant groups. Despite promising investment by all jurisdictions in addressing the main pressures on biodiversity, state of the environment reports around the nation continue to conclude that the decline in biodiversity is not being arrested or reversed. Most pressures on biodiversity that arise directly or indirectly from human activities appear to still be strong, and those that have declined, such as land clearing, continue to have legacy effects that will last for years or decades.

However, despite this bleak history, there is hope for the future. Australian governments and nongovernment organisations have been debating and trialling new approaches to biodiversity management, including ways to engage the right stakeholders at the right times and in the right places. This nation is poised to build on these trials and, if wise decisions are made, there is potential to make major advances. However,

■ Flinders Ranges, South Australia
Photo by Nick Rains

the legacies of past pressures like land clearing, ongoing pressures like invasive species and emerging challenges like climate change will take decades to address, so even in the most optimistic scenarios we will not see overnight change.

As Australia's population grows, serious thought needs to be given to the dependence of people on biodiversity and natural resources, and how we protect those resources. Human activities have the potential to lead to further declines in components of biodiversity, which will seriously affect the delivery of environmental benefits to Australians and reduce our quality of life. Improving the collection of information that will allow us to understand the effects of interactions and interrelationships between humans and biodiversity over the long term is vital. Most of the potential risks and surprises affecting biodiversity also present opportunities if Australians think strategically, anticipate, prepare and act.



Heritage

Our heritage includes those places with natural, Indigenous or historic values that we have inherited and want to pass on to future generations. Heritage provides an important context for our perception of ourselves as Australians, and is part of the 'social glue' that binds communities together and expresses identity. Australians see natural and cultural heritage as important, but also as vulnerable, but these sentiments are not reflected in the resources devoted to heritage assessment and conservation.

The systems we use to manage our heritage are cumbersome: land reserves, inventories and statutes. These structures do not adequately identify, protect, manage, resource or celebrate our nation's natural, historic and cultural landscape. Our heritage is, as a consequence, at risk from the impacts of climate change, the threats arising from development and the pressures arising from population growth.

Although the value of our natural heritage is widely recognised, neither private nor public natural heritage places are adequately protected. The National Reserve System continues to improve, but reservation of a truly representative set of landholdings is hampered by factors such as perceived economic values. Climate change poses major risks to natural heritage and, if its impacts are to be managed effectively, scientists and managers will need work proactively and together. Our natural heritage is also threatened by inappropriate land use, development pressures, loss of habitat and invasive species. Adverse effects can be minimised through thorough understanding of natural heritage resources, recognition of the benefits of public–private partnerships and a ‘whole-of-landscape’ approach to conservation and management.

There is increasing recognition of the importance of Australia’s Indigenous heritage by all Australians. However, Indigenous heritage in Australia is inadequately documented and protected. Incremental destruction continues. The inclusion of Indigenous heritage places within protected reserved lands is therefore particularly important. ‘Closing the Gap’ is a welcome initiative, as is the increasing involvement of Indigenous people in sustainable land and sea management. However, loss of language, knowledge and traditional practices continues to erode Indigenous cultural traditions and connections to country.

There are many well-managed Australian historic heritage places that remain in good condition. However, statutory lists and registers are inconsistent and incomplete. Historic heritage conservation is not well supported by planning and assessment systems and is directly threatened by development pressure, often because heritage is identified only after a project is proposed and is therefore perceived as ‘the problem’. Population shifts and inadequate incentives for private owners also threaten historic heritage. A wider range of management approaches would enhance the place of historic heritage in the community and facilitate effective conservation.

Overall, the outlook for Australia’s heritage will depend on government leadership and two key factors: firstly, willingness to undertake thorough assessments that lead to comprehensive natural and cultural heritage inventories, and truly representative areas of protected land; and, secondly, our ability to respond to emerging threats through improved resourcing and more flexible heritage management approaches and processes.



Built environment

Australia’s diverse built environment faces many pressures—driven by population and economic growth, and climate change—and is only in a fair shape. An increasing urban footprint, increasing traffic congestion and increasing consumption are impacting on the livability and environmental efficiency of our cities and towns. Traffic congestion, in particular, is of growing concern in our cities. Residents are also concerned about the look and design of their cities; in the biggest cities, there are concerns about whether they are clean, well maintained and unpolluted.

The Australian built environment consumes significant natural resources, including water, energy and land. There is also significant waste generation, although there is emerging evidence that growth in the use of natural resources and waste generation may be slowing. Climate change is creating increased risks to the built environment through the greater likelihood of weather-related events such as mega-storms.

Management of the built environment is characterised by complex arrangements involving federal, state and territory, and local governments, as well as the private sector, and these arrangements lack coordination. Recent Council of Australian Governments initiatives to reform capital city planning, as well as the recently released National Urban Policy, seek to address this issue. Overall, the outlook for the built environment is mixed, with the negative impacts of the expected increased physical size of cities and increased traffic congestion offset by prospects for improved management and more efficient use of natural resources.



Coasts

Variations in climate, and changes in population size and composition around Australia's coasts have been major drivers of pressure on Australian coasts over the past decades, including both natural and built environments. Concerns about how to deal with the pressures caused by these drivers, as well as how to prepare for possible future climate change, have been the focus for adaptation responses in the past decade. Some trends have acted to reduce some pressures. These include expansion of conservation and Indigenous areas, decline in the extent of native forest managed for wood production and a corresponding increase in the extent managed for conservation, and improvements in land-management practices that have reduced the flows of sediments and chemicals to the coast that were characteristic of major rainfall events in the past.

There are also examples of promising responses to coastal challenges by governments, working individually and together, but outcomes in relation to a number of major issues are still far from ideal. There is significant uncertainty regarding how species and ecological systems will be impacted by climate change, and local governments are expressing concern about the lack of guidelines, standards and national strategic approaches to addressing coastal development, growing populations and environmental impacts. The recent Hawke report recommended changes to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that would allow it to be applied more strategically, and at ecosystem and landscape scales. Many of these recommendations have been accepted by the Australian Government. It remains to be seen whether action is sufficient and soon enough to allow assessment and successful management of the cumulative effects of small developments along the coastal strip.

The 2009 report from the House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts, *Managing our coastal zone in a changing climate: the time to act is now*, noted that there is limited national collaboration and cooperation to achieve consistencies, efficiencies and agreements on issues such as variations in planning laws, capacities of local councils, monitoring coastal habitat change and legal liabilities. It made 47 recommendations to address these issues. Most of these recommendations have been noted or accepted in principle by the Australian Government. As with the responses to the review of the EPBC Act, the quality and timeliness of actions will be critical if existing challenges to coastal sustainability are to be addressed and looming ones prepared for.

Recent research comparing Australian coastal governance with examples elsewhere in the world has concluded that, in many parts of Australia, the ability to adapt to emerging pressures, especially climate change, is low and declining. Recommended remedies include: (a) allocate authority and resources between levels of governance according to their effectiveness at each level; (b) strengthen development rules and incentives to relocate as an unwanted threshold is approached; (c) allow for uncertainties by enabling rules and incentives to be changed when circumstances change; (d) reassign public and private benefits, costs, risks, uncertainties and responsibilities from governments to beneficiaries of development; and (e) institutionalise catastrophes as opportunities for change, not signals to rebuild. There is potential for these issues to be addressed in the responses to the key reports mentioned above, but this will require strong leadership from both government and other sectors.

The major emerging risks that remain incompletely addressed for Australia's coasts are those related to climate change—especially sea level rise—and demographic change. The future of coastal Australia will depend largely on how rapidly these changes occur, how extreme they are, and how all Australians prepare for and respond to these risks. Desirable futures are most likely if major reform of coastal governance is achieved in the next decade or sooner, which is possible but not guaranteed.