

Executive summary

Australian governments remain strongly committed to managing biodiversity, addressing the threats and pressures and arresting the continuing losses. Pivotal to assessing progress in these areas is the ability to assess biodiversity itself. This Assessment was carried out as a cooperative partnership between the Australian Government, and state and territory agencies. It builds on the 2002 National Land and Water Resources Audit (NLWRA) Assessment, and describes indicators that could provide a basis for ongoing monitoring and reporting and evaluation of the status and trends in Australia's biodiversity.

The objectives

The aims of this Assessment of Australia's Terrestrial Biodiversity 2008 (hereafter referred to as the 'Assessment') are two-fold:

- To present the results of an assessment based on information available up to the end of June 2007.
- To report these results using indicators that could contribute to ongoing monitoring and reporting of trends in Australia's biodiversity at a national scale.

The framework

The framework for this Assessment of biodiversity is based on assets, threats and responses.

Australia's major biodiversity assets are identified as: terrestrial ecosystems; aquatic ecosystems; and species and ecological communities. This Assessment does not address marine biodiversity.

The key threats to biodiversity are: habitat fragmentation; climate change; land use change; invasive species; grazing pressure; altered fire regimes; and changed hydrology.

Institutional responses examined in this Assessment include: policy and legislation; management of at-risk biodiversity; threat abatement; conservation on private land; protected areas (the National Reserve System) and regional natural resource management arrangements.

This Assessment identifies indicators of trends in biodiversity assets, threats and responses that could be used for future assessments, and outlines the currently available national datasets that have been used to report against these indicators.

The indicators vary in the length of time-series data, temporal and spatial resolution, and confidence in the data for trends in assets, threats and responses. As a suite, however, they do provide a view of biodiversity from a number of different complementary angles. Table 1 summarises the indicators and ratings of current reporting capacities for each indicator.

Where nationally consistent data were not available, the jurisdictions proposed developing case studies in response to specific indicators. For each of the indicators where case studies were sought, they were generally the data-rich cases that could provide insight and learning. These case studies are an important part of this Assessment.

The key findings

The major findings are:

- Many of Australia’s biological assets are still in decline, and threats are ongoing and compounded by climate change.
- Progress has been made in the collaboration between national, and state and territory jurisdictions in improving Australia’s biodiversity information.
- Despite this progress, there are insufficient data to report on national trends in important aspects of Australia’s biodiversity.
- A range of useful monitoring systems exist at regional and state levels.
- Landscape-scale approaches are pivotal to long term biodiversity conservation successes, but there is a lack of effective and systematic monitoring systems at this scale that can be used for evaluation.
- The strengthening and consolidation of the regional delivery model for natural resource management (NRM) has assisted delivery of biodiversity outcomes.

Table 1 Indicators for this Assessment

Indicator	Current reporting capacity rating
Terrestrial ecosystems	
The extent and distribution of native vegetation	Good nationally for extent Moderate nationally for type
Change in the extent and distribution of native vegetation	Poor nationally Good nationally for forest (Kyoto definition) Good in Queensland for woody vegetation Good in Victoria for native vegetation cover
Status and trends in native vegetation condition	Good in Victoria In areas where native vegetation is monitored, there is evidence of decline in condition
Aquatic ecosystems	
The extent and distribution of wetlands	Moderate for important wetlands nationally Good for some states
Trends in river and wetland health	Poor nationally Good for the Murray-Darling Basin (rivers) Good in some states (rivers)

Good at case-study level	
Species and communities	
Trends in the conservation status of species and ecological communities	Poor for national trends Good at case-study level
<ul style="list-style-type: none"> The numbers of threatened taxa and ecological communities The extent and distribution of threatened biodiversity Change in the extent and distribution of threatened biodiversity 	Moderate at national level
<ul style="list-style-type: none"> Trends in listed species with recovery plans in place Trends in recovery action of target species and communities A count of modern bioregional extinctions 	Average for listing and recovery plan statistics
Threats to Australian biodiversity	
Trends in habitat fragmentation and decline in ecosystem function	Poor nationally Moderate at case-study level
The range and relative importance of threats to biodiversity over time	Poor nationally Moderate for listed species and communities
Trends in the impacts of climate change on biodiversity	Poor nationally Poor at case-study level
Trends in the impacts of land use change on biodiversity <ul style="list-style-type: none"> Trends in land clearing rates 	Poor nationally Good for clearing rates in Queensland Moderate at case-study level
Trends in the impacts of invasive species and pathogens on biodiversity <ul style="list-style-type: none"> Extent and distribution of important invasive species 	Poor nationally Good at case-study level
Trends in the impacts of grazing pressure on biodiversity	Poor nationally Moderate at case-study level
Trends in the impacts of altered fire regimes on biodiversity	Poor nationally Good at case-study level
Managing Australia's biodiversity	
Progress in building the National Reserve System <ul style="list-style-type: none"> Progress towards comprehensiveness, adequacy and representativeness (CAR) targets 	Good for representativeness and comprehensiveness Poor for adequacy
<ul style="list-style-type: none"> Progress in instituting recovery plans Progress in managing threats Trends in major threats 	Poor at national and state/territory levels Poor for national trends in threats Good only at state/territory and case-study level
Progress towards conservation of	Moderate for general effectiveness of

biodiversity on private land <ul style="list-style-type: none"> • Effectiveness of key institutional responses on private land • Progress in industry engagement in biodiversity conservation 	major programs Good for industry engagement Poor for biodiversity outcomes of conservation efforts on private land
Biodiversity outcomes of the regional investment model	Moderate at general level of systems and capacity building Poor for biodiversity outcomes
Progress in addressing the threats of climate change	Poor nationally but building

Table 2 Key findings

Terrestrial ecosystems

Native vegetation is a key surrogate for biodiversity.	Native vegetation is a cost-effective and powerful surrogate for biodiversity. The distribution of threatened species and communities is closely aligned with areas where native vegetation has been extensively cleared.
The extent of native vegetation is known.	<p>National mapping of native vegetation has advanced significantly since 2002 with improvements in data and in mapping technologies (e.g. through the Native Vegetation Information System). Although important gaps remain (in scale, and in defining some major vegetation groups such as derived native grasslands), we now know the extent of most major vegetation types in the landscape.</p> <p>From the national vegetation data sets, we know that about 87 per cent of the Australian continent still has native vegetation cover.</p> <p>National Forest Inventory data, which compiles state and territory forest mapping information, estimate total forest cover to be 149 million hectares (using <i>Australia's State of the Forests Report 2008</i> definition of forest).</p>
Native vegetation has been modified or cleared.	Native vegetation has been modified and cleared since European settlement, especially from intensive agricultural and urban areas (particularly in southern and eastern Australia and in south-western Australia). The losses have been greatest in eucalypt woodlands and have also been significant in eucalypt open forest and mallee woodlands and shrublands. The loss of biota in the cleared and modified areas has been dramatic and continues today (e.g. in woodland birds).
Native vegetation is being lost faster than it is replaced.	Broad-scale clearing has been reducing since 2002, however nationally, native vegetation is still being cleared and modified faster than it is replaced. A net loss of forest (including native and non-native vegetation) of around 260,000 hectares per year occurred between 2000 and 2004 and was primarily attributed to clearing for agriculture and urban development.
We are making progress towards assessing native vegetation condition.	Since 2002, there has been progress in the collaboration between national, state and territory jurisdictions in improving Australia's vegetation information. This includes approaches to modelling, monitoring and mapping vegetation condition, on both national and more localised scales. Reference-based methodologies are being used in most states for target setting, investment and planning decisions, and reporting.

Aquatic ecosystems

The extent and distribution of wetlands nationally is not known.	Studies identify that only 17 per cent of Australia has comprehensive coverage of the extent and distribution mapping of wetlands.
A wetland mapping methodology has been developed.	A methodology for mapping wetlands, as well as providing information on the extent and distribution of different wetland types, has been developed and is starting to be implemented on a state-wide basis.

Selected case studies indicate a decline in the extent of wetlands.	Case studies indicate a decline in the extent of wetlands. This is predominantly due to altered flow regimes through river regulation, increased surface and groundwater abstraction, increased interception of surface water, and land use change.
	These findings are consistent with assessments indicating altered flow regimes have resulted in the loss of 90 per cent of floodplain wetlands in the Murray-Darling Basin.
Wetland health assessment methodologies are being developed.	A wetland health assessment program for state-wide application is being developed by one state. Other states are developing wetland health assessment techniques for potential use.
River health assessment methodologies are improving.	Methods to determine river health have evolved considerably by moving from using only one indicator to incorporating data from several indicators, to provide a more comprehensive and holistic indication of river health.
Most states have implemented independent river health programs.	Most states have implemented independent river health programs. States have developed their own methodologies for data collection and analysis of different indicators, with the exception of the standardised collection and processing methods of AUSRIVAS for macroinvertebrates.
Basin-wide river health assessments have been undertaken.	Jurisdictions have collaborated in developing and implementing river health assessments in the Murray-Darling Basin (MDB) and the Lake Eyre Basin (LEB).
Assessments indicate:	The Sustainable Rivers Audit of the MDB found 13 rivers valleys to be in 'very poor' health, seven in 'poor' health, two in 'moderate' health and one in 'good' health. Native fish species were found in only 43 per cent of valley zones where they were predicted to occur under reference condition, indicating a decline of native fish in the Basin.
- A decline in river health and fish species within the Murray-Darling Basin.	
- Intact aquatic ecosystems in the Lake Eyre Basin.	The LEB Rivers Assessment found the rivers and catchments of the LEB to be in generally good condition, with critical aquatic ecosystem processes remaining intact. Intact aquatic ecosystems make the LEB rivers unique compared with other arid river systems in Australia and around the world. The LEB may therefore provide critical aquatic habitat, especially for migratory waterbirds, given the greater impacts seen in other river systems.

Species and communities

Threatened biota are a focus of some specific conservation programs in Australia.	Conservation status can be tracked through the formal listings of threatened species and ecological communities nationally and within the states and territories. The lists are reasonably stable but are subject to change, therefore cannot be used as the only basis for reporting changes in conservation status.
Threatened biota occur in highest percentages in intensive land use zones and settled regions.	Threatened taxa and listed ecological communities occur in higher numbers along the east coast of Australia, in southern Australia generally and in the south-west of Western Australia. Mammals and birds largely account for the high numbers of threatened species in central and northern Australia.
There is accumulating	The relatively intact tropical savanna of northern Australia has been regarded as a stronghold for mammals. However, there is accumulating evidence of

evidence of decline in small mammals in the northern savannas.	decline in small mammals in this region, much of it relatively recent and likely to be ongoing. Changes are likely to be due to extensive pastoral land use and changed fire regimes.
Threatened taxa make up large proportions of totals in many subregions.	<p>Almost every bioregion of Australia contains numerous threatened taxa. Threatened taxa range up to around 30 per cent of total taxa for vascular plants, up to 60 per cent for mammals, up to 30 per cent for birds and up to 25 per cent for reptiles in the best surveyed regions for these taxonomic groups.</p> <p>The counts for invertebrates are patchy, reflecting the lower intensity of survey for invertebrates relative to other taxonomic groups. Fish and amphibians are represented in relatively low numbers in all jurisdictions.</p>
Change in conservation status has generally been to a more threatened category.	<p>The analysis of <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC) lists found that the formal status of 75 nationally listed flora taxa and 44 fauna taxa changed between 2002 and 2007.</p> <p>It is apparent that most of the change in conservation status occurred because of improved knowledge (46 per cent of records) and taxonomic updates (36 per cent of records, Table 4.7). Together these categories account for 82 per cent of all changed status in the lists for flora. Overall, improved knowledge tended to result in a decline in status of threatened flora—233 flora taxa were changed to a higher threat category because of new knowledge, while 107 changed to a lesser threat category.</p> <p>Real change accounted for 21.3 per cent of flora and 52.3 per cent of fauna. All of this change was attributed to decline. There were no cases of real improvement in the status of listed taxa at the national level.</p> <p>For nationally listed communities, nine underwent a change in status between 2002 and 2007. Of these, 33 per cent underwent real change, of which 100 per cent was decline.</p> <p>Changes in the total state and territory listed taxa showed similar trends: for flora of the 68 records of real change, 93 per cent involved decline; for fauna of 128 records of real change, 91 per cent involve decline.</p>
Case studies conducted for this Assessment confirm the overall trend of decline.	These findings are supported by an analysis of 26 case studies. The case studies represent a range of threatened species and communities across Australia and were selected as relatively data-rich examples.
Extinctions are expected to continue.	Modern mammal extinctions have mostly occurred in central and northern bioregions, with losses of up to 12 taxa recorded. There were also losses of mammal taxa in several eastern bioregions. Reptile taxa have been lost mainly from arid zone bioregions, and the losses are low in number relative to mammals. Many amphibians have become regionally extinct in the past decade.
Intensive recovery can have local success in rescuing highly threatened species.	<p>Decline in highly threatened taxa can be arrested through intensive recovery and threat abatement programs. Trends in the status of listed species with recovery plans can be used as an indicator of recovery plan effectiveness, and baselines have been established in this Assessment.</p> <p>Of 38 case study recovery plans examined in this Assessment, improvements were evident in 29 per cent, decline in 37 per cent and no change or insufficient information for the remainder.</p> <p>Case studies in NSW and Victoria highlight factors that will improve the success of recovery actions.</p> <p>Conservation action benefits species near extinction but is less effective for moderately threatened species, although often the recovery effort is greater for species nearing extinction.</p>
Case studies of data-rich species and communities provide important information about assessing trends in	<p>Good, reliable population and trends data are available for only a relatively small number of species and communities that are the targets of extensive recovery actions.</p> <p>Well-conceived community-based monitoring and recovery programs tend to have greater continuity than those that depend entirely on ongoing institutional</p>

species and communities.

support.

Threats to Australia's biodiversity

Key threats are habitat fragmentation and the spread of invasive species.

A national analysis of the documentation and recovery plans for threatened species and communities listed under the EPBC Act found that the most frequently cited threats are those of habitat fragmentation and the spread of invasive species

Weeds remain a threat to biodiversity but their impacts on biodiversity are not generally assessed.

Weed management strategies and policies have historically failed to address impacts on biodiversity adequately.

There are already a number of observed impacts from changes in the climate.

Observations of changes in native species and natural systems linked to climate change in Australia include: the expansion of rainforest at the expense of savanna; the encroachment by snow gums into sub-alpine grasslands at higher elevations; saltwater intrusion into freshwater swamps; and changes in bird behaviour including arrival of migratory birds, range shifts and sea-surface temperature- induced reproductive changes.

Selected case studies illustrate specific impacts of climate change.

A number of findings emerge from the selected case studies: impacts of threats are complex and variable; impacts are difficult to predict and generic modelling will require substantial localised input to be relevant; long-term monitoring is required.

Case studies of land use change show the threat posed to biodiversity by such change.

A high percentage of species are absent from cleared areas. Most species, however, can occur in regrowth (Queensland) or corridors of native vegetation (Northern Territory).

Understanding species' requirements in terms of patch size and connectivity may allow the 'design' of landscapes with some clearing that retain vertebrate biodiversity.

Grazing pressure is a longstanding threat over much of the Australian landscape.

Almost 60 per cent of the Australian land mass is used for the production of livestock based on native pastures.

Strong linkages between artificial watering points and impacts on biodiversity can serve as an indicator of grazing pressure.

Information on monitoring fire distribution and frequency has improved greatly.

Fire frequency maps over the period 1997 to 2006 illustrate: higher frequencies of fire in the central arid lands and northern savannas; a clear relationship with extended aridity; and frequent uncontrolled wildfires in southern Western Australia, south-east Victoria and coastal southern New South Wales.

Our knowledge of biodiversity responses to fire is still patchy.

Altered fire regimes threaten biodiversity and interact with other threats in complex ways that are not yet fully understood.

Managing Australia's biodiversity

All jurisdictions have biodiversity policies and programs underpinned by legislative and other mechanisms.

Australia implements an extensive portfolio of policies and programs to manage and conserve biodiversity across the range of land tenures. These policies and programs are cast in strong governance and legislative frameworks.

National biodiversity policies and strategies are developed through cooperative arrangements among the jurisdictions.

Jurisdictions have different approaches to the management of threatened species and communities.

The states and territories vary in how they define threatened biodiversity and how they respond. Some provide a regulatory framework for comprehensive listing and recovery of at-risk species and communities while in others threatened species and communities are not comprehensively protected nor provided with recovery planning under legislation. Queensland provides protection for at-risk communities under clearing laws but not under biodiversity protection laws.

The scale of the

A series of case studies representing a range of institutional responses

impacts from threatening processes to biodiversity requires a mix of responses.	<p>revealed two particularly significant issues: a lack of effective and systematic monitoring systems for evaluation, and limited resources invested in responses to threats compared with the scale and nature of the threats.</p> <p>The scale of the impacts from threatening processes is such that the voluntary and uncoordinated approaches adopted to date will not be effective. Getting the mix of responses right will require levels of cooperation hitherto not fully demonstrated.</p>
Reducing threats at a landscape scale is a major challenge but is essential to arresting decline.	<p>The move to large-scale, multi-partner responses that take a systems approach and focus on ecological processes is an encouraging development.</p> <p>The large-scale, intensive threat abatement case studies can also provide key messages for landscape scale approaches in particular: building on and integrating with existing programs; the need for cross-tenure delivery; and having well-designed monitoring and evaluation for adaptive management.</p>
All Australian governments provide initiatives on private land.	<p>Features of private land biodiversity conservation programs include: the use of economic instruments and incentive-based policies to achieve biodiversity objectives; incorporation of biodiversity conservation in whole-farm or property management plans; and bioregional and catchment planning.</p>
We are progressing towards a CAR (comprehensiveness, adequacy, responsiveness) protected area system through the National Reserve System.	<p>Protected areas with high levels of conservation management grew by 1.6 per cent from 2002 to 2006. This represents a substantial increase on the rate for the previous decade but still falls well below what would be required to meet a target of 10 per cent reservation for every bioregion by 2010. In 2006, 49 bioregions meet or exceed this target, while 36 fall below this level of protection. Five bioregions are highly unlikely to reach the target due to clearing and fragmentation of native vegetation.</p> <p>By 2006, 11.6 per cent of Australia's land mass was reserved in protected areas. The National Reserve System is expanding on public and private land.</p>
Valuing biodiversity will contribute to the long term maintenance of biodiversity.	<p>Case studies reveal that, ultimately, the long-term future of biodiversity on private land will rely on land managers valuing the protection and maintenance of biodiversity.</p>
Biodiversity conservation has benefited from the strengthening and consolidation of the regional delivery model for NRM.	<p>The majority of regional organisations have built on a history of catchment planning to successfully develop a strong strategic basis for delivery of programs based on specific conditions and circumstances of the region.</p> <p>The regional model provides for negotiated target setting that can operate within, but is relatively unimpeded by, an often highly contested and adversarial regulatory setting for biodiversity conservation. The resulting regional biodiversity targets are more likely to be understood, owned and accepted by the people who need to be engaged in biodiversity conservation on the ground, especially landholders.</p>

Implications for future biodiversity assessments

This Assessment has highlighted the lack of many nationally consistent datasets to assess the status and trends of biodiversity in Australia, while showing that there are many instances of good datasets at a state and regional level.

To assist in national reporting of trends in biodiversity, all jurisdictions could:

- support strategic long-term monitoring of selected species and communities following agreed protocols
- support strategic research to establish empirical relationships between biodiversity and important surrogates, including native vegetation and wetlands

- support adaptive learning from major biodiversity management and conservation programs (including the reserves system, recovery actions, and threat abatement actions)
- support research into the impacts of climate change on biodiversity and its interactions with existing stressors, and
- support programs that build resilience in ecosystems, communities and species to threats to biodiversity.