
The Parliament of the Commonwealth of Australia

Managing Australia's biodiversity in a changing climate: the way forward

**Final report of the inquiry into Australia's biodiversity in a
changing climate**

House of Representatives
Standing Committee on Climate Change, Environment and the Arts

May 2013
Canberra

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Front cover (L-R): One of the Goolwa Barrages in the Coorong, Lower Lakes and Murray Mouth region; Committee members inspecting the NSW Seedbank; flowering wattle gum.

Back cover (L-R): Committee members inspecting Sydney Olympic Park; Coorong, Lower Lakes and Murray Mouth region; Committee members inspecting the turtle hospital at Reef HQ.

Contents

| | |
|-----------------------------------|-----|
| Foreword | vii |
| Membership of the Committee | ix |
| Terms of reference | xi |
| List of abbreviations | xii |
| List of recommendations | xv |

THE REPORT

| | |
|-------------------------------------------------------------|-----------|
| 1 Introduction to biodiversity and the inquiry | 1 |
| Conduct of the inquiry | 2 |
| Structure of this report | 2 |
| The state of Australia's biodiversity | 4 |
| Terrestrial | 4 |
| Marine | 5 |
| Freshwater | 6 |
| Biodiversity hotspots | 8 |
| Threats to biodiversity | 9 |
| Biodiversity losses | 10 |
| Impacts of climate change | 12 |
| Impacts on marine and freshwater biodiversity | 13 |
| Variable impacts of climate change nationally | 17 |

| | | |
|----------|--------------------------------------------------------------------------------------------|-----------|
| 2 | Biodiversity, human communities and the economy | 19 |
| | What is the relevance of biodiversity to us? | 19 |
| | Ecosystem services..... | 22 |
| | Climate change impacts on biodiversity and ecosystem services | 22 |
| | Incorporating ecosystem services into decision making..... | 30 |
| | Measuring the economic value of biodiversity..... | 30 |
| | Committee conclusions on environmental accounting and information | 36 |
| | Community engagement through education programs and citizen science initiatives.... | 37 |
| | Biodiversity education programs | 38 |
| | Citizen science initiatives | 39 |
| | Conclusions and recommendations | 42 |
| 3 | Sustainable use of natural resources | 45 |
| | Policy approach | 46 |
| | Adaptive management and coordinated planning | 46 |
| | Innovative governance | 48 |
| | Sustainable populations | 49 |
| | Practice approach | 50 |
| | Examples of sustainable resource use..... | 50 |
| | Conclusions..... | 54 |
| 4 | Connectivity conservation..... | 57 |
| | The National Reserve System..... | 59 |
| | Benefits of connectivity conservation..... | 61 |
| | Refugia in a changing climate | 61 |
| | Community engagement | 63 |
| | Challenges for connectivity conservation | 65 |
| | Costs of managing private land for conservation purposes..... | 66 |
| | Land use considerations | 67 |
| | Planning, management, research and monitoring | 68 |
| | Conclusions and recommendations | 72 |

| | | |
|----------|----------------------------------------------------------------------------------------|------------|
| 5 | Climate change adaptation strategies | 77 |
| | Introduction | 77 |
| | New approaches to biodiversity conservation | 78 |
| | Climate change mitigation strategies | 80 |
| | Increasing resilience in ecosystems and human communities | 82 |
| | Adaptive management approaches..... | 85 |
| | New approaches require new resources..... | 89 |
| | Requirement for long-term baseline environmental monitoring | 89 |
| | Multi-disciplinary approaches to biodiversity conservation in a changing climate | 107 |
| | Conclusions and recommendations | 109 |
| 6 | Natural resource management | 117 |
| | Introduction | 117 |
| | Regional delivery model..... | 118 |
| | Benefits of NRM delivery at local and regional levels..... | 119 |
| | Is the system working? | 121 |
| | Integration between levels of governance..... | 121 |
| | Regional program delivery | 123 |
| | Conclusions and recommendations | 128 |
| | Natural resource management program delivery | 128 |
| | Research and development | 129 |
| 7 | Governance issues..... | 131 |
| | Introduction | 131 |
| | Environment Protection and Biodiversity Conservation Act | 132 |
| | Outline of the EPBC Act..... | 132 |
| | Evolution of proposed changes to the EPBC Act | 132 |
| | Governance of species and communities..... | 139 |
| | Legislative effectiveness | 139 |
| | Threatened species and translocation | 141 |
| | Biosecurity considerations | 142 |
| | International obligations..... | 145 |
| | Introduction | 145 |
| | International cooperation on migratory birds | 146 |

| | |
|--------------------------------------------|-----|
| International cooperation on research..... | 146 |
| Cross-border management | 148 |
| Integrated forest management..... | 150 |
| Conclusions and recommendations | 153 |
| Conditions for bilateral agreements..... | 153 |
| Governance of species | 154 |
| Cross-border management | 155 |
| Integrated forest management | 155 |

MINORITY REPORT

| | |
|--------------------------------------------------------------|-----|
| Minority Report – Nola Marino MHR – Member for Forrest | 157 |
|--------------------------------------------------------------|-----|

APPENDICES

| | |
|----------------------------------------------------------------|-----|
| Appendix A: List of submissions | 161 |
| Appendix B: List of exhibits | 165 |
| Appendix C: List of site inspections and public hearings | 173 |



Foreword

The fact that the earth's climate is changing is well-documented. Australia and other countries have long-run data showing a marked change in the earth's temperature. But although we can be certain that climate change is occurring, its effect on Australia's environment, in particular on biodiversity, is unknown beyond the models and theories that are being used to make informed projections.

Australia has a rich biodiversity and many species are only found here. This has been recognised internationally. Australia is one of 17 'megadiverse' countries and has 15 national biodiversity hotspots across the continent. The Committee quickly learnt during the inquiry that climate effects vary greatly across species. For some, the increase in the earth's temperature and related effects will diminish their habitat and reduce their numbers, perhaps to extinction. For others, the changing climate will be to their advantage and their population will increase.

During its investigations, the Committee received a great deal of support from not-for-profit environmental groups, natural resource management bodies, State government agencies, research institutions and landholders. All these organisations and individuals were very generous with their time and expertise and they made important contributions to the report. As befitting a national inquiry, the Committee held site inspections, briefings, and public hearings in each of Australia's states and territories.

One of the major findings of the report is that important information is being collected about our biodiversity, but it can be better coordinated and the funding for it should be long term. In terms of coordination, the policy is already partly in place through the National Plan for Environmental Information. What is needed in this instance is quicker progress for a project that is admittedly very challenging due to its innovative nature and broad scope. The Council of Australian Governments can also contribute. The Committee would like to see it facilitate the development of national environmental accounts and of a central national

biodiversity database which can be scientifically accredited and to which information can be uploaded.


The Committee received consistent evidence that the usual three-year funding cycle for environmental projects is too short because it does not allow researchers to build up a baseline for a process that is continuing over decades. The Committee heard evidence from an organisation that had to reinvent their project at each funding application so that they could also continue their long term work. This is counter-productive and the Committee believes that agencies should be able to extend their funding periods where warranted.

The Committee recognises the importance of natural resource management (NRM) organisations in managing our natural environment. NRM organisations, groups and Catchment Management Authorities have the advantage of operating at the local level and deliver many NRM programs. However, they have different origins depending on the state or territory in which they are located. This has resulted in a significant variation in their consistency, standards and quality across the nation. The Committee supports the regional delivery model, but believes there is scope for improvement and has made recommendations in relation to NRM bodies' skills, standards and funding.

As in most research areas, there is considerable demand for funding but only limited resources are available. The Committee was mindful during the inquiry not to propose a large increase in funding for biodiversity action, in particular noting that much of the baseline research and data collection that would inform this work still needs to be done. However, the Committee did make some funding recommendations where the quality and value of the work warranted it. An example of this is the Atlas of Living Australia, which received funding up to June 2012 and was allowed to disburse unspent money until June 2013. The Committee believes that the Atlas would be a natural repository for the digitisation of Australia's biological collections and that the Australian Government should work with the Atlas to develop a sustainable funding model for it.

I again thank the organisations that assisted the Committee during the inquiry through submissions, participating at the hearings, or assisting the Committee at its briefings and inspections. I also thank my colleagues on the Committee and the secretariat for their contribution to the inquiry and the report.

Tony Zappia MP
Chair



Membership of the Committee

Chair Mr Tony Zappia MP

Deputy Chair Dr Mal Washer MP

Members Ms Anna Burke MP (to 7/2/12)

Mr Geoff Lyons MP (from 11/10/11 to 18/1/12)

Mr Darren Cheeseman MP (from 13/2/13)

Ms Nola Marino MP

Ms Jill Hall MP

Mr Wyatt Roy MP

Mr Harry Jenkins MP (from 7/2/12)

Mr Kelvin Thomson MP (to 11/10/11; from 18/1/12 to 13/2/13)

Committee Secretariat

Secretary Ms Julia Morris

Inquiry Secretaries Ms Peggy Danaee (from 7/11/11 to 7/12/12)
Ms Julia Searle (to 4/11/11)

Senior Research Officers Ms Susan Dinon (from 28/5/12)
Mr James Nelson (to 25/5/12)

Research Staff Mr David Monk (from 29/04/13)
Ms Leonie Bury (from 29/04/13)

Administrative Officers Ms Tamara Palmer (to 23/9/11)
Mr Peter Pullen (from 12/9/11)
Ms Jessica Hargreaves (from 9/8/12)

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Terms of reference

The Committee will inquire into and report on biodiversity in a changing climate, in relation to nationally important ecosystems. The inquiry will have particular regard to:

- terrestrial, marine and freshwater biodiversity in Australia and its territories
- connectivity between ecosystems and across landscapes that may contribute to biodiversity conservation
- how climate change impacts on biodiversity may flow on to affect human communities and the economy
- strategies to enhance climate change adaptation, including promoting resilience in ecosystems and human communities
- mechanisms to promote the sustainable use of natural resources and ecosystem services in a changing climate
- an assessment of whether current governance arrangements are well placed to deal with the challenges of conserving biodiversity in a changing climate
- mechanisms to enhance community engagement.

The scope of the committee's inquiry shall include some case studies of 'nationally important ecosystems', as defined by submissions to the inquiry.¹

¹ Referred on 2 June 2011 by the Minister for Sustainability, Environment, Water, Population and Communities, the Hon Tony Burke MP, and the Minister for Climate Change and Energy Efficiency, the Hon Greg Combet AM MP.



List of abbreviations

| | |
|---------|------------------------------------------------------------------------------|
| ABS | Australian Bureau of Statistics |
| ACE CRC | Antarctic Climate and Ecosystems Cooperative Research Centre |
| ACF | Australian Conservation Foundation |
| ACRS | Australian Coral Reef Society |
| ACS | Australian Coastal Society |
| AIATSIS | Australian Institute of Aboriginal and Torres Strait Islander Studies |
| AMSA | Australian Marine Sciences Association |
| ANEDO | Australian Network of Environmental Defender's Offices |
| BOM | Bureau of Meteorology |
| CFOC | Caring for our Country |
| CMA | Catchment Management Authority |
| COAG | Council of Australian Governments |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DAFF | Department of Agriculture, Fisheries and Forestry |
| DIISRTE | Department of Industry, Innovation, Science, Research and Tertiary Education |

| | |
|----------|------------------------------------------------------------------------------------|
| DIT | Department of Infrastructure and Transport |
| DSEWPAC | Department of Sustainability, Environment, Water, Population and Communities |
| EPBC | Environment Protection and Biodiversity |
| GER | Great Eastern Ranges |
| IMAS | Institute for Marine and Antarctic Studies |
| IMOS | Integrated Marine Observing System |
| ISC | Invasive Species Council |
| IUCN WPA | International Union for Conservation of Nature World Commission on Protected Areas |
| MPA | Marine Protected Area |
| NAILSMA | Northern Australian Indigenous Land and Sea Management Alliance |
| NCCARF | National Climate Change Adaptation Research Facility |
| NHT | Natural Heritage Trust |
| NFF | National Farmers' Federation |
| NPA | National Parks Association |
| NPAC | National Parks Australia Council |
| NRM | Natural Resource Management |
| NRS | National Reserve System |
| NWCP | National Wildlife Corridors Plan |
| RCAAE | Research Centre for Applied Alpine Ecology |
| REDMAP | Range Extension Database and Mapping Project |
| SWCC | South West Catchments Council |
| TERN | Terrestrial Ecosystem Research Network |

| | |
|----------|----------------------------------------------------------------------------|
| WALGA | Western Australian Local Government Association |
| WRAFBARN | Water Resources and Freshwater Biodiversity Adaptation Research Network |



List of recommendations

2 Biodiversity, human communities and the economy

Recommendation 1

The Committee recommends that in the course of developing and implementing an effective and sustainable system of national environmental accounts, the Australian Government include on the agenda of the Council of Australian Governments a requirement for five-yearly reports, using the existing framework of the national State of the Environment Report, and equivalent reports of each state and territory. Such reports should include assessments of the state of all significant national parks and reserves, including:

- qualitative and quantitative analysis of native biota including any loss of distribution, and
- qualitative and quantitative analysis of invasive species of flora, fauna and pathogens, including any increase of distribution.

Recommendation 2

The Committee recommends that the Australian Government, through the Council of Australian Governments, develop a central national database, incorporating a consistent and adaptable model of uploading and storing information which is able to be scientifically accredited.

4 Connectivity conservation

Recommendation 3

The Committee recommends that ongoing funding for threatening processes, including fire and invasive species management, be provided under the National Wildlife Corridors Plan.

Recommendation 4

The Committee recommends that national marine and terrestrial biodiversity corridors be included on the agenda of the Council of Australian Governments.

5 Climate change adaptation strategies

Recommendation 5

The Committee recommends that the Australian Government ensure funding cycles for environmental and biodiversity data collection programs are long enough to allow a proper baseline to be developed. This may be up to 10 years.

The Committee also recommends that funded research needs to comply with proper governance requirements such as reporting, acquittal, and ensuring that the original project goals are still being met.

Recommendation 6

The Committee recommends that the Australian Government ensures the success of the National Plan for Environmental Information by:

- implementing the recommendations of the Independent Review of Australian Government Environmental Information Activity
- publishing information about project scope and timelines as a means of helping the Plan being conducted in a timely manner
- consulting widely with the scientific community and other stakeholders, such as the Australian Bureau of Statistics, on the design of the Plan.

Recommendation 7

The Committee recommends that the Australian Government work with the Atlas to develop a sustainable funding model for it, which could include the involvement of non-government partners.

Recommendation 8

The Committee recommends that the Australian Government provide funding to the CSIRO and Atlas of Living Australia to:

- assess the current level of digitisation of biological collections in Australia
- coordinate the digitisation of biological data into the Atlas.

Recommendation 9

The Committee recommends that the Australian Government consult with the museum and education sectors to develop a strategy to attract, train, and retain taxonomists.

Recommendation 10

The Committee recommends the Australian Government include a focus on incorporating Indigenous ecological knowledge into federal biodiversity conservation and land management programs.

Recommendation 11

The Committee recommends that the Australian Government continue funding the Australian Seed Bank Partnership.

6 Natural resource management**Recommendation 12**

In recognising the importance that NRM boards operate effectively, the Committee recommends that the Australian Government conduct a review, with particular reference to:

- funding, including assessing claims that existing application processes result in ‘grant fatigue’, and can foster competition, rather than cooperation between NRM bodies
- measures to improve consistency of standards between NRM bodies nationally
- measures which may improve skills management, including sufficient capacity to attract and retain personnel, especially in regional areas.

Recommendation 13

That the Australian Government advise the Committee and stakeholders as to how the research and development needs formerly undertaken by Land and Water Australia are now being met.

7 Governance issues**Recommendation 14**

The Committee recommends that the Minister refer an exposure draft of the EPBC Amendment Bill to the Committee for review prior to introduction in the Parliament.

Recommendation 15

The Committee recommends that the Australian Government publish a progress report on developing a single national list of threatened species as part of the changes to the EPBC Act, as well as expected future timelines.

Recommendation 16

The Committee recommends that the Australian Government review the current co-management arrangements in the Australian Alps with a view to determining whether a different model – such as the Great Reef Marine Park Authority model – would improve coordination and priority management of the area's biodiversity.

Recommendation 17

The Committee recommends that the Australian Government establish an expert panel, including representatives of the timber industry and national parks, to inquire into and report on options for Australia's future integrated forest management.

Introduction to biodiversity and the inquiry

Biodiversity is the variety of life. It includes not only the diversity of species of plants, animals, fungi, bacteria and viruses that inhabit our planet, but also the genetic material within those species, the diversity of ecosystems, habitats and communities within which they live, and the diversity of processes that are performed by genes and species and the interactions among them.¹

- 1.1 Australia has a rich biodiversity, with between 7 and 10 per cent of all species on Earth occurring here.² There are between 600 000 and 700 000 species found in Australia, many of which are unique (endemic) to the country.³ The main drivers affecting the state of the environment are recognised as being climate change, population growth and economic growth.⁴
- 1.2 In recognition of the immensity and relevance of these issues in current debates and challenges facing government in Australia and internationally, the Committee sought to conduct an inquiry into climate change impacts on biodiversity, and on 2 June 2011 adopted broad terms of reference, with a focus on nationally important ecosystems.

1 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), Canberra, 2011, p. 573.

2 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, Commonwealth Scientific and Industrial Research Organisation (CSIRO) publishing, Collingwood, Victoria, 2009, p. 7.

3 DSEWPAC, 'Biodiversity hotspots', <<http://www.environment.gov.au/biodiversity/hotspots/index.html>> viewed 4 March 2013.

4 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 45.

Conduct of the inquiry

- 1.3 The Committee received 89 submissions, 14 supplementary submissions and 60 exhibits. Based on those submissions, public hearings and site inspections were held in each state and territory. In the course of these site inspections, the Committee received extensive and valuable evidence on aspects of climate change impacts in nationally important ecosystems. As a result, two interim reports were published in May and November 2012. The interim reports provide a useful platform on which this final report is based. Without duplicating the narrative of the interim reports, some themes are further developed in this final report, which takes a more strategic focus and makes recommendations for changes to administration and policy in biodiversity conservation and related areas.
- 1.4 The first interim report (May 2012) reviewed site inspections conducted in south-west Western Australia, an internationally recognised biodiversity hotspot; the Tasmanian Midlands and Central Plateau; the New South Wales Snowy Mountains region, and areas around Sydney, NSW, which included biodiversity conservation programs in urban areas.⁵
- 1.5 The second interim report (November 2012) reviewed museums and bird habitats in Victoria, water and biodiversity in South Australia, Kakadu National Park in the Northern Territory and the Wet Tropics of Queensland World Heritage Area and Reef HQ Aquarium in Queensland.⁶
- 1.6 In conducting such a comprehensive inquiry, the Committee focussed on the likely impacts of biodiversity if climate change projections are realised, and the resultant implications for management and policy-making in biodiversity conservation. The Committee did not focus on the causes of climate change or sustainable population growth as relating to biodiversity. As the terms of reference required, attention was given to 'nationally important ecosystems', although themes and issues considered by the Committee in its 2009 report into managing Australia's coastal zone continued to inform members' deliberations.⁷

Structure of this report

- 1.7 As noted earlier, both interim reports provided a platform; a means to explore themes common to more than one term of reference, and across
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5 House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 1*, May 2012.

6 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012.

7 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*, October 2009.

nationally important ecosystems. For example, community engagement was a theme in projects in most states, and across most ecosystem projects, although some of the challenges faced by the projects may have related specifically to data-collection, or the nature of the threat from pests or invasive species. An inquiry of this breadth and complexity will inevitably produce many areas which ‘overlap’, and structuring the interim and final reports to reflect these complexities will inevitably result in intersecting discussions across some terms of reference.

- 1.8 The remainder of this chapter will follow the first term of reference, and examine the state of Australia’s terrestrial, marine and freshwater biodiversity.
- 1.9 Chapter two considers the third term of reference, and examines the effects of biodiversity loss on human communities. Ecosystem services are discussed, and conclusions and recommendations are made in relation to national environmental accounts and citizen science initiatives.
- 1.10 Chapter three examines examples of the sustainable use of resources encountered by the Committee, particularly during site inspections. Considering the fifth and seventh terms of reference, the Committee acknowledges the importance of government support for such initiatives and the benefits for community engagement.
- 1.11 Chapter four considers connectivity conservation as a management approach in a changing climate, following the second term of reference, and also explores community engagement and the National Reserve System.
- 1.12 Chapter five examines climate change adaptation strategies in relation to mitigation, resilience and adaptive management, as well as the resources required to support these strategies. In considering the fourth term of reference, conclusions and recommendations are made on a range of issues including funding, the National Plan for Environmental Information, and national biodiversity databases.
- 1.13 Chapter six considers the effectiveness of the natural resource management structure in Australia, including its funding and the need for regional approaches; these relate to the seventh term of reference.
- 1.14 Chapter seven assesses governance issues relating to the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), international obligations, cross-border management and integrated forest management, following the sixth term of reference, and makes recommendations accordingly.

- 1.15 Aspects of community engagement, as referred to by the seventh term of reference, are relevant to many areas of the report, and are therefore considered in chapters two, three, four and six.

The state of Australia's biodiversity

- 1.16 The Committee considered the state of biodiversity in terrestrial, marine and freshwater environments, as well as examining biodiversity 'hotspots'. The current state of these different environments and hotspots will be canvassed, followed by an outline of threats, and current and projected losses to biodiversity. Climate change is seen as an additional stressor on biodiversity in each of these environments, to varying extents and with varying effects. Some of the threats posed by climate change will then be discussed in general terms, followed by a specific focus on marine and freshwater ecosystems. At the conclusion of this chapter, observations of the Committee across its range of site inspections are summarised, demonstrating the range of impacts and the extent of variability.

Terrestrial

- 1.17 There are 85 bioregions in Australia, representing vast and diverse terrestrial ecosystems including deserts, rangelands, tropical monsoon rainforests, temperate grasslands, wet eucalypt forests, alpine regions, and sub-Antarctic and Antarctic regions in the external territories.⁸
- 1.18 As mentioned above, there are many endemic species in Australia's terrestrial environment, including:
- 1350 endemic terrestrial vertebrates
 - 305 terrestrial mammal species, of which 85 per cent are endemic
 - 89 per cent of reptile species
 - 94 per cent of frog species
 - 45 per cent of bird species
 - 17 580 species of flowering plants, of which 91 per cent are endemic.⁹

8 Australian Bureau of Statistics (ABS), '1301.0 – Year Book Australia, 2009-10', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%939310>> viewed 5 March 2013.

9 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, , Canberra, 2011, p. 574, citing various sources; DSEWPAC, 'Biodiversity hotspots', <<http://www.environment.gov.au/biodiversity/hotspots/index.html>> viewed 4 March 2013.

- 1.19 The 2011 State of the Environment report assessed terrestrial plant species in 'high-altitude, remote and/or very dry parts of Australia' as in a good state, with adequate high-quality evidence and a high level of consensus supporting the assessment. Recent trends indicated that the assessment was stable, with limited evidence or limited consensus.¹⁰
- 1.20 The outlook was not as positive for terrestrial birds, reptiles and amphibians, which were all assessed as in a poor state, with recent trends indicating that state was deteriorating, with limited evidence or limited consensus on both the assessments and the trends. Terrestrial mammals fared even worse, being assessed as in a very poor state, with recent trends indicating that state was deteriorating, with limited evidence or limited consensus on both the assessments and the trends.¹¹
- 1.21 Terrestrial invertebrates were assessed as in a poor state and the trend as being unclear, with evidence and consensus too low to make a confident assessment on both the state and trend.¹²

Marine

- 1.22 Australia's marine environment covers 16 million square kilometres and 37 000 kilometres of coastline, including Australia's Exclusive Economic Zone, the continental shelf and vast oceans incorporating tropical marine to sub-Antarctic ecosystems.¹³ These ecosystems include coral reefs, seagrass plains, kelp forests, sand-bottomed habitats, seamounts, mangrove forests and abyssal plains.¹⁴
- 1.23 The Census of Marine Life, completed in 2010, identified that Australia has approximately 33 000 marine species recorded in the major marine databases, with a further estimated 17 000 species being likely to occur (as reported but not confirmed). Of the recorded species there are:
- 58 listed as threatened

10 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 615.

11 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 615.

12 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 615.

13 ABS, '1301.0 – Year Book Australia, 2009-10', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%939310>> viewed 5 March 2013.

14 ABS, '1301.0 – Year Book Australia, 2009-10', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%939310>> viewed 5 March 2013; CSIRO, *Submission 23*, p. 8.

- an unknown number being endemic
 - 8525 species of mollusc
 - 6365 species of crustacean
 - 5184 species of fish.¹⁵
- 1.24 Further, '[i]t is crudely estimated that there may be as many as 250 000 species (known and yet to be discovered) in the Australian EEZ [Exclusive Economic Zone]'.¹⁶ The Australian Marine Sciences Association stated that 'there is a serious underestimate of our known marine biodiversity', especially in northern Australia and in deeper waters.¹⁷
- 1.25 The 2011 State of the Environment report stated that knowledge of distribution and taxonomy of Australia's marine species remains patchy.¹⁸ The report gave an assessment of the overall state of marine species and ecosystem as in good condition, with recent trends indicating that good condition as stable, with limited evidence or limited consensus on both the assessment grade and trend. The report further assessed a few areas, specifically coastal places and areas on the continental shelf and upper slope, as in very poor condition due to the effects of specific human activities. The recent trend indicated that very poor condition as deteriorating, with limited evidence or limited consensus on both the assessment grade and trend.¹⁹

Freshwater

- 1.26 Freshwater ecosystems incorporate, among others, lakes, swamps, wetlands, waterways and rivers. The Australian Bureau of Statistics' (ABS) 2009-10 Year Book identified a likelihood of high levels of locally endemic

15 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 382-83, citing AJ Butler, T Rees, P Beesley, NJ Bax, *Marine biodiversity in the Australian region*, PLoS ONE 2010;5(8):e11831. For further discussion on the Census of Marine Life, see CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 7-8.

16 A.J. Butler, T. Rees, P. Beesley, N.J. Bax, *Marine biodiversity in the Australian region*, PLoS ONE 2010;5(8):e11831.

17 Australian Marine Sciences Association, *Submission 17*, p. 1.

18 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 382.

19 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 616.

freshwater species, and some species with limited distribution, including crayfish, dragonflies and mountain stream frogs.²⁰

- 1.27 In terms of monitoring the biodiversity of freshwater ecosystems, an example given in the 2011 State of the Environment report highlighted that 'only 17 [per cent] of Australia has comprehensive mapping of wetlands'.²¹ The Water Resources and Freshwater Biodiversity Adaptation Research Network also indicated that for large parts of Australia, including 75 per cent of WA:

... there is limited mapping of freshwater ecosystems or information about freshwater system values, typology, hydrology or variability. Even less knowledge exists about groundwater-dependent ecosystems in Australia.'²²

- 1.28 The ABS 2009-10 Year Book also stated that many of Australia's aquatic [marine and freshwater] species are endemic and that 'there are likely to be many more aquatic species in Australia than are currently described'.²³
- 1.29 The 2011 State of the Environment report assessed the state and trends of aquatic species and ecosystems in northern and central Australia and in southern, eastern and south-western Australia. The freshwater ecosystems in northern and central Australia were assessed to be in good condition, with adequate high-quality evidence and a high level of consensus on the assessment grade. The trend was assessed as stable, with limited evidence or limited consensus on the trend.
- 1.30 The southern, eastern and south-western Australian freshwater ecosystems were assessed as being in a poor condition and deteriorating in recent trends in areas heavily developed for agriculture. The assessment summary also indicated that 'information on wetlands is limited but there is good evidence of losses and poor health of rivers in large areas of south-

20 ABS, '1301.0 - Year Book Australia, 2009-10', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%939310>> viewed 5 March 2013.

21 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 612.

22 Water Resources and Freshwater Biodiversity Adaptation Research Network, *Submission 22*, p. [4].

23 ABS, '1301.0 - Year Book Australia, 2009-10', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%939310>> viewed 5 March 2013.

eastern and south-western Australia'. There was limited evidence or limited consensus on both assessment of the state and trend.²⁴

Biodiversity hotspots

- 1.31 Australia is one of 17 'megadiverse' countries, with 15 national biodiversity hotspots across the continent.²⁵ National biodiversity hotspots were first identified in 2003 as areas:
 - that 'support natural ecosystems that are largely intact and where native species and communities associated with these ecosystems are well represented'
 - with high levels of locally endemic species
 - where the levels of stress or future threat were considered to be high.²⁶
- 1.32 The Committee visited the Tasmanian Midlands national biodiversity hotspot and one in the south-west of WA – the Busselton-Augusta national biodiversity hotspot – during its site inspection program. The south-west WA hotspot is the only one of the national hotspots to have been designated one of 34 global biodiversity hotspots.²⁷ Global biodiversity hotspots must contain at least 1500 endemic species of vascular plants and must have lost at least 70 per cent of its original habitat.²⁸
- 1.33 The south-west of WA is a 'flat, stable highly weathered low plateau dominated by old landscapes with nutrient-deficient soils', an area in which fire plays a major role. The south-west of WA displays a number of notable statistics:
 - more than 7400 named plant taxa and an estimated 6500 vascular flora species, with greater than 50 per cent being endemic

24 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 616.

25 DSEWPAC, 'Biodiversity hotspots',
<<http://www.environment.gov.au/biodiversity/hotspots/index.html>> viewed 4 March 2013.

26 DSEWPAC, 'Biodiversity hotspots',
<<http://www.environment.gov.au/biodiversity/hotspots/index.html>> viewed 4 March 2013.

27 Conservation International, 'Overview',
<http://www.conservation.org/where/priority_areas/hotspots/asia-pacific/Southwest-Australia/Pages/default.aspx> and
<http://www.conservation.org/where/priority_areas/hotspots/hotspots_revisited/key_findings/Pages/key_findings.aspx> viewed 4 March 2013.

28 Conservation International, 'Hotspots defined',
<http://www.conservation.org/where/priority_areas/hotspots/Pages/hotspots_defined.aspx> viewed 4 March 2013.

- approximately 20 per cent of plant species are listed as threatened, rare or poorly known
- approximately 100 species of vertebrates are endemic
- sixty-three wetlands of national significance are located in the region
- in 2007 there were 82 threatened ecological communities, 351 threatened plant taxa (111 critically endangered) and 69 threatened non-marine animal taxa in the region.²⁹

Threats to biodiversity

1.34 There are many threats to Australia's biodiversity, including:

- land-use practices and changes
- grazing pressure
- habitat fragmentation
- climate change including pollution
- invasive species
- fire regime change
- hydrology change
- consumption of natural resources.³⁰

1.35 The impacts of these threats vary across the continent, as the Committee discovered throughout its site inspection program, with some examples given below.

1.36 **Land use** poses a threat to biodiversity. Land clearing for timber harvesting, urban expansion, mining, agriculture and tourism can impact negatively on biodiversity. In some areas, such as the south-west of WA, there has been extensive clearing for agricultural and urban use, creating small pockets of remnant vegetation thereby making conservation management and species movement difficult.³¹

29 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 55, citing Andrew A Burbidge.

30 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 617-18.

31 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 55, citing Andrew A Burbidge.

- 1.37 **Invasive species** can have a devastating impact on ecosystems, like phytophthora dieback has on native forests.³² The myrtle rust disease has spread on windborne spores up the east coast of Australia, threatening to infect over 200 plant species in the wet tropics of Queensland.³³ Invasive weeds like para grass in the Northern Territory quickly dominate and create monocultures in the ecosystems they invade, having the potential to alter fire regimes due to the resultant increased fuel loads.³⁴
- 1.38 **Fire** poses a threat to biodiversity, making fire management an important land management tool for biodiversity and ecosystem protection. Fire management in Kakadu National Park is based on Indigenous methods for burning, hazard reduction, and for managing species, with the interrelationships being used to protect the habitat of species that are important for ecological and cultural reasons.³⁵

Biodiversity losses

- 1.39 The many threats to Australia's biodiversity have resulted in losses in biodiversity, with more losses predicted in future. The 2011 State of the Environment report included a number of national assessments of species, with statistics on biodiversity losses which included:
- small mammals in northern Australia are declining, with modern mammal extinctions having mostly occurred in central and northern bioregions, with up to 12 taxa having been lost
 - up to 25 per cent of known species for reptiles are threatened
 - many amphibian species have become regionally extinct in the past decade
 - 90 per cent of floodplain wetlands in the Murray-Darling Basin have been lost.³⁶
- 1.40 The ABS reported that:
- Australia has experienced the largest documented decline in biodiversity of any continent over the past 200 years. Under the EPBC Act, more than 50 species of Australian animals have been listed as extinct, including 27 mammal species, 23 bird species, and 4 frog species. The number of known extinct Australian plants

32 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 11-12.

33 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 59.

34 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 44.

35 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 45-46.

36 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 602, 610, 612.

is 48. Australia's rate of species decline continues to be among the world's highest, and is the highest in the OECD.³⁷

1.41 A number of species have been declared as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act); as at March 2009 there were 1318 threatened plant species and subspecies and 402 threatened animal species and subspecies listed under the EPBC Act.³⁸

1.42 In January 2010, the ABS reported on the increase in threatened species and communities in the ten years between the introduction of the EPBC Act in 1999 to 2009:

[During this period] ... the number of threatened fauna has risen by 35%, from 315 to 426 in 2009. In 2009, almost half (47%) the species on the list were vulnerable, 40% were endangered or critically endangered, and 13% were extinct or extinct in the wild.

Together, birds and mammals accounted for the majority of vulnerable and endangered species, and almost half the extinct species were mammals.

Since the commencement of the EPBC Act, the number of listed threatened flora has risen by 15%, from 1,147 in 2000 to 1,324 in September 2009. In 2009, there were 24 eucalypt species listed as endangered and 49 listed as vulnerable. Two species of wattle were listed as extinct, three as critically endangered, 29 as endangered and 44 as vulnerable.

The number of threatened communities rose from 21 in 2000 to 46 in 2009. However, these increases may reflect improved information and field investigations and do not necessarily represent a change in conservation status of ecological communities.³⁹

1.43 The Australian Coral Reef Society stated in its submission that, globally, 19 per cent of coral reefs have been lost and 35 per cent are threatened, mostly due to human activity.⁴⁰

37 Liz Burton, *Submission 85*, pp. 22-23, quoting the ABS, '1301.0 - Year Book Australia, 2009-10'.

38 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 44. Section 179 of the EPBC Act categorises listed threatened species into six categories: extinct, extinct in the wild, critically endangered, endangered, vulnerable, and conservation dependent.

39 ABS, '4613.0 - Australia's Environment: Issues and Trends, Jan 2010', <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/DD486E7A8C8F95A4CA2576C000194E09?opendocument>> viewed 5 March 2013.

40 Australian Coral Reef Society, *Submission 63*, p. [2].

- 1.44 The Water Resources and Freshwater Biodiversity Adaptation Research Network stated that 'freshwater systems have the highest rates of extinction of any ecosystem, with estimates of at least 10 000 – 20 000 freshwater species extinct or at risk'.⁴¹

Impacts of climate change

- 1.45 Climate change is expected to act as an additional stressor on biodiversity, at the same time interacting with existing threats to exacerbate pressure and transform ecosystems, presenting managers with novel ecosystems and challenges.
- 1.46 The 2012 State of the Climate report highlighted a number of key changes that have occurred in the climate, and the predicted impacts of those changes, as follows:
- both natural and human influences have affected climate over the past 100 years
 - human activities have also influenced ocean warming, sea-level rise, and temperature extremes
 - it is clear that increasing greenhouse gas concentrations will result in significant further global warming
 - further uncertainties relate to tipping points in the climate system, such as the break-up of ice-sheets, which can lead to rapid climate change.⁴²
- 1.47 The Committee heard from Professor Will Steffen that climate is 'not just another environmental issue,' and that:
- ... climate actually affects the basic physical and chemical underpinning of life ...
- It changes temperature, it changes rainfall, it changes water availability, it changes CO₂ and, of course, plants are affected by that because it is indeed a plant food and they react to that. We change the acidity of the ocean and the land and so on. These are the very fundamental basic underpinnings of life.
- ... the rate of change is unprecedented at least since the last mass extinction event about 60 million to 65 million years ago.⁴³

41 Water Resources and Freshwater Biodiversity Adaptation Research Network, *Submission 22*, p. [3].

42 Australian Government, 'State of the Climate 2012', Bureau of Meteorology, Commonwealth Scientific and Industrial Research Organisation, Canberra, 2012, pp. 4, 12.

43 Professor Will Steffen, Executive Director, Australian National University Climate Change Institute, *Transcript of evidence*, 13 October 2011, p. 2.

- 1.48 Changes in temperature, rainfall, extreme weather events and sea level rise, among others, have already affected Australia's biodiversity. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) stated, in a terrestrial biodiversity context, that climate change is predicted to affect almost all aspects of biodiversity conservation, as well as amplify and further complicate the management of existing threats to biodiversity, such as those described earlier.⁴⁴ The CSIRO also highlighted that:

Species and ecosystems are very likely to be affected directly by impacts cascading from individuals to populations to ecosystems and indirectly via changes to the interactions between species, provision of habitat, regulation of ecosystem processes and feedbacks on the climate.⁴⁵

- 1.49 The National Climate Change Adaptation Research Facility (NCCARF) Terrestrial Biodiversity Network stated that:

Australia's biodiversity is unique and there is strong evidence to demonstrate that negative impacts due to climate change are already occurring across many taxonomic groups and environmental processes, and that these impacts will continue to get significantly worse in the future. Consequently, Australian natural ecosystems are highly vulnerable to global climate change and it is recognised that they have a lower capacity to adapt compared to other settings such as agricultural and urban environments ... These negative trends compound the pressures on ecosystems that are already stressed by invasive species, habitat loss and fragmentation, fire, feral animals and natural climate variability.⁴⁶

Impacts on marine and freshwater biodiversity

- 1.50 The CSIRO stated that:

Marine, coastal and estuarine biodiversity is already, or highly likely to be, affected by sea level rise, increased ocean storm intensity, ocean acidification, increasing sea surface temperatures, the southern penetration of the East Australia Current ... These effects are expected to cascade throughout food chains with flow-on effects that cannot fully be anticipated.⁴⁷

44 CSIRO, *Submission 23*, p. 7.

45 CSIRO, *Submission 23*, p. 7.

46 National Climate Change Adaptation Research Facility (NCCARF), National Adaptation Research Network - Terrestrial Biodiversity, *Submission 20*, p. [2].

47 CSIRO, *Submission 23*, p. 9.

- 1.51 The CSIRO gave examples of how 'human, land and resource use pressures are likely to interact with climate change to exacerbate the impacts on marine systems':
- poor water quality (e.g. due to terrestrial runoff at the coast) increases coral bleaching risk
 - coastal development may limit landward migration of estuarine habitats as sea levels rise
 - fishing pressures may limit the capacity of species to repopulate habitats following disturbance events.⁴⁸
- 1.52 The 2012 Marine climate change in Australia report card highlighted a number of key changes that have already occurred in the marine environment due to increasing sea temperatures, as follows:
- sea temperature increases of between 2 and 4 degrees Celsius on the west coast (in early 2011), with changes in the local abundance and distribution of seaweeds, abalone, and fish species reported, and a shift towards a more tropical fish community observed, providing insight to possible long-term change
 - a demonstrated southwards retreat of macroalgae (a foundation species that supports marine life) by 10 to 50 kilometres per decade, being likely to affect entire marine ecosystems
 - changes in sex ratios of sea turtles, more frequent bleaching of corals, changes in abundance of fish species, and ocean acidification leading to a potential reduction in coral calcification
 - southwards movements of seaweeds, phytoplankton, zooplankton and some fish species have been documented.⁴⁹
- 1.53 The report card also indicated that increasing sea temperatures are likely to impact on the distribution of marine mammals and seabirds, with species likely to move southwards.⁵⁰ Sea level rise was stated to be increasing at 3mm per year, which will threaten coastal systems.⁵¹

48 CSIRO, *Submission 23*, p. 9.

49 E.S. Poloczanska, A.J. Hobday and A.J. Richardson (editors), *Marine climate change in Australia: impacts and adaptation responses – 2012 report card*, CSIRO Climate Adaptation Flagship, NCCARF Marine Biodiversity and Resources Adaptation Network, Fisheries Research and Development Corporation, Canberra, 2012.

50 E.S. Poloczanska, A.J. Hobday and A.J. Richardson (editors), *Marine climate change in Australia: impacts and adaptation responses – 2012 report card*, CSIRO Climate Adaptation Flagship, NCCARF Marine Biodiversity and Resources Adaptation Network, Fisheries Research and Development Corporation, Canberra, 2012.

51 E.S. Poloczanska, A.J. Hobday and A.J. Richardson (editors), *Marine climate change in Australia: impacts and adaptation responses – 2012 report card*, CSIRO Climate Adaptation Flagship, NCCARF Marine Biodiversity and Resources Adaptation Network, Fisheries Research and Development Corporation, Canberra, 2012.

- 1.54 The Australian Institute of Marine Science stated that the trend of increasing carbon dioxide in the atmosphere:
- ... means that the threat from ocean warming and acidification to Australia's coral reefs will grow significantly stronger over the coming decades. Predictions are more intense coral bleaching events, more frequent severe cyclones and declining capacity for damage repair.⁵²
- 1.55 The Great Barrier Reef Marine Park Authority stated that climate change is likely to be the greatest influence on the long-term outlook for the Great Barrier Reef.⁵³
- 1.56 The Australian Marine Sciences Association (AMSA) stated that:
- ... extinction risk is highest for endemic species and those that have narrow distributional ranges ... As the ocean warms, these [endemic] species will increasingly be restricted to a smaller portion of Australian waters, and range shifts will be limited by the southern extent of our coastline.⁵⁴
- 1.57 AMSA also discussed how climate change will affect key physical processes in the marine environment, as follows:
- ... the increased frequency and severity of catastrophic events such as cyclones will damage marine coastal habitats impairing their function and, in turn, impacting biodiversity. These habitats will be among the first and most severely affected by sea level rise ... Rising sea levels will affect the distribution of wetlands and seagrasses and drown intertidal habitats which are critical to biodiversity because of their nursery ground value and their role in translocation of nutrients to offshore habitats. In some cases these communities will migrate to follow rising sea levels, but in many situations this movement will be blocked by human structures such as training walls and roadways.⁵⁵
- 1.58 In terms of climate change impacts on freshwater biodiversity, CSIRO advised the Committee that:
- Freshwater aquatic biodiversity is predicted to be altered by climate change via direct and indirect pathways. The direct pathways that are predicted to affect water quality and quantity are:
-

52 Australian Institute of Marine Science, *Submission 59*, p. 2.

53 Great Barrier Reef Marine Park Authority, *Submission 28*, p. [1], as referring to the *Great Barrier Reef Outlook Report 2009*.

54 Australian Marine Sciences Association, *Submission 17*, p. 2.

55 AMSA, *Submission 17*, pp. 2-3.

- changes in global air and sea temperature are reflected in equivalent changes in water temperatures of streams, lakes, wetlands, etc;
- an increase in air temperature will result in increased water temperature, longer stratification periods in reservoirs and lakes, as well as advances in spring events and delays in autumn events;
- intensification of coastal winds mainly due to higher cyclonic activity increase shore erosion, alter mixing patterns, and lead to changed salinity conditions in coastal lakes and estuaries;
- changes in precipitation and evaporation will result in changes of hydrological cycles, river flow regimes, sediment and nutrient transport, and can promote salinisation;
- changes of flow regime classes due to decrease in precipitation;
- reduction of water availability in large parts of Australia;
- sea level rise will result in inundation of coastal freshwater ecosystems, saltwater intrusion in coastal groundwater systems, and upstream movement of the tidal influence; and
- increased CO₂ absorption will result in fresh water becoming more acidic, in some cases an increase in phytoplankton productivity or a decrease in, for example molluscs, is possible.

Indirect pathways by which freshwater biodiversity is predicted to be affected include:

- levels of dissolved oxygen tend to decrease due to increasing temperature, possibly decreasing wind speeds, and possible increase in eutrophication
- changes in air temperature will lead to changes in evaporation impacting mainly shallow water bodies and wetlands by reducing water levels.

The net effect of these factors is that freshwater ecosystems are likely to be significantly affected by climate change; however, in general the research base here is poorer than in other environments.⁵⁶

- 1.59 The Water Resources and Freshwater Biodiversity Adaptation Research Network outlined a number of ways that freshwater ecosystems are expected to be affected by climate change, including by changes in hydrological regime, global warming, sea level rise, and aquatic chemistry through groundwater and sub-surface water exchange.⁵⁷

⁵⁶ CSIRO, *Submission 23*, pp. 9-10.

⁵⁷ Water Resources and Freshwater Biodiversity Adaptation Research Network, *Submission 22*, p. [3].

Variable impacts of climate change nationally

- 1.60 The Committee observed variations in climate change impacts across the country, as displayed in different regions and different ecosystem types, including terrestrial, marine and freshwater. Much of this variation is described following observations and evidence from site inspections which resulted in the Committee's two interim reports:
- the decline of woodland tree species due to hotter and drier conditions, combined with an increased susceptibility to existing stressors such as diseases
 - likely increase in threats from pests and diseases due to projected temperature rises
 - a shift in bird ranges further south in general, and upslope in alpine areas, due to increasing temperatures
 - possibility of alteration of sex-ratios and species decline of reptile species with temperature-dependent sex determination due to predicted temperature rises
 - loss of species adapted to living in high altitudes due to increased temperatures
 - coral bleaching of reef ecosystems that can inhibit coral reproduction, due to increased sea temperatures
 - a drying trend and reduced groundwater levels due to changed rainfall patterns in southwest WA
 - the decline in tree species due to reduced rainfall in the Tasmanian Midlands
 - the spreading of invasive weeds into inaccessible locations due to the predicted increase in the frequency and intensity of cyclones
 - loss of bird habitats due to inundation of roosting sites by sea level rise
 - negative impacts on the Indigenous communities of Kakadu National Park resulting from loss of biodiversity due to climate change.
- 1.61 Further to the climate change impacts listed above, the Committee made several observations relating to fire regimes and increased temperatures in different ecosystems. Alpine ecosystems, such as in the Tasmanian Central Plateau, have evolved largely in the absence of fire, whilst the ecosystems in northern Australia, such as are present in Kakadu National Park, have adapted in the presence of fire over thousands of years.
- 1.62 The Committee observed that inappropriate fire regimes had been implemented in the alpine ecosystems of Tasmania, contributing to the decline of some species (such as the miena cider gum). On the other hand,

the Committee noted that fire management in Kakadu National Park was based on traditional Indigenous fire burning methods, hazard reduction, and for managing species (as noted above). In both cases, the Committee noted the importance of fire management for ecological and safety reasons, as well as for cultural reasons in the ecosystems of Kakadu National Park.⁵⁸

- 1.63 In terms of variable impacts arising from increased temperatures, the Committee observed the impacts of species decline in alpine regions as compared to wet tropical regions. In the NSW Snowy Mountains region the Committee heard about the potential for loss of species adapted to living in high altitude conditions due to small increases in the average temperature. In the wet tropics of Queensland region, the Committee heard about the decline in numbers of the endemic lemuroid ringtail possum, partly due to an extreme, extended heat wave experienced in the region in 2005.
- 1.64 In the NSW Snowy Mountains region, the Committee noted the complexity of interactions taking place in the alpine environment in response to climate change, and that precise outcomes for individual species were difficult to predict but that some species would be threatened with extinction. The Committee also observed changes to the level of the alpine tree line due to increasing temperatures. In the wet tropics of Queensland, the Committee noted the potential for species adapted to living in high altitude conditions having to move to higher altitudes to survive.⁵⁹
- 1.65 Having assessed in this chapter the state of Australia's biodiversity, the threats to biodiversity and biodiversity losses, and the variable impacts of climate change, the Committee will, in the next chapter, discuss the effects of biodiversity loss on human communities.

58 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 25-26; CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 45-46.

59 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 38-40; CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 60-61.

Biodiversity, human communities and the economy

Biodiversity represents our biological wealth. It provides a wide variety of life supporting ecosystem services upon which we depend for our health, economy and survival. We have long been relying on the resilience of natural systems but we have now severely depleted our natural capital, leaving us with a much more uncertain future.¹

- 2.1 This chapter will consider the relevance of biodiversity to human communities by looking at ‘ecosystem services’, including their impacts on health and the economy, as part of a holistic approach to policy making. The Committee considers how biodiversity impacts can be better measured, for example, by national environment accounts. By understanding the links between biodiversity, economies and physical and psychological health, areas for better awareness and engagement can be explored. In this chapter, conclusions and recommendations are made regarding environmental accounting and information, and education programs and citizen science initiatives.

What is the relevance of biodiversity to us?

- 2.2 The Committee heard extensive evidence attesting to the need to consider ‘biodiversity’ as encompassing more than strictly environmental themes, that it should be seen as central to human existence. According to the 2009 report by the Biodiversity and Climate Change Expert Advisory Group, commissioned by the Australian Government and prepared for the Natural Resource Management Ministerial Council (‘2009 report on

1 Monash Sustainability Institute, *Submission 69*, p. 1.

Australia's biodiversity and climate change'), many believe there is inherent value in conserving biodiversity from the viewpoint of each species being a unique evolutionary product, and the rich diversity of other life forms being a core part of humanity.² The 2009 report on Australia's biodiversity and climate change, as well as the accompanying Summary for policy makers,³ was often quoted in submissions to the inquiry, as it comprehensively covers many of the terms of reference. The lead author of the report, Professor Will Steffen, also gave evidence early in the inquiry process, providing a contextual framework for the Committee to analyse submissions and examine the issues in detail.

- 2.3 The 2009 report on Australia's biodiversity and climate change stated that biodiversity must be conserved in order to ensure options for future needs will be available, given that many biological resources that are not necessarily valuable now will become valuable in future.⁴

Loss of biodiversity has significant impacts on human populations in a number of physical and psychosocial ways, including direct psychological impacts, loss of social connections, loss of choice and freedom, increased conflict and violence ...

... We underestimate the importance of having a stable, predictable environment for our mental wellbeing.⁵

- 2.4 The Committee heard that there is a need to increase awareness about the importance of biodiversity to health, which can be done by linking the two in policy and research.⁶ Dr Paul Sinclair, Program Manager of the Healthy Ecosystems Program for the Australian Conservation Foundation (ACF) explained the need to get better at telling the stories – historically present in all cultures – about why our connection to the natural world and the way it sustains us matters.⁷
- 2.5 Ecosystems and biodiversity can be viewed as natural capital that yields goods and services that affect the wellbeing of humans. The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

2 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 20 ('2009 report on Australia's biodiversity and climate change').

3 Professor Will Steffen, *Exhibit 2, 'Australia's biodiversity and climate change: Summary for policy makers 2009'*, 2009.

4 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 20.

5 The Australian Psychological Society, *Submission 62*, pp. 4, 8.

6 Monash Sustainability Institute, *Submission 69*, p. 6.

7 Dr Paul Sinclair, Program Manager, Healthy Ecosystems Program, Australian Conservation Foundation (ACF), *Transcript of evidence*, 4 May 2012, p. 29.

set out in its submission the followings links between natural capital and social and economic sectors:

- the extensive areas of natural and modified pastures in which rangeland grazing is the main land use over 60% of Australia
- native forests that account for jobs in many sectors
- intact (remnant) terrestrial native vegetation (including forests and native pastures) that provide clean water and mitigate the adverse impact of natural hazards such as erosion and flooding
- biodiversity that provides important pollinators, seed dispersers, and pest control agents on which agriculture and forestry depend
- riparian and littoral vegetation are special cases of native vegetation that occur at complex interfaces between terrestrial and aquatic systems, where they protect areas from erosion, filter sediments, nutrients and pollutants, mitigate the effects of flooding and storm events, and provide supporting habitats for aquatic biodiversity
- marine life that acts in coastal defence against damaging waves and storms, processing of pollution, oxygen production and greenhouse gas regulation
- biodiversity that directly supplies ecosystem services such as: food, income and leisure activities through commercial and recreational uses (especially fishing), and income and cultural services through tourism
- the deep link between land, sea and biodiversity that is a part of the culture and identity of Aboriginal and Torres Strait Islander people.⁸

2.6 The CSIRO stated that it was likely that some valuable natural assets would change but how those changes would affect the complex interactions among social and economic systems was not clear.⁹

2.7 The Committee heard that governments will spend more on roads and desalination plants than on natural infrastructure that supports economic prosperity and human wellbeing, and that we need to ensure our economy more accurately reflects the state of our natural wealth.¹⁰

8 The Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission 23*, pp. 12-13.

9 CSIRO, *Submission 23*, p. 13.

10 Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, p. 24.

Ecosystem services

2.8 Ecosystem services are the benefits that humans receive from resources and processes supplied by ecosystems. The 2005 United Nations Millennium Ecosystem Assessment framework set out a method of categorising ecosystem services, with four categories of ecosystem services: provisioning, regulating, cultural and supporting. Examples have been added to each category to assist with interpretation:

- **provisioning:** food, fresh water, wood, fibre, fuel, genetic and medicinal resources, biochemicals and natural medicines, ornamental resources
- **regulating:** climate regulation, flood regulation, water regulation and purification, disease regulation, carbon sequestration, air quality regulation, erosion control, pest control, pollination
- **cultural:** aesthetic values, spiritual and religious values, educational values, recreation, Indigenous culture, ecotourism, psychological wellbeing, cultural diversity and heritage, knowledge systems, inspirational values
- **supporting:** nutrient cycling, soil formation, primary production, photosynthesis.¹¹

2.9 Extensive evidence received by the Committee attested to the threats posed by reduced biodiversity to the ecosystem services outlined above. Evidence received with regard to each of the four categories of ecosystem services is canvassed below.

Climate change impacts on biodiversity and ecosystem services

2.10 The Committee heard from the Climate and Health Alliance that climate change is having severe adverse impacts on biodiversity, on which we depend for food, clean air, medicine and many other ecosystem services.¹² The Committee heard from the Australian Psychological Society that loss of biodiversity can threaten food security, reduce access to clean water, decrease energy security, increase vulnerability to natural disasters and limit the availability of natural resources, ultimately threatening human survival.¹³

11 Millennium Ecosystem Assessment, 2005; W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 19.

12 Climate and Health Alliance, *Submission 49*, p. 2.

13 Australian Psychological Society, *Submission 62*, p. 7.

- 2.11 The Committee heard from Dr Marion Carey, a Senior Research Fellow at the Monash Sustainability Institute, that a 'loss of ecosystem services can increase the vulnerability of human communities to the impacts of natural disasters'.¹⁴

Provisioning services

- 2.12 Ecosystem services provided under this category include: food, fresh water, wood, fibre, fuel, genetic and medicinal resources, biochemicals and natural medicines, and ornamental resources.
- 2.13 The Department of Agriculture, Fisheries and Forestry (DAFF) indicated that adverse effects on agricultural productivity, profitability and viability could arise from:
- weed or pest animal migration or population increases due to climate change
 - agricultural industries requiring increased pesticide or herbicide use to remain productive, possibly leading to an increase in the number of chemical tolerant weeds and pest animals, further increasing their populations
 - farming practices responding to the drive to increase sustainability and biodiversity, and production outputs, which may cause unexpected interactions with weeds and pest animals.¹⁵
- 2.14 DAFF stated some general impacts on agriculture would likely include:
- ... significant crop and pasture reductions by 2070 in southern Australian regions, reduced grain and grape quality, increased thermal stress on stock reducing productivity, increased incidence and distribution of weeds and increased fire risk.¹⁶
- 2.15 The Committee heard from Dr Carey that 'biodiversity supports food security and dietary health' and that approximately 50 per cent of commercially available medicines come directly from nature.¹⁷
- 2.16 The Monash Sustainability Institute discussed how food and water security is being threatened by climate change. Oceans threatened by acidification and warming, mixed with other stressors, impacts upon fisheries which provide a major source of protein and nutrients for the human diet. Native vegetation threatened by increasing fire and drought

14 Dr Marion Carey, Senior Research Fellow, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, p. 48.

15 Department of Agriculture, Fisheries and Forestry (DAFF), *Submission 73*, pp. 10-11.

16 DAFF, *Submission 73*, p. 10.

17 Dr Carey, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, pp. 48, 51.

- risks impacts upon the hydrological cycle, which is important for fresh water production and the prevention of waterborne disease in humans.¹⁸
- 2.17 Climate-induced changes in coastal habitats, ocean temperature, currents, winds, nutrient supply, rainfall, ocean chemistry and extreme weather conditions are expected to have severe impacts on the fisheries industry.¹⁹ The Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) and DAFF highlighted the major contribution that the Australian fishing and aquaculture industries make to the Australian economy, contributing around \$2 billion per year.²⁰ The Tasmanian rock lobster industry also contributes around \$72 million per year,²¹ with seafood making up an important part of the Australian diet.²²
- 2.18 The Research Centre for Applied Alpine Ecology explained that 'a large proportion of the water in the Murray River is derived from the Australian Alps', and the need to protect the catchments given the projected changes in rainfall patterns.²³ The water in the Murray-Darling Basin is estimated to contribute \$10 billion per annum to the national economy.²⁴
- 2.19 Native and planted forests are likely to be affected by changes in rainfall, temperature, associated impacts on key production species, and changes in fire frequency and intensity.²⁵ Climate modelling suggests that most production forest areas will experience lower rainfall and an increase in temperature by 2030.²⁶ The effects of climate change on forest productivity would vary across Australia, with wood yields projected to decline in most commercial forest production areas.²⁷

Regulating services

- 2.20 Ecosystem services provided under this category include: climate regulation, flood regulation, water regulation and purification, disease regulation, carbon sequestration, air quality regulation, erosion control, pest control, and pollination.

18 Monash Sustainability Institute, *Submission 69*, pp. 4, 5.

19 Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), *Submission 66*, p. 5.

20 DSEWPAC, *Submission 66*, p. 5; DAFF, *Submission 73*, p. 12.

21 DSEWPAC, *Submission 66*, p. 5.

22 DAFF, *Submission 73*, p. 12.

23 Research Centre for Applied Alpine Ecology, *Submission 72*, pp. 2-3.

24 International Union for Conservation of Nature World Commission on Protected Areas (IUCN WCPA), *Submission 30*, p. 6.

25 DAFF, *Submission 73*, pp. 12, 13.

26 DAFF, *Submission 73*, p. 13.

27 DAFF, *Submission 73*, p. 13.

- 2.21 In its submission, DAFF stated that water supply and quality are likely to be affected by higher temperatures, increased evaporation rates and changes in amount and patterns of rainfall.²⁸ DAFF commented that:
- projected changes in rainfall patterns, outlined in the 2007 Intergovernmental Panel on Climate Change report, will see northern Australia receive more rainfall while southern and south-eastern Australia will likely receive less rainfall
 - reduced rainfall and increased evaporation in southern and eastern Australia will intensify water security problems by 2030
 - 'annual stream flow in the Murray Darling Basin is likely to fall 10 to 25 per cent by 2050'.²⁹
- 2.22 DAFF also stated that 'reduced water supply and quality are likely to affect agricultural production'.³⁰
- 2.23 The Australian Alps performs a very important ecosystem service by providing water of a high yield and of exceptional quality to lowland rivers. The Committee heard that impacts of climate change on this ecosystem service could reduce 'groundwater recharge and summer base-flows as a consequence of reduced winter snowpack' and degrade 'water quality due to contraction or loss of alpine peatlands'.³¹
- 2.24 DSEWPAC stated that the effects of rising sea levels and extreme weather events on coastal communities include the threat of inundation, erosion and effects on water quality and supply.³²
- 2.25 The Committee heard from Dr Carey of the Monash Sustainability Institute that ecosystem disturbance has implications for human disease.³³ DSEWPAC stated that changes to temperature and rainfall patterns in areas like Kakadu National Park could lead to an increase in transmission of disease by insects, and increase in the occurrence of food and waterborne diseases.³⁴
- 2.26 DAFF outlined that increasing temperatures directly impact on changes in animal health risks.³⁵ It is estimated that up to 75 per cent of newly

28 DAFF, *Submission 73*, p. 10.

29 DAFF, *Submission 73*, p. 10.

30 DAFF, *Submission 73*, p. 10.

31 Research Centre for Applied Alpine Ecology, *Submission 72*, p. 4.

32 DSEWPAC, *Submission 66*, p. 5.

33 Dr Carey, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, p. 48.

34 DSEWPAC, *Submission 66*, p. 5.

35 DAFF, *Submission 73*, p. 13.

recognised infectious diseases of humans can be transmitted between animals to humans.³⁶

- 2.27 The Committee heard of a disconnect between understanding the benefits of locally sourced sustainable food and understanding the ecosystem services behind food production.³⁷ The Committee heard that many crops are dependent upon natural pollinators for fertilisation, and of the importance of natural vegetation for bees in providing essential nectar and pollen. The Committee was further informed that bee populations in many countries have been decimated,³⁸ and that Australians do not well appreciate the role of pollinators.³⁹ The Committee heard from Mr Dale Park, Senior Vice President of the Western Australian Farmers Federation, that 'there is a possibility that we could lose our bee population, and I think a lot of broadacre growers do not actually realise that, if it does come about, it is going to have an incredible impact on growing various crops.'⁴⁰

Cultural services

- 2.28 Ecosystem services provided under this category include: aesthetic values, spiritual and religious values, educational values, recreation, Indigenous culture, ecotourism, psychological wellbeing, cultural diversity and heritage, knowledge systems, and inspirational values.
- 2.29 The Committee heard that healthy ecosystems contribute to our quality of life, are integral to human health and wellbeing and important for people's connection with nature, a sense of identity, restoration, stress reduction and recreation.⁴¹ Further, that biodiversity plays a key role in proper mental functioning.⁴²
- 2.30 The Committee heard of the importance of enhancing the resilience of the natural environment and human communities at the same time. Dr Susie Burke, a Senior Psychologist in the Australian Psychological Society, presented two examples of how this can be achieved. Dr Burke described the work of Landcare groups as being about sustaining local biodiversity, with human community resilience emerging through the sense of wellbeing and meaning they have.⁴³ Dr Burke also described the inclusion
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36 DAFF, *Submission 73*, p. 13.

37 Dr Carey, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, p. 52.

38 Monash Sustainability Institute, *Submission 69*, pp. 4-5.

39 Dr Carey, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, p. 52.

40 Mr Dale Park, Senior Vice President, Western Australian Farmers Federation, *Transcript of evidence*, 7 November 2011, p. 16.

41 Australian Psychological Society, *Submission 62*, pp. 4, 6.

42 Australian Psychological Society, *Submission 62*, p. 7.

43 Dr Susie Burke, Senior Psychologist, Australian Psychological Society, *Transcript of evidence*, 4 May 2012, p. 49.

- of walking tracks through nature parks as protecting nature and enabling people to use the natural environment for recreation and exercise, giving them a sense of peace, and activating values of caring for the natural environment.⁴⁴
- 2.31 The Committee heard that biodiversity should be preserved for our mental and physical health, and that public awareness of the importance of biodiversity to human health should be improved.⁴⁵
- 2.32 The importance of engaging and educating the community on the importance of the risks to human health posed by the loss of biodiversity was raised by Ms Fiona Armstrong, Convenor of the Climate and Health Alliance.⁴⁶ The Committee heard that the more biologically diverse our natural environment, the greater the psychological value and the greater protection it offers for humans in the transmission of infectious diseases.⁴⁷
- 2.33 The Committee was interested to hear that human relationships with animals illustrate the importance we place on connections to nature and other species, as demonstrated by human interest in and interaction with wildlife through bird watching, and zoo and national park attendance – further underscoring the importance of healthy biodiversity to human quality of life.⁴⁸ These benefits to our mental health can also be demonstrated through other outdoor activities including gardening, snorkelling, diving, bushwalking, whale watching, and nature retreat.⁴⁹
- 2.34 The Committee heard that a loss of biodiversity can result in a loss of sense of place in local residents and Indigenous people. DSEWPAC stated that the impact of climate change on Indigenous people’s sacred sites and traditional lands may adversely affect the mental and physical well-being of Indigenous communities.⁵⁰ Further, that a loss of biodiversity can harm relations and create tension and conflict between groups of people if one group profits from the losses of another; for example, the logging of native forests may be seen as a loss of biodiversity to one group but a profit to another group.⁵¹

44 Dr Burke, Australian Psychological Society, *Transcript of evidence*, 4 May 2012, p. 49.

45 Dr Carey, Monash Sustainability Institute, *Transcript of evidence*, 4 May 2012, p. 48.

46 Ms Fiona Armstrong, Convenor, Climate and Health Alliance, *Transcript of evidence*, 4 May 2012, p. 54.

47 Dr Burke and Ms Armstrong, Climate and Health Alliance, *Transcript of evidence*, 4 May 2012, p. 54.

48 Australian Psychological Society, *Submission 62*, p. 7.

49 Monash Sustainability Institute, *Submission 69*, p. 4.

50 DSEWPAC, *Submission 66*, p. 6.

51 Australian Psychological Society, *Submission 62*, p. 8.

- 2.35 DSEWPAC stated that 64 per cent of international visitors to Australia participate in a nature-based experience and that any changes to biodiversity are expected to have a direct impact on the tourism industry. The CSIRO gave some examples of the effects that damage to marine biodiversity could have on tourism:
- loss of coral diversity due to ocean acidification and coral bleaching of the Great Barrier Reef could make it a less desirable tourist destination
 - inundation of near-coastal freshwater systems with sea water at the floodplains at Kakadu National Park may change the Park's appearance and would likely affect tourism numbers.⁵²
- 2.36 The value of the Great Barrier Reef to the economy is approximately \$51 billion, with total coral mortality potentially removing \$38 billion of that value.⁵³ DAFF stated that any reduction in marine biodiversity as a result of climate change and ocean acidification will impact on Australia's economy and communities, as recreational fishing is a multi-billion dollar per year industry and an important leisure activity for millions of Australians, whilst the Great Barrier Reef and Ningaloo Reef ecosystems are important for tourism.⁵⁴
- 2.37 The Great Barrier Reef Marine Park Authority reiterated the above points made by the CSIRO, DSEWPAC and DAFF, highlighting that reef-based industries and communities are expected to be seriously affected by climate changes, including tourism, commercial fishing and small coastal settlements.⁵⁵ Extreme weather events, like Tropical Cyclone Yasi, can have major consequences for areas such as commercial fishing in the Great Barrier Reef region, which contributed \$139 million to the economy in 2006-07.⁵⁶ The Committee heard that tourism expenditure in the Great Barrier Reef Catchment Area totalled over \$5.8 billion in 2006-07.⁵⁷
- 2.38 Climate change impacts on the Australian Alps will have flow on effects for tourism in the area. The Research Centre for Applied Alpine Ecology stated that local tourist economies will be under pressure with the expected downturn in winter skiing tourism as a result of climate change,

52 CSIRO, *Submission 23*, p. 13; DSEWPAC, *Submission 66*, p. 6.

53 DSEWPAC, *Submission 66*, p. 6; In 2009, the total present economic value of the Great Barrier Reef, excluding Indigenous values, was valued at \$51.4 billion: Oxford Economics, *Valuing the effects of Great Barrier Reef bleaching*, Great Barrier Reef Foundation, Newstead, 2009, p. 2.

54 DAFF, *Submission 73*, p. 12.

55 Great Barrier Reef Marine Park Authority, *Submission 28*, p. [2].

56 Great Barrier Reef Marine Park Authority, *Submission 28*, p. [3].

57 Australian Institute of Marine Science (AIMS), *The AIMS Index of Marine Industry*, AIMS, Canberra, 2012, p. 9.

with many operators perhaps looking to summer tourism for survival.⁵⁸ The Australian Seed Bank Partnership's Alpine and Montane Research Program is developing knowledge on combating the expected loss of biodiversity through seed based research to determine climatic thresholds, collections to identify resilient populations with the potential for restoration or translocation, and seed collection for conservation.⁵⁹

- 2.39 The Committee gathered evidence throughout the inquiry relating to different traditional and scientific knowledge systems used for managing land and biodiversity, including the cultural information management system being developed for Kakadu National Park, as discussed in the second interim report.⁶⁰ The Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS) outlined the Yorta Yorta cultural mapping project, developed in partnership with Monash University 'to assist the Yorta Yorta people of the Barmah-Millewa floodplain to adapt to the challenges of climate change by drawing on traditional knowledge known only to them'.⁶¹ The project would see Indigenous knowledge recorded and entered, along with scientific data, into 'a unique database ... used to combine traditional knowledge with more conventional forms of information (climate, vegetation etc.) to improve the way natural resources are managed' and help Indigenous people, managers and policymakers make better management decisions.⁶²
- 2.40 AIATSIS further outlined a climate change monitoring and evaluation project to create a seasonal calendar database that captures Traditional Ecological Knowledge to 'describe the interactions between changing weather patterns and flora and fauna behaviour'.⁶³ This information can be used by rangers and Indigenous Protected Area managers to inform conservation activities. The results of the project, which is in development, will help to identify 'culturally appropriate land management strategies in response to climate change'.⁶⁴

Supporting services

- 2.41 Ecosystem services provided under this category include: nutrient cycling, soil formation, primary production, photosynthesis. There was little

58 Research Centre for Applied Alpine Ecology, *Submission 72*, p. 3.

59 Australian Seed Bank Partnership, *Submission 19*, p. 5.

60 House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 2*, November 2012, p. 50.

61 Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), *Supplementary Submission 34.1*, p. [4].

62 AIATSIS, *Supplementary Submission 34.1*, p. [4].

63 AIATSIS, *Supplementary Submission 34.1*, p. [4].

64 AIATSIS, *Supplementary Submission 34.1*, p. [5].

specific evidence on supporting services, and discussion on relevant areas has been included with other ecosystem services.

Incorporating ecosystem services into decision making

- 2.42 The Committee agrees with the view that 'the value of biodiversity and of ecosystem services should be recognised in public policy decision making'.⁶⁵
- 2.43 The Committee heard of the importance of studying human health and environmental health as a single, complex system, so that when looking to improve the resilience of the natural environment and human communities they are considered together.⁶⁶
- 2.44 The Committee heard that all biodiversity policy development processes must include human health impact assessments to evaluate the implications for human health.⁶⁷
- 2.45 The Climate and Health Alliance recommended that investment in research that looks at the costs and benefits of the risks to human health posed by the loss of biodiversity be undertaken and shared with the community in order to help build understanding and increase support for public policy in that area.⁶⁸

Measuring the economic value of biodiversity

- 2.46 The Committee acknowledges the view that 'much of the value of biodiversity as an ecosystem service is not captured in markets, and consequently is not included in national accounts', resulting in a failure to represent the true value of biodiversity to society.⁶⁹ The Committee learned that this has flow on effects of reducing the urgency to reverse the loss of biodiversity, and of underinvestment in biodiversity conservation.⁷⁰ The Committee learned further of the importance of understanding the difficulties economic systems have in dealing with

65 Climate and Health Alliance, *Submission 49*, p. 2; Ms Armstrong, Climate and Health Alliance, *Transcript of evidence*, 4 May 2012, p. 47.

66 Dr Burke, Australian Psychological Society, *Transcript of evidence*, 4 May 2012, p. 49.

67 Ms Armstrong, Climate and Health Alliance, *Transcript of evidence*, 4 May 2012, p. 48.

68 Ms Armstrong, Climate and Health Alliance, *Transcript of evidence*, 4 May 2012, p. 54.

69 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, pp. 20-21.

70 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 21.

biodiversity and the need to overcome these difficulties in order to improve the effectiveness of biodiversity conservation.⁷¹

- 2.47 In its submission, DSEWPAC stated that full valuation of biodiversity relies on understanding the goods and services that ecosystems provide, and acknowledged that there is further scope to measure the full value of ecosystem services.⁷² DSEWPAC highlighted the market-based instruments that are providing opportunities to value ecosystem services, including environmental offsets, water pricing, and conservation tenders.⁷³
- 2.48 The Australian Government has acknowledged biodiversity banking as a market-based mechanism to deliver environmental offsets. Biodiversity banking is a system that places financial value on biodiversity assets and a mechanism to trade biodiversity credits to offset the impacts of land use changes that degrade the conservation value of an area.⁷⁴
- 2.49 The following are two examples of economic indicators in environmental areas currently in use, and show how they can be used in comparison to other areas of the economy:
- The Institute for Marine and Antarctic Studies (IMAS) stated that we are extracting a large economic benefit from our oceans, through marine tourism, oil and gas, shipping, fishing and aquaculture industries.⁷⁵ The Australian Institute of Marine Science (AIMS) 2012 Index of Marine Industry set the total measurable value of economic activity based in the Australian marine environment in 2009-10 at \$42.3 billion,⁷⁶ a four per cent decrease from 2008-09.⁷⁷
 - The Index of Marine Industry figure of \$42.3 billion was compared to the gross value of all agricultural production in Australia in 2009-10 (\$39.6 billion), and the sales and service total income from automotive and automotive parts manufacturing in the same period (\$19.4 billion).⁷⁸

71 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 21.

72 DSEWPAC, *Submission 66*, p. 9.

73 DSEWPAC, *Submission 66*, p. 9.

74 DSEWPAC, *Environmental Protection and Biodiversity Conservation Act 1999: Environmental Offsets Policy*, DSEWPAC, Canberra, October 2012, p. 26.

75 AIMS, *Supplementary Submission 77.2*, p. [1].

76 AIMS, *The AIMS Index of Marine Industry*, AIMS, Canberra, 2012, p. 6.

77 AIMS, *The AIMS Index of Marine Industry*, AIMS, Canberra, 2012, pp. 6-7: The decrease in value was mainly due to reductions in marine resource related industries.

78 AIMS, *The AIMS Index of Marine Industry*, AIMS, Canberra, 2012, p. 6.

- 2.50 Economic indicators of this kind, if applied to considerations of biodiversity and economic productivity, could provide a better understanding of the state of biodiversity in relation to the rest of the economy.

National environmental accounts

- 2.51 As demonstrated above, the loss of Australia's biodiversity could have detrimental effects on our economy. It is a long held view of this Committee, and predecessor committees of previous parliaments, that environmental accounts should be established. In the 2009 *Managing our coastal zone in a changing climate report*, a predecessor committee recommended to the Australian Government that a system of national coastal zone environmental accounts be established, through the Council of Australian Governments.⁷⁹ The Australian Government agreed with this recommendation in principle, referring to the development of its National Plan for Environmental Information.⁸⁰
- 2.52 The Committee welcomed evidence from many individuals and organisations about the need for and importance of setting up a nationally consistent set of environmental accounts. Various models and their current status and viability are discussed below.
- 2.53 The Planet Ark Environmental Foundation (Planet Ark) stated that a precautionary approach to safeguarding biodiversity loss should be adopted, while the social and economic value of biodiversity is being identified by global initiatives such as The Economics of Ecosystems and Biodiversity.⁸¹ Dr Sean O'Malley, Research and Technical Manager with Planet Ark, stated that people need to see the monetary value of ecosystems in order to see that ecosystems and biodiversity are critical and need to be preserved.⁸² Dr O'Malley highlighted the role of the Australian Government as overseeing and coordinating the process of funding environmental management and putting economic values on ecosystems.⁸³

79 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*, October 2009, pp. 167-72.

80 Australian Government, *Australian Government response, House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts, House of Representatives Committee Report: Managing our coastal zone in a changing climate: The time to act is now*, November 2010, p. 19.

81 Planet Ark Environmental Foundation, *Submission 21*, p. 2.

82 Dr Sean O'Malley, Research and Technical Manager, Planet Ark Environmental Foundation, *Transcript of evidence*, 4 May 2012, p. 6.

83 Dr O'Malley, Planet Ark Environmental Foundation, *Transcript of evidence*, 4 May 2012, p. 6.

- 2.54 Mr Graham Tupper, the National Liaison Manager with the ACF recommended that Land and Water Australia – a rural research and development corporation that operated between 1990 and 2009, focussing on research into sustainable land use – or an equivalent body, be restored under the planned national environmental system.⁸⁴ He further suggested that the national environmental accounting system must have integrity and credibility, be accessible and understandable in the community, use satisfactory measures to monitor the environment, and be tested by external bodies such as this Committee.⁸⁵

NRM governance

- 2.55 The Committee heard that natural resource management (NRM) groups nationally are working on establishing national environmental accounts.⁸⁶ The Western Catchment Management Authority, as an example, stated the necessity to implement a mechanism that recognises an economic value of environmental services.⁸⁷
- 2.56 The Committee heard that a natural asset accounting framework, such as had been developed by the Australian Natural Resources Atlas (no longer being updated) ‘needs to be developed as part of a national strategy on NRM’.⁸⁸ Australia’s Regional NRM Chairs released a paper in July 2010 on Australia’s NRM governance system. This document discussed the challenge of assessing environmental condition across Australia:

... the lack of a nationally consistent framework means it is not possible to know with any certainty whether condition is improving or not across the nation – or whether interventions are having an impact – or even where the greatest need for investment really is. This issue has been on the work program of the NRM Ministerial Council [now discontinued] for many years without completion. The National Land and Water Audit has been discontinued. Meanwhile the Wentworth Group has proposed an approach based on accumulating simple regional catchment health assessments up to the national level ... but it has not found formal acceptance in government at this stage. The review of the EPBC Act (Hawke 2009) also addressed this issue in its recommendation:

... invest in building blocks of a better regulatory system such as national environmental accounts, skills development, policy guidance,

84 Mr Graham Tupper, National Liaison Manager, ACF, *Transcript of evidence*, 4 May 2012, p. 27.

85 Mr Tupper, ACF, *Transcript of evidence*, 4 May 2012, p. 28.

86 Ms Kate Andrews, Chair, Territory Natural Resource Management, *Transcript of evidence*, 4 July 2012, p. 10.

87 Western Catchment Management Authority, *Submission 42*, p. 3.

88 Liz Burton, *Submission 85*, p. 21.

and acquisition of critical spatial information. This is a crucial issue for good NRM governance.⁸⁹

Accounting for Nature

- 2.57 In response to questions on notice asking what elements should be included in a national environmental account, BirdLife Australia supported the Wentworth Group of Concerned Scientists' Accounting for Nature model for building the national environmental accounts for Australia.⁹⁰ This model identifies five asset classes for inclusion in national environmental accounts:
- land: native vegetation, fauna and soils
 - water: rivers, wetlands and estuaries
 - atmosphere: greenhouse gas emissions
 - marine and coastal resources: fish stocks, reefs, beaches and estuaries
 - towns and cities: air quality, waste, water use and consumption.⁹¹
- 2.58 Ten of the 56 regional NRM organisations are participating in a trial of the Accounting for Nature model (stage three of the trial is expected to conclude in 2014), in which the organisations are testing whether it is possible to construct asset condition accounts using a common unit of measurement (based on the established science of reference condition benchmarking), and whether it is feasible to do so.⁹² Another of the important elements of this model is the requirement for scientific accreditation of the account and information supporting it, which will encourage markets and decision makers to accept ecosystem accounting as an accurate measure of asset condition.⁹³

89 K. Andrews, K. Broderick, S. Ryan, Y. Sneddon, *Australia's NRM Governance System: Foundations and principles for meeting future challenges*, Australian Regional NRM Chairs, Canberra, July 2010, p. 42.

90 BirdLife Australia, *Supplementary Submission 40.1*, p. [1].

91 BirdLife Australia, *Supplementary Submission 40.1*, p. [1]; Wentworth Group of Concerned Scientists, *Accounting for nature: a model for building the national environmental accounts of Australia*, 2008, Sydney, pp. 4-5.

92 P. Cosier, Wentworth Group of Concerned Scientists, *Environmental asset condition account trials in Australia*, a paper prepared for the United Nations Statistics Division International Seminar entitled 'Towards linking ecosystems and ecosystem services to economic and human activity', New York, 27-29 November 2012, pp. 3-4.

93 P. Cosier, Wentworth Group of Concerned Scientists, *Environmental asset condition account trials in Australia*, a paper prepared for the United Nations Statistics Division International Seminar entitled 'Towards linking ecosystems and ecosystem services to economic and human activity', New York, 27-29 November 2012, p. 4.

United Nations System of Environment-Economic Accounting

- 2.59 The Australian Bureau of Statistics (ABS) discussed the United Nations' System of Environmental-Economic Accounting, an initiative to standardise ecosystem reporting which incorporates environmental and economic information in a common framework. The benefits of the system were described as allowing for 'consistent analysis of the contribution of the environment to the economy, the impact of the economy on the environment, and the efficiency of the use of environmental resources within the economy'.⁹⁴ The System of Environmental-Economic Accounting will include a framework for experimental ecosystem accounting, in the development of which ABS was taking part. The ABS stated that 'it is recognised that spatially referenced environment and economic data are essential for ecosystem accounting', and that socio-ecological landscape units were emerging as the preferred unit of reference.⁹⁵

ABS Land Accounts

- 2.60 The ABS discussed its Land Accounts and how they have the capacity to, among other things, 'provide a system into which monetary valuations of land assets and environment related flows can be incorporated with physical data, to assess the monetary implications of environmental actions'.⁹⁶ The benefits of Land Accounts were described as: providing a powerful decision making tool for planning by industry, government and the community; to inform debate; and as a critical tool in ecosystem management.⁹⁷ One example given by ABS that demonstrated these benefits related to Australia's population growth:

With Australia's population projected to be between 31 and 43 million people by 2056 ... and further impacts from climate change forecasted, land use changes such as the loss of agricultural land to urban growth or the clearance of native forests for agriculture will become a key policy and planning issue for some locations. Land accounts would provide information for policy makers to make informed decisions about the economic and environmental impact of the location of new suburbs, towns and cities.⁹⁸

94 Australian Bureau of Statistics (ABS), *Submission 53*, p. [4].

95 ABS, *Submission 53*, p. [4].

96 ABS, *Submission 53*, p. [5].

97 ABS, *Submission 53*, p. [5].

98 ABS, *Submission 53*, p. [5].

Committee conclusions on environmental accounting and information

- 2.61 The Committee understands that putting a value on ecosystems and biodiversity is a global challenge, and acknowledges the need to properly ascertain the economic value of biodiversity in Australia. This is required in order to be able to accurately measure the impacts of climate change on biodiversity, the effects of policies and management practices on biodiversity, and in order to be able to adapt to prevent future losses and minimise the effects of the losses of biodiversity on the community. The Committee notes Australia's support for the Communiqué on Natural Capital Accounting, arising out of the United Nations Conference on Sustainable Development (Rio+20) in June 2012, aimed at strengthening the implementation of natural capital accounting. The Committee notes the November 2012 report entitled *Independent Review of Australian Government Environmental Information Activity*, which is discussed in greater detail in chapter five, in the context of a national biodiversity database.
- 2.62 In recognition of the critical role of accurate environmental accounting on a national level, the Committee proposes that this issue be included on the agenda of the Council of Australian Governments (COAG), to ensure that appropriate frameworks be developed with the assistance of lead Commonwealth agencies, as well as input from states and territories.

Recommendation 1

- 2.63 **The Committee recommends that in the course of developing and implementing an effective and sustainable system of national environmental accounts, the Australian Government include on the agenda of the Council of Australian Governments a requirement for five-yearly reports, using the existing framework of the national State of the Environment Report, and equivalent reports of each state and territory. Such reports should include assessments of the state of all significant national parks and reserves, including:**
- **qualitative and quantitative analysis of native biota including any loss of distribution, and**
 - **qualitative and quantitative analysis of invasive species of flora, fauna and pathogens, including any increase of distribution.**

Community engagement through education programs and citizen science initiatives

- 2.64 Together with establishing a framework for managing national environmental accounts, the Committee heard that education, engagement and communication programs are important in helping the community to understand and play an active role in finding solutions to biodiversity loss.⁹⁹ Evidence received throughout the inquiry focussed on the need for biodiversity education programs, including citizen science initiatives, to highlight the relevance of biodiversity to human communities.
- 2.65 The importance of community engagement to highlight the relevance of biodiversity was described by Dr Gretta Pecl, a Senior Research Fellow at the Institute of Marine and Antarctic Studies in Tasmania:
- Public acceptance and understanding of the impacts of climate change on biodiversity is quite low, yet that is probably a necessary prerequisite ... for the development of adaptation options. For example, in our fishing industry, development of adaptation options to changing climate depends on acknowledging that climate change is real, acknowledging that there are changes in the marine environment, and then linking that to their own activities, and, further, that there is something constructive they may be able to do to help with that. Those links are not there for large sectors of our marine community.¹⁰⁰
- 2.66 Citizen science initiatives are also important in ensuring that communities understand climate change impacts. The Range Extension and Database Mapping (REDMAP) project launched in 2009 in part evolved from:
- ... research in a project [Dr Pecl] was involved in [which] demonstrated that up to 80 per cent of commercial fishers did not think climate change existed nor that it was an issue for their industry ... That research has recently been published in the *Journal of Marine Policy*. Surveys conducted by the Tasmanian Seafood Industry Council suggest similar numbers for lack of acceptance of climate change.¹⁰¹
- 2.67 During the course of site inspections, the Committee observed various biodiversity education programs and citizen science initiatives, including:
- Community engagement in Sydney Olympic Park

⁹⁹ Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, p. 23.

¹⁰⁰ Dr Gretta Pecl, Senior Research Fellow, Institute for Marine and Antarctic Studies (IMAS), *Transcript of evidence*, 31 January 2012, p. 19.

¹⁰¹ Dr Pecl, IMAS, *Transcript of evidence*, 31 January 2012, p. 19.

- Melbourne Museum's interactive exhibits
- Museum Victoria's Reef Watch Victoria
- BirdLife Australia's Birddata and Atlas of Australian Birds
- The REDMAP project
- CSIRO supported acid sulphate soil monitoring program in the Coorong, Lower Lakes and Murray Mouth region in South Australia
- Reef HQ Aquarium in Townsville's formal school education program and the Reef Guardian program.

2.68 These and other programs and initiatives were described in the Committee's two interim reports, so will not be examined in detail in this report. Some general observations about the utility of such programs can provide some insights into establishing and maintaining effective links to ensure the relevance of biodiversity to human communities is better understood.

Biodiversity education programs

- 2.69 The Conservation Council of South Australia highlighted the need to support and strengthen environmental education in order to connect people to the importance and value of biodiversity, as well as promote participation in local biodiversity conservation initiatives.¹⁰² It further suggested that the Australian Government use the United Nations Decade on Biodiversity to 'launch a community-wide program to upgrade ecological literacy, and improve skills in biodiversity management'.¹⁰³
- 2.70 Mr Tupper of the ACF suggested that biodiversity education programs needed to look outside of successful environmental programs to places like sporting club outreach programs and broader public health initiatives, like the efforts made to deal with smoking.¹⁰⁴ Further, that direct feedback to the community is required, for example by way of a sign on the side of the road saying what the daily consumption of water was the day before.¹⁰⁵ Mr Tupper described the need for more programs allowing 'schools to connect with parks and reserves and experience the things that are important ... food, veggie gardens, local suppliers, where milk comes from ...'.¹⁰⁶ Dr Sinclair urged the Committee to recommend that 'schools and universities be supported to create teacher-friendly, classroom-ready

102 Conservation Council of South Australia, *Submission 58*, p. [6].

103 Conservation Council of South Australia, *Submission 58*, p. [6].

104 Mr Tupper, ACF, *Transcript of evidence*, 4 May 2012, p. 29.

105 Mr Tupper, ACF, *Transcript of evidence*, 4 May 2012, p. 29.

106 Mr Tupper, ACF, *Transcript of evidence*, 4 May 2012, p. 29.

resources to help Australians understand the shared interest we all have in replenishing our natural life support systems'.¹⁰⁷

- 2.71 Mr Kevin Evans, Chief Executive Officer of the National Parks Association of New South Wales, discussed how the Association communicates biodiversity protection issues to the public and helps people understand those issues, through its website, various publications and the biodiversity survey work it undertakes. The biodiversity survey allows the public to meaningfully contribute by doing simple scientific assessment under supervision, by entering a sighting or absence of a particular bird in the national park, for example, with the information being put into the Atlas of Living Australia.¹⁰⁸ Mr Evans further highlighted the need for nationally consistent, simple communications to the public on climate change and invasive species issues, and suggested that the design of such educational material could be discussed within COAG.¹⁰⁹
- 2.72 The Committee heard numerous ideas for biodiversity education in schools, including that park agencies should be encouraged to develop programs at low cost for school children, to teach them about the cultural and natural values of the environment.¹¹⁰
- 2.73 The Committee heard about the tourism and recreation activities undertaken by a large number of visitors to the Australian Alps, and how they present an 'opportunity to educate the general public about the outstanding natural heritage values of the Australian Alps, and their vulnerability to climate change and other human impacts'.¹¹¹
- 2.74 Another example of community engagement in education programs is the school excursions undertaken at the conservation sites, the Education Centre in Bicentennial Park and the wetlands at Sydney Olympic Park, as discussed in greater detail in the Committee's first interim report.¹¹²

Citizen science initiatives

- 2.75 The Committee considered numerous citizen science initiatives throughout the inquiry, and notes the value of these initiatives in directly engaging members of the community on biodiversity and climate change issues. Citizen science uses local observations and expertise in larger scale

107 Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, p. 23.

108 Mr Kevin Evans, Chief Executive Officer, National Parks Association of New South Wales (NPA NSW), *Transcript of evidence*, 28 March 2012, p. 29.

109 Mr Evans, NPA NSW, *Transcript of evidence*, 28 March 2012, p. 29.

110 IUCN WCPA, *Submission 30*, p. 15.

111 Research Centre for Applied Alpine Ecology, *Submission 72*, p. 4.

112 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 51-52.

analyses,¹¹³ and in the case of examples provided below, it is used to gather nationwide environmental data.

Atlas of Living Australia

2.76 The Atlas of Living Australia is an online biological collection database – with records uploaded by citizen scientists, from museum and herbaria collections and other biological collections – that makes biodiversity knowledge accessible to the nation. Community events have been held with local residents and scientists to conduct surveys of local biodiversity, using tools to assist in capturing biodiversity data to input into the Atlas.¹¹⁴

2.77 Dr John La Salle, Director of the Atlas, stated that the Atlas was working with CSIRO education (its host agency), the Academy of Science and the Australian Science Teachers Association, to promote the availability of the database and the usefulness of the data, including working on creating mobile data capture tools to collect records on hand-held devices.¹¹⁵ In terms of accuracy of the data, the Committee was informed that:

Every one of those 32 million records has had over 40 data cleaning tools run over ... Additionally, for any record, anybody can go in ... and report an issue or flag an issue with the record ... If you are doing an analysis, you can do your analysis just on the dataset that represents vouchered museum specimens, or Birds Australia data. So you can cut out all of these citizen science sightings and not use them at all if you do not trust them ... What we are finding is that the people who want to contribute data to us are in general trying to do a pretty good job of keeping it nice and clean and tidy.¹¹⁶

2.78 The identification and control of invasive species in a governance context is discussed in chapter seven. Dr La Salle discussed the issue of invasive species' identification in the Atlas, as follows:

... the atlas, as an aggregator of data, does not make decisions on what is invasive or what is not invasive. What we would do is create a list of agreed names for all organisms in Australia and then ask someone to provide us a list of those names that are invasive, and then we would flag them ... In the first instance, we

113 Professor Ted Lefroy, Director, Centre for Environment, University of Tasmania and Director, Landscapes and Policy National Environmental Research Hub, *Transcript of evidence*, 31 January 2012, p. 8.

114 Atlas of Living Australia (the Atlas), *Submission 83*, p. 2.

115 Dr John La Salle, Director, The Atlas, *Transcript of evidence*, 21 June 2012, p. 2.

116 Dr La Salle, The Atlas, *Transcript of evidence*, 21 June 2012, p. 4.

would not make any decisions on invasive species; we would ask someone else to supply us a list.¹¹⁷

Range Extension Database Mapping Project

- 2.79 The Committee heard that REDMAP – hosted by IMAS in Tasmania – promotes education and awareness of marine and climate change issues, successfully engaging a broad audience in marine monitoring, including directly engaging with fishers and divers, and engaging with school groups and local events to promote marine issue awareness.¹¹⁸ The REDMAP project is a volunteer research program inviting community members to report observations of marine species from outside their known distributions; the resulting data will show the marine species that are shifting range as a result of warming waters.¹¹⁹
- 2.80 IMAS stated that REDMAP lets people ‘discover for themselves how the seas are changing by collecting their own ‘data’; and over time will show marine industries – on a map – which species are on the move’.¹²⁰ Dr Pecl of IMAS stated that citizen scientist data had been used to fill research gaps, by being added to scientific survey information to be used in journal articles.¹²¹ Dr Pecl also commented on the importance of reporting back to the community on how the information gathered by citizen scientists is being utilised, with the methods used in this case being through a Facebook page and a quarterly newsletter.¹²²
- 2.81 The Committee heard that participation in initiatives such as REDMAP is very important as it engages local communities to provide important information to the public whilst providing valuable scientific information for use by scientists.¹²³ The Committee heard that there are 3.5 million recreational fishers in Australia, thousands of commercial fishers and thousands of divers that can help with this monitoring, in the process engaging with biodiversity and marine climate change issues.¹²⁴ It was also suggested that the REDMAP framework could be duplicated in other geographical areas.¹²⁵

117 Dr La Salle, *The Atlas, Transcript of evidence*, 21 June 2012, p. 4.

118 IMAS, *Submission 77*, pp. [1], [2] and [3].

119 IMAS, *Submission 77*, p. [1].

120 IMAS, *Submission 77*, p. [3].

121 Dr Pecl, IMAS, *Transcript of evidence*, 31 January 2012, p. 22.

122 Dr Pecl, IMAS, *Transcript of evidence*, 31 January 2012, p. 22.

123 Dr Anthony Press, Chief Executive Officer, Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), *Transcript of evidence*, 31 January 2012, p. 8.

124 Dr Pecl, IMAS, *Transcript of evidence*, 31 January 2012, p. 19.

125 Dr Press, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

Reef Life Survey

- 2.82 The Reef Life Survey uses recreational divers trained to collect scientific data compatible with data collected by scientific teams using scientific methods.¹²⁶ The Committee heard that the Reef Life Survey is 'the most comprehensive ecological dataset for the marine system' with 1200 sites, and is a 'hugely valuable resource in terms of understanding how threats are distributed in the marine environment' and also in 'providing a baseline to assess changes through time'.¹²⁷

Australian Seed Bank Partnership

- 2.83 The Australian Seed Bank Partnership suggested that it will work with the Botanic Gardens Education Network to 'design and launch a citizen science program to engage communities in the diverse work of the Partnership and encourage greater use of the growing seed biology information'.¹²⁸ In its submission, the Partnership stated that it was also working with the Atlas to create national standards for recording data on wild species collections, and to build an accessible online seed resource.¹²⁹
- 2.84 The Committee is supportive of the many citizen science initiatives observed during the course of the inquiry, and views these initiatives as powerful tools that can be used to engage the community in climate change and biodiversity issues. The Committee acknowledges the need for accurate and useful information to be gathered in a structured and consistent way, so that it can be used in scientific research projects, and to provide data that can be supplemented in future to build Australia's environmental knowledge base.

Conclusions and recommendations

- 2.85 The Committee acknowledges the benefits the community derives from biodiversity education programs and citizen science initiatives, and the importance of local, regional and national programs and initiatives to highlight the relevance of biodiversity to human communities.
- 2.86 The Committee acknowledges the importance of engaging the community in biodiversity issues, and the opportunities afforded by citizen science to involve the community in collecting environmental data and in that way
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126 Professor Graham Edgar, IMAS, *Transcript of evidence*, 31 January 2012, p. 21.

127 Professor Edgar, IMAS, *Transcript of evidence*, 31 January 2012, p. 22.

128 Australian Seed Bank Partnership, *Submission 19*, p. 6.

129 Australian Seed Bank Partnership, *Submission 19*, p. 6. See chapter six for further discussion on this issue.

- contribute to biodiversity research and the collection of baseline environmental information. The Committee notes the unique opportunity to use these initiatives to educate the public on the importance of biodiversity to human communities, our way of life and the economy.
- 2.87 The Committee considers that national programs should be organised and promoted by the Australian Government, utilising existing programs and initiatives (discussed above) to develop a nationally consistent, clear education program, the material and framework of which could be discussed at the COAG forum.
- 2.88 The Committee concludes that the Atlas of Living Australia (Atlas) is one such important tool in community education on biodiversity issues, and encourages the Australian Government to provide funding to develop and broaden its community engagement functions, and also to develop its information technology data collection tools to improve the quality and quantity of data collected (see further discussion in chapter five).
- 2.89 Further, in regard to the Atlas and the development of a national database for environmental information (discussed further in chapter five), the Committee considers that a national list of invasive species would assist the Atlas in categorising invasive species on its database. Invasive species management is discussed further in chapter seven.
- 2.90 The Committee was impressed by the REDMAP project and suggests to the Australian Government that it look into the viability of extending this concept to be implemented for other ecosystems.
- 2.91 The Committee acknowledges the considerable potential of developing existing citizen science databases into a single consistent and adaptable national database for monitoring biodiversity and the environment.
- 2.92 The Committee considers that the Australian Government must view provision of this information in an accessible format as a priority, in order to assist the community to understand the effects that biodiversity loss has on the community and the economy, and to assist land managers and policymakers in measuring the effects of policy implementation on biodiversity, and to ensure that adaptive management is a priority.

Recommendation 2

- 2.93 **The Committee recommends that the Australian Government, through the Council of Australian Governments, develop a central national database, incorporating a consistent and adaptable model of uploading and storing information which is able to be scientifically accredited.**

Sustainable use of natural resources

- 3.1 This chapter considers aspects of the terms of reference relating to mechanisms to promote the sustainable use of natural resources and ecosystem services in a changing climate, and mechanisms to enhance community engagement. In the course of its inquiry, the Committee considered mechanisms as deriving from two complementary approaches: policy and practice; both with biodiversity conservation as core elements.
- 3.2 The **policy approach** outlines the broad measures and mechanisms required to promote the sustainable use of resources and ecosystem services in an uncertain climatic future; an example is the adaptive management approach. The **practice approach** highlights the individual programs and projects required or underway that promote the sustainable use of natural resources and ecosystem services; an example is the stormwater recycling projects supported across Australia. The Committee received a range of evidence demonstrating both approaches, some of which are explored below, and in later chapters.
- 3.3 Many examples of the ‘practice approach’ incorporated community engagement and participation at the same time as promoting the sustainable use of resources. The Committee has observed the extent to which several programs and projects are:
- being undertaken and supported in our local communities
 - protecting our biodiversity
 - alleviating some of the impacts that changing biodiversity due to climate change will have on our human communities
 - preparing human communities for the eventuality that some natural resources will become scarcer in a changing climate.
- 3.4 This chapter canvasses examples of mechanisms relating to locally organised conservation initiatives and government programs and policies. Connectivity conservation initiatives are discussed in chapter four, and

programs utilised by regional natural resource management (NRM) organisations, including under the Federal Government's Caring for our Country initiative, are discussed in detail in chapter six.

Policy approach

- 3.5 Among the evidence received relating to policy approaches promoting the sustainable use of natural resources and ecosystem services, the Committee was pleased to see input from a range of government and non-government agencies, as well as individuals operating in different jurisdictions, a sample of which is canvassed below. The general thread throughout this evidence highlighted the need for policy approaches to be integrated with other policy areas covering, among others, land use planning, adaptive management approaches, and sustainable population growth.

Adaptive management and coordinated planning

- 3.6 The Department of Infrastructure and Transport (DIT) highlighted the sustainability objectives of Australia's National Urban Policy, which include 'managing our resources sustainably by reducing resource consumption and waste and improving water, energy and food security'.¹
- 3.7 DIT also highlighted the importance of integration of NRM planning and land use planning systems, and that 'outer urban and peri urban land management, natural resource management planning and land use planning systems are ill-equipped to address the biodiversity management impacts'.²
- 3.8 The Commonwealth Scientific and Industrial Research Organisation (CSIRO) suggested the need to:
- 'accept and plan for significant and continuous changes in the distribution of species and ecosystems ... '
 - develop adaptive management approaches
 - promote strategic coordination of NRM at regional levels, using tailored approaches in different regions.³
- 3.9 The Australian Coastal Society (ACS) stated that there is an urgent need to define what 'sustainable' and 'sustainability' mean, as well as identify the
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1 Department of Infrastructure and Transport (DIT), *Submission 56*, p. 1.

2 DIT, *Submission 56*, p. 2.

3 The Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission 23*, pp. 17-18.

scientific criteria, benchmarks and milestones required to objectively assess the efficacy of land-use strategies, conservation measures or management regimes.⁴ The ACS stated that there is no consideration of sustainability in planning or management in Australia's coastal areas, and also a lack of recognition of the importance of ecosystem services, as no economic value of ecosystems is given in planning or land management frameworks.⁵

- 3.10 The Tom Farrell Institute for the Environment stated the need for government assistance with 'planning, management and research into alternative sources of energy', and the need for the government to support and require 'investment from the coal export sector to stop the degradation of our biodiversity and ensur[e] that ecosystems function to support future human economies not dependent on coal or oil'.⁶
- 3.11 Ms Liz Burton, a planning and environment advocate, suggested in her submission the need to develop a 'national strategy on biodiversity asset conservation in a changing climate'; in order to address the three interconnected factors affecting the natural environment, namely: climate change; the 'structure of the Australian economy and impacts on biodiversity of natural resource commercial exploitation'; and population growth and native vegetation clearance.⁷ Ms Burton also suggested the need to review state planning policies in order to prevent extensive land clearing and fragmentation, improve coordination across the three levels of government, and introduce monitoring and accounting processes of biodiversity loss in relation to biodiversity assets.⁸
- 3.12 The Western Australian Farmers Federation was concerned that the Committee not make recommendations which 'introduce additional restraints on Western Australian farmers who are already significantly restricted in the[ir] land management practices'.⁹ The Committee met with the WA Farmers Federation in Perth and heard about the WA Government's land clearing regulation restrictions placed on WA farmers, and the amount of land clearing allowed for mining and urban use. Further to information provided in the Federation's submission, Mr Alan Hill, Director of Policy, told the Committee that:

... in an environment where we recognise that productive farmland is decreasing for a number of reasons and demand is

4 Australian Coastal Society (ACS), *Submission 61*, p. 8.

5 ACS, *Submission 61*, pp. 7-8.

6 Tom Farrell Institute for the Environment, *Submission 82*, p. 6.

7 Liz Burton, *Submission 85*, pp. 25-26.

8 Liz Burton, *Submission 85*, p. 28.

9 Western Australian Farmers Federation, *Submission 48*, p. [3].

increasing because of our sheer capacity to breed and reproduce, the Australian farmer and particularly the Western Australian farmer needs to function in that market and be more productive than ever before. If we are going to put restrictions on his or her ability to do that, that needs to be recognised and the full cost of that not borne by the landholder simply because they are a landholder.¹⁰

Innovative governance

3.13 The International Union for the Conservation of Nature World Commission on Protected Areas (IUCN WCPA) suggested that innovative governance is required, with models combining biodiversity goals with climate mitigation and adaptation goals, supported by all levels of government. The IUCN WCPA suggested that innovative governance requires:

- 'grants to the voluntary sector to maintain a viable NGO [non-government organisation] community'
- incentive mechanisms and stewardship payments
- 'rate and taxation incentives and multiple biodiversity and carbon market mechanisms to encourage conservation on private lands'
- 'investment in large scale biodiverse vegetation restoration and terrestrial carbon plantings'.¹¹

3.14 The Western Catchment Management Authority suggested the need to:

- recognise an economic value of environmental services (canvassed in chapter two)
- support concepts such as Enterprise-based Conservation which establishes 'conservation management as a viable alternative enterprise to grazing' (canvassed in chapter six).¹²

3.15 The Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) highlighted the importance of:

- decision-making managing uncertainties surrounding climate change impacts, risk management, the selection of priority action areas, and how to avoid maladaptation

10 Mr Alan Hill, Director of Policy, Western Australian Farmers Federation, *Transcript of evidence*, 7 November 2011, p. 20.

11 International Union for the Conservation of Nature World Commission on Protected Areas (IUCN WCPA), *Submission 30*, p. 12.

12 Western Catchment Management Authority, *Submission 42*, pp. 3-4.

- further research to expand knowledge of climate change impacts and continually incorporate the knowledge into policy, plans and management practices
 - the National Plan for Environmental Information (discussed in chapter five) in improving the quality and coverage of Australia's environmental information
 - regional NRM plans in delivering integrated approaches to NRM.¹³
- 3.16 The Department of Agriculture, Fisheries and Forestry (DAFF) outlined the Australian Government's commitment to 'increasing the adoption of management practices [by farmers and fishers] that continue to maintain and improve production, while delivering ecosystem services that benefit the whole community.'¹⁴ DAFF stated that the Australian Government was delivering on this objective through grants and capacity building through Caring for our Country and the Carbon Farming Initiative (both discussed below in relation to practice approaches) and other strategies and initiatives.¹⁵

Sustainable populations

- 3.17 As may be anticipated in a consideration of the continued ability to sustainably use natural resources, population growth is a factor. This issue was raised on a few occasions with the Committee, specifically in relation to the effects of predicted population growth on biodiversity.
- 3.18 Mr Sean Sullivan, Acting Deputy Secretary, DSEWPAC stated that Australia's Sustainable Population Strategy, released in May 2011, recognises that our population growth and trends in population growth mean that 'we need to take into account what sustainable population means both now and planning into the future'.¹⁶
- 3.19 Population growth is a major indirect driver on the Australian environment, with population projected to increase to between 30.2 and 35.9 million by 2050.¹⁷ As a key driver impacting on biodiversity, the

13 The Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), *Submission 66*, p. 11.

14 Department of Agriculture, Fisheries and Forestry (DAFF), *Submission 73*, p. 23.

15 DAFF, *Submission 73*, p. 24.

16 Mr Sean Sullivan, Acting Deputy Secretary, DSEWPAC, *Transcript of evidence*, 12 October 2012, p. 31.

17 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 45 and 54.

Committee heard that the 'rate of population growth has become considerably faster since the mid-2000s'.¹⁸

... population growth is likely to continue to drive the need for expanded suburban development. The size of this impact will depend on how sensitive the planning has been towards local environmental assets and values, and on the effectiveness of policies to improve the energy efficiency of housing and transport.¹⁹

- 3.20 The Coast and Wetlands Society discussed the large human population, and existence of landscapes interrupted by barriers of infrastructure, urban areas and agricultural and forestry land.²⁰ The Society went on to discuss the impacts of population growth, observing that:

The growth of the human population and the increasing trend to urban living will, even in the absence of climate change, require intensification of agricultur[e] likely to make agricultural land more inhospitable to wildlife. Climate change will force further changes in agricultural practice which may also further impact on the ability of agricultur[e] and wildlife to co-exist.²¹

- 3.21 An example of a policy approach to the sustainable use of natural resources was encountered during the Committee's site inspections in Townsville, and in evidence received during the inquiry, namely the *Great Barrier Reef Marine Park Zoning Plan 2003*, which rezoned the region and resulted in recovery of fish populations.²²

Practice approach

Examples of sustainable resource use

- 3.22 The following programs and projects were encountered during the Committee's site inspections and discussed in its interim reports:
- rainwater harvesting system to supplement the water naturally occurring in the Lake Cave, Margaret River.²³

18 Liz Burton, *Submission 85*, p. 13.

19 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 45.

20 Coast and Wetlands Society Inc., *Submission 51*, p. 2.

21 Coast and Wetlands Society Inc., *Submission 51*, pp. 2-3.

22 House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 2*, November 2012, p. 70.

23 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 6, 13-14.

- Sydney Olympic Park's:
 - ⇒ Brickpit Ring Walk site, incorporating: a protected area for endangered species; natural and constructed wetlands used for biodiversity conservation; and a reservoir to supply non-potable water to Sydney Olympic Park and Newington
 - ⇒ Eastern Water Quality Control Pond to moderate the flow of stormwater run-off and absorb nutrients before the water is filtered and pumped into the brickpit reservoir for distribution.²⁴
 - City of Salisbury's Greenfields Wetlands project forms a significant part of the City's stormwater recycling program – urban stormwater run-off is treated in the constructed wetlands then distributed for non-potable use.²⁵
 - Goolwa Barrages at Hindmarsh Island, South Australia, are intended to help maintain the fresh water of the River Murray and Lakes Alexandrina and Albert, keep water at a sufficient level to permit watering of reclamation areas, and prevent salt water from entering during periods of low river.²⁶
 - Reef HQ Aquarium, Townsville's:
 - ⇒ coral propagation program aimed at reducing collection of coral from the Great Barrier Reef for display and research purposes
 - ⇒ reduced energy consumption, including the use of photovoltaic solar panels expected to reduce annual greenhouse gas emissions
 - ⇒ Reef Guardian program displays.²⁷
- 3.23 The Great Barrier Reef Marine Park Authority's Reef Guardian program addresses the 'additional challenges a changing climate represents for ensuring sustainable use of the Reef's natural resources and ecosystem services'.²⁸
- 3.24 The Committee briefly discussed the Reef Guardian program in its second interim report, and reiterates its suggestion that the Reef Guardian program could be adapted to other areas and ecosystem types, in order to enhance community engagement in sustainable environmental management.

24 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 48-50.

25 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 25, 34-37.

26 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 24.

27 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 63-64.

28 Great Barrier Reef Marine Park Authority, *Submission 28*, p. [4].

Government and market-based initiatives

- 3.25 DSEWPAC outlined two programs that can provide benefits for biodiversity:

Under the new Carbon Farming Initiative ... landholders can earn carbon credits by reducing emissions from agriculture and increasing the carbon stored in forests and other ecosystems. These credits can then be sold to companies with obligations under the carbon price mechanism, or to those who wish to voluntarily offset their greenhouse gas emissions. Carbon Farming Initiative projects that provide co-benefits for biodiversity will be able to advertise these credentials in order to seek a premium price for their carbon credits.

The [Biodiversity] fund will support landholders to undertake projects that establish, restore, protect or manage biodiverse carbon stores in targeted areas of the landscape. It is intended that this financial incentive for landholders will enhance the environmental outcomes of carbon farming projects and improve the resilience of Australia's species to the impacts of climate change.²⁹

- 3.26 The Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS) discussed the long-term research project called the West Arnhem Land Fire Abatement Project, accepted under the Carbon Farming Initiative.³⁰ Dr Lisa Strelein, Director of Research, Indigenous Country and Governance at AIATSIS indicated that it is successful in relation to sustainable land management and in the potential for economic opportunities through selling carbon credits.³¹

- 3.27 DAFF outlined the Sustainable Farm Practices initiative of Caring for our Country:

Sustainable Farm Practices is a national priority area within the Caring for our Country initiative. It aims to help improve adoption of practices which will benefit soil condition and ground cover and indirectly, above and below-ground biodiversity. Sustainable

29 DSEWPAC, *Submission 66*, p. 10. The legislation to establish the Carbon Farming Initiative was referred to the Committee for consideration. Further information on the inquiry and the report of the Committee is available at:

<http://www.aph.gov.au/Parliamentary_Business/Committees/House_of_Representatives_Committees?url=ccea/24march2011/report.htm> viewed 22 March 2013.

30 Dr Lisa Strelein, Director of Research, Indigenous Country and Governance, the Australian Institute for Aboriginal and Torres Strait Islander Studies (AIATSIS), *Transcript of evidence*, 20 September 2012, p. 3.

31 Dr Strelein, AIATSIS, *Transcript of evidence*, 20 September 2012, p. 3.

Farm Practices also acknowledges the stewardship relationship that landholders have with biodiversity, by providing support for landscape scale conservation activities including protection of native vegetation and threatened ecological communities and revegetation.

Caring for our Country's long-term (20 year) projection is that Australia's agricultural lands will support and maintain clean water, biodiversity and healthy soils, while continuously improving food and fibre productivity. The agricultural sector will be based on the sustainable management of natural resources and be better able to respond to the threats and opportunities created by changing circumstances, particularly a changing climate.

Under this 20 year projection, one of Caring for our Country's 5 year outcomes is to assist at least 30 per cent of farmers to increase their uptake of sustainable and land management practices that deliver improved ecosystem services.

Through the Caring for our Country initiative, assistance is available to protect biodiversity and national icons through on-ground works and stewardship payments; and to build the capacity of farmers to adopt sustainable agricultural practices through supporting extension activities, information dissemination, and actions to demonstrate and pilot innovative practices on-ground.³²

3.28 DAFF stated that one of the Caring for our Country targets was:

... for an additional 42 000 farmers to have improved their management practices to reduce the risk of soil acidification, soil loss through wind and water erosion and increase the carbon content of soils by 2013.³³

3.29 The Committee learned that 'by 2011-12 Caring for our Country alone had supported over 46 000 farmers to adopt more sustainable practices'.³⁴

32 DAFF, *Submission 73*, p. 18.

33 DAFF, *Submission 73*, p. 24.

34 Mr Ian Thompson, First Assistant Secretary, Sustainable Resource Management, DAFF, *Transcript of evidence*, House Standing Committee on Agriculture, Resources, Fisheries and Forestry's Inquiry into the Department of Agriculture, Fisheries and Forestry annual report 2011-12 and Department of Sustainability, Environment, Water, Population and Communities annual report 2011-12, 13 February 2013, p. 3. The transcript is available at: <http://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query%3DId%3A%22committees%2Fcommrep%2F78974eb1-1b55-4363-83cd-b5a7cc9064c0%2F0000%22> viewed 22 March 2013.

- 3.30 The Australian Bureau of Statistics' Agricultural Resource Management Survey demonstrates trends in the adoption of land management practices, and in 2012 it indicated that 'over half of the agricultural businesses with native vegetation, wetlands, rivers and creeks on farm are protecting them for conservation purposes'.³⁵ DAFF stated that this information can be used to understand the effectiveness of Caring for our Country initiatives in changing land management practices.³⁶
- 3.31 The then Queensland Government outlined strategies and actions being used to enhance adaptive capacity including the NatureAssist Program, which supports landholders in managing and protecting biodiversity on land subject to conservation agreements.³⁷
- 3.32 The National Farmers' Federation highlighted a number of market-based approaches to environmental management, including the private sector stewardship initiatives: the Environmental Champions Program and Landcare.³⁸ The Environmental Champions Program is a voluntary program for rice-based systems that aims to recognise growers for their environmental stewardship, achieve on farm benefits and improve the regional landscape.³⁹ According to its website, the Environmental Champions Program also combines regional environmental programs, best management practices and government and irrigation bodies' requirements into one streamlined process.⁴⁰

Conclusions

- 3.33 The Committee understands the importance of sustainably using natural resources and ecosystem services, and the benefits of engaging the community in doing so. The Committee reiterates its support for

35 DAFF, *Submission 73*, p. 24; Australian Government, *Caring for our Country: An outline for the future 2013-2018*, Department of Sustainability, Environment, Water, Population and Communities and Department of Agriculture, Fisheries and Forestry, Canberra, 2012, p. 4.

36 DAFF, *Submission 73*, p. 24.

37 Department of Environment and Resource Management (Queensland Government), *Submission 70*, pp. 5-6. In April 2012, the Department of Environment and Heritage Protection was established, following machinery-of-government changes.

38 National Farmers' Federation, *Submission 43*, p. 14.

39 Environmental Champions Program, 'Overview of Environmental Champions Program - Australia', <http://www.environmentalchampions.rga.org.au/about_ecp/Overview.htm> viewed 26 February 2013.

40 Environmental Champions Program, 'Overview of Environmental Champions Program - Australia', <http://www.environmentalchampions.rga.org.au/about_ecp/Overview.htm> viewed 26 February 2013.

programs that promote the sustainable use of natural resources while also supporting biodiversity conservation.

- 3.34 The Committee was impressed by the numerous projects being undertaken in the community aimed at the sustainable use of natural resources and ecosystem services, as discussed in the Committee's interim reports. The benefits of these projects are important in that they:
- encourage innovative thinking, learning and development of ideas to promote the sustainable use of natural resources
 - markedly improve return on, and encourage recycling and reuse of, ecosystem services
 - positively impact upon biodiversity
 - encourage participation in learning and research on the implications of the unsustainable use of natural resources and the possibilities of changes in availability of some natural resources in future
 - involve communities in rewarding and educational activities.
- 3.35 The Committee understands the importance of government support for such initiatives. The Committee supports policies and market-based approaches to environmental management that promote the sustainable use of natural resources and ecosystem services, as canvassed above. The ability for land managers and community members to participate in, and benefit in economic terms from, conservation activities that positively affect biodiversity is a very important message for governments, particularly the Australian Government, to be promoting. Further, the ability for land managers to learn new management skills and adopt more sustainable practices is also beneficial for the surrounding communities and for maintaining biodiversity. Governments should be constantly improving, developing and extending such initiatives.
- 3.36 The Committee understands that coordinating policy approaches in different areas involves many and varied complexities. The Committee discusses these complexities, relating to natural resource management and governance issues generally in chapters six and seven below.

Connectivity conservation

- 4.1 Connectivity conservation involves ‘conserving or re-establishing interconnected areas and corridors of vegetation to protect linked ecosystems and the species within them’.¹ The 2011 State of the Environment report stated that connectivity conservation areas, also known as corridors and biolinks:

... interconnect protected areas, help maintain large-scale natural Australian landscapes and ecosystem processes, and are a natural and critical partner in biodiversity conservation to the National Reserve System. These areas are a critical conservation response to climate change. They provide opportunities for species to move, interact, adapt and evolve as higher temperatures and changed rainfall patterns cause ecosystem shifts at a landscape scale.²

- 4.2 The National Reserve System (NRS) is Australia’s network of parks, reserves and protected areas – including Indigenous Protected Areas (IPAs) and private land conservation areas – covering approximately 13.4 per cent of the country.³
- 4.3 The National Representative System of Marine Protected Areas (MPA) covers approximately one third of Australia’s oceans – 3.1 million square

1 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), Canberra, 2011, Glossary, p. 906.

2 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 357.

3 DSEWPAC, ‘The National Reserve System (NRS)’, <<http://www.environment.gov.au/parks/nrs/index.html>> viewed 15 January 2013; DSEWPAC, ‘The National Reserve System (NRS) – Private landholders’, <<http://www.environment.gov.au/parks/nrs/getting-involved/private.html>> viewed 15 January 2012.

kilometres of ocean – and is managed primarily for biodiversity conservation.⁴

- 4.4 The National Wildlife Corridors Plan (NWCP) is 'the Australian Government's framework to retain, restore and manage ecological connections in the Australian landscape' – a landscape scale approach to biodiversity conservation.⁵
- 4.5 The following list includes the major connectivity conservation areas in Australia:
 - Great Eastern Ranges (GER) Initiative corridor (2800 kilometres from central Victoria to Far North Queensland)
 - Gondwana Link (1000 kilometres in south-west Western Australia)⁶
 - Trans-Australia Eco-link Corridor (3500 kilometres in South Australia and the Northern Territory)
 - Tasmanian Midlandscapes (up to 64 000 hectares in Tasmania)
 - Habitat 141° (18 million hectares, stretching 700 kilometres from north to south along the 141° meridian, across the borders of South Australia, New South Wales and Victoria)
 - NatureLinks, a set of connectivity conservation projects led by the South Australian Government (five separate corridors, two of which form part of the Trans-Australia Eco-link Corridor, in South Australia)
 - Northern Australia Tropical Savannah Lands Corridor and Kimberley Landscape Conservation Areas (3000 kilometres in Western Australia, the Northern Territory and Queensland)
 - Biolinks (various parts of Victoria).
- 4.6 As noted above, the NRS is described as a 'natural and critical partner' to connectivity conservation areas in biodiversity conservation. This chapter will therefore outline the purpose of the NRS before assessing the benefits and challenges of connectivity conservation.

4 DSEWPAC, 'Commonwealth Marine Reserves', <<http://www.environment.gov.au/marinereserves/index.html>> viewed 16 January 2012.

5 DSEWPAC, *National wildlife corridors plan: A framework for landscape-scale conservation*, DSEWPAC, Canberra, 2012, p. 1.

6 The Great Eastern Ranges Initiative corridor and Gondwana Link were considered by the Committee during its program of site inspections - see House of Representatives Standing Committee on Climate Change, Environment and the Arts, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 14-15, 41-43.

The National Reserve System

- 4.7 As noted above, the NRS covers approximately 13.4 per cent of Australia.⁷ One of the stated national targets in the NRS Strategy is to, by 2030:
- Include critical areas to ensure the viability, resilience and integrity of ecosystem function in response to a changing climate, such as large and small refuges, critical habitats, broad landscape-scale corridors, places of species and ecosystem richness, sites of endemism and sites that support threatened species and/or ecological communities, and places important for the stages in the life cycle of migratory or nomadic species, to act as core lands of a broader whole of landscape approach to biodiversity conservation.⁸
- 4.8 The 2011 State of the Environment report observed that assessing the adequacy of the NRS is difficult because there is no nationally agreed approach to its assessment, and that its objectives are not entirely clear.⁹ Further, that the long-term achievement of the comprehensiveness, adequacy and representativeness criteria is difficult, possibly due to a mismatch between targets and allocation of resources to achieve them; and that considerable expansion is still required in order to achieve adequate protection of threatened species within the system. The 2011 State of the Environment report concluded that effective off-reserve conservation is important.¹⁰
- 4.9 The Committee is aware of a view that all types of protected areas should be integrated into a single national system, with better integration between off-reserve conservation and protected areas.¹¹ Dr Robert Lambeck, former Chief Executive Officer of Greening Australia (WA)

7 DSEWPAC, 'The National Reserve System (NRS)', <<http://www.environment.gov.au/parks/nrs/index.html>> viewed 15 January 2013.

8 Australian Government, *Australia's Strategy for the National Reserve System 2009-30*, endorsed by the Natural Resource Management Ministerial Council, Canberra, May 2009, p. 13. (NRS Strategy)

9 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 651, 654.

10 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 654.

11 The Committee was initially aware of this view from the report of the Biodiversity and Climate Change Expert Advisory Group, *Australia's biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change – Summary for policy makers 2009*, Summary of a report to the Natural Resource Management Ministerial Council commissioned by the Australia Government, Department of Climate Change and Energy Efficiency, Canberra, 2009, p. 14 (Exhibit 2).

described the importance of complementing the NRS with the private land-use surrounding it, and the interplay between them as being critical.¹² Mr Hamish Jolly, Advisor and former Chief Executive Officer of Greening Australia also discussed the need to break down the on-reserve, off-reserve connections.¹³

- 4.10 The International Union for Conservation of Nature, World Commission on Protected Areas (IUCN WCPA) advised the Committee of the need to identify refugia outside the NRS and establish them as protected areas, also ensuring that protected areas are interconnected and actively managed across all tenures.¹⁴ The National Parks Association of Queensland advised that the acquisition of these identified refugial areas should be incorporated into natural resource management (NRM) and biodiversity conservation strategies as a priority.¹⁵
- 4.11 The Australian Network of Environmental Defender's Offices (ANEDO) stated that, in addition to recognising threats:

... the design of the reserve system under a changing climate needs to focus on building resilience to climate change by increasing connectivity (through protection of key migration corridors) and identifying and protecting ecological processes and climate refugia.¹⁶
- 4.12 ANEDO noted that '[i]dentification of refugia and key migration corridors across bioregions should therefore be a key priority for the identification of proposed protected areas under the NRS'.¹⁷ ANEDO also noted that protected area management plans should include strategies that build resilience and manage for further uncertainty, including 'mandatory requirements to incorporate assessments of climate change impacts and to focus on climate change adaptation'.¹⁸ It was also suggested that adaptive management be incorporated as a management principle under the *Environment Protection and Biodiversity Conservation Act 1999*.¹⁹
- 4.13 The Committee was advised about the operation of the South Australian Government's program for the co-management of parks and reserves with

12 Dr Robert Lambeck, former Chief Executive Officer, Greening Australia (WA), *Transcript of evidence*, 7 November 2011, p. 31.

13 Mr Hamish Jolly, Adviser and former Chief Executive Officer, Greening Australia, *Transcript of evidence*, 7 November 2011, p. 34.

14 IUCN WCPA, *Submission 30*, p. 2.

15 National Parks Association of Queensland Inc., *Submission 12*, p. [1].

16 The Australian Network of Environmental Defender's Offices (ANEDO), *Submission 57*, p. 14.

17 ANEDO, *Submission 57*, p. 14.

18 ANEDO, *Submission 57*, pp. 14-15.

19 ANEDO, *Submission 57*, p. 15.

Indigenous Australians. The program provides opportunities for genuine involvement and power-sharing, and builds and improves on the existing formal reserve system. The Committee understands that the South Australian Government was looking at further co-management of parks, including with the Ngarrindjeri community in the Coorong area, and that other jurisdictions in Australia and overseas had expressed interest in these innovative co-management arrangements.²⁰

Benefits of connectivity conservation

- 4.14 The Committee heard that connectivity conservation is an internationally endorsed approach to addressing habitat fragmentation and providing species the best chance at adaptation in the face of a changing climate.²¹ Connectivity corridors such as the GER Initiative have been described as vital for mitigating the effects of climate change on biodiversity.²²
- 4.15 The Committee discussed the benefits of connectivity conservation with representatives of the Gondwana Link and the GER Initiative. In Perth, the Committee met with a representative of Gondwana Link, as well as representatives from two of their partner organisations, Greening Australia and the Cape to Cape Catchments Group. Near the small town of Michelago, in New South Wales, the Committee met with representatives of the GER Initiative and its regional partner organisation, Kosciuszko to Coast.
- 4.16 The Committee met with the National Wildlife Corridors Plan Advisory Group at a public hearing in Canberra. Many interested stakeholders also provided evidence to the Committee on the benefits of connectivity conservation.

Refugia in a changing climate

- 4.17 One of the benefits of connectivity corridors is the provision of vital refugia to species in the face of unexpected changes in climate. As noted in the context of the NRS discussion earlier, such refugia are a priority in biodiversity conservation. The Committee is aware of the work between the South Australian Government, regional NRM boards, non-government organisations and community groups in developing the NatureLinks

20 Mr Greg Leaman, Executive Director, Policy, Department of Environment and Natural Resources (South Australian Government) (DENR), *Transcript of evidence*, 17 May 2012, p. 8.

21 Boobook Declaration Steering Committee, *Submission 11*, p. 6; BirdLife Australia, *Submission 40*, p. 8.

22 National Parks Association of New South Wales (NPA NSW), *Submission 45*, p. 4.

project. In its submission, the South Australian Government stated that the project will build the resilience of social and ecological systems to enable them to adapt to climate change.²³

- 4.18 The ACT Government stated that it was engaged in activities aimed at enhancing existing reserve management that would facilitate recovery and restoration of habitat, better control feral animals and weeds, improve fire management practices and enhance riparian areas to better retain water and be more resilient to flash flooding, so as to provide refuges and corridors for biodiversity in a drying climate.²⁴
- 4.19 According to the National Parks Association of NSW (NPA NSW), the GER corridor provides a key opportunity for species to shift their ranges and habitat use to respond positively to climate change.²⁵ According to the Australian Marine Sciences Association (AMSA), ensuring connectivity among marine populations and regions will be critical to facilitating range shifts of species, in turn helping to mitigate the impact of climate change and maintain the resilience of marine communities.²⁶
- 4.20 Another benefit of connectivity conservation is the ability to incorporate the existing natural elements of the landscape, including the travelling stock route and reserve networks around the country. These networks could form part of connectivity conservation areas as they naturally act as corridors and stepping stones connecting fragmented vegetation across the landscape.²⁷ It was suggested by the Namoi Catchment Management Authority (CMA) that travelling stock routes should be incorporated into the protected area network.²⁸
- 4.21 The Namoi CMA also stated that '[w]ell managed conservation areas on private land, especially when linked with public lands, could prove to be vital refugia for biodiversity given the threat of climate change'.²⁹ Mr Greg Leaman, Executive Director of Policy at the then South Australian Department of Environment and Natural Resources, advised the Committee that many people are interested in participating in landscape scale conservation and the key is to engage those landowners and land managers.³⁰

23 DENR, *Submission 80*, p. 2.

24 ACT Government, *Submission 75*, pp. 1-2.

25 NPA NSW, *Submission 45*, p. [3].

26 Australian Marine Sciences Association (AMSA), *Submission 17*, p. 3.

27 NPA NSW, *Submission 45*, pp. 5-6.

28 Namoi Catchment Management Authority (Namoi CMA), *Submission 31*, p. [2].

29 Namoi CMA, *Submission 31*, p. [3].

30 Mr Leaman, DENR, *Transcript of evidence*, 17 May 2012, p. 7.

Community engagement

- 4.22 Because of their cross-tenure, socially inclusive nature, connectivity conservation projects like the GER Initiative engage broad sections of communities. Such projects often involve governments, landowners, researchers, regional NRM organisations and community groups.³¹
- 4.23 The Committee was told that the NWCP cannot work without the engagement of private landowners, and that connectivity corridors are about finding ways to improve conservation management in between formally reserved areas, as a complement to the NRS.³² Dr Judy Henderson, a member of the NWCP Advisory Group, stated that it is important to expand the community's understanding of connectivity conservation through education and information generation programs within the communities.³³
- 4.24 Mr Jolly of Greening Australia agreed that investment in landowner education and support is important at the community level, in order to achieve biodiversity at a landscape scale.³⁴ Mr Jolly suggested the need to focus on capacity building in relation to the Federal Government's Biodiversity Fund program, and that the Federal Government should use existing organisations such as Greening Australia, Landcare and regional NRM organisations to facilitate this.³⁵
- 4.25 The Committee heard from the South Australian Government that the NatureLinks projects seek to integrate conservation with regional development and NRM, and provide a framework for sustainable use. It was stated that the key is to provide the framework and direction, then encourage and allow local implementation. The South Australian Government prepared implementation plans for NatureLinks in order to guide the participant partners as to how to achieve the corridors. The corridors' establishment became a target in the state's strategic plan, which has further evolved in subsequent plans. The NatureLinks principles have also been incorporated into the state's NRM plan, all eight regional NRM plans, the South Australian planning strategy including the 30-year plan for Greater Adelaide, and regional planning documents. The purpose of incorporation into so many different places, it was said, is to

31 NPA NSW, *Submission 45*, p. 5.

32 The Hon. Bob Debus, Chair, National Wildlife Corridors Plan (NWCP) Advisory Group, *Transcript of evidence*, 12 October 2012, p. 20.

33 Dr Judy Henderson, NWCP Advisory Group, *Transcript of evidence*, 12 October 2012, pp. 21-22.

34 Mr Jolly, Greening Australia, *Transcript of evidence*, 7 November 2011, p. 31.

35 Mr Jolly, Greening Australia, *Transcript of evidence*, 7 November 2011, p. 33.

- ensure the embedding of NatureLinks in the institutional framework so that it has a longer term and longer lasting effect.³⁶
- 4.26 Mr Rob Dunn, Chief Executive Officer of the GER Initiative, indicated that each of the councils in partnership with the Initiative were identifying opportunities to align their programs with it, and also looking at it in respect of their planning instruments.³⁷
- 4.27 The Committee heard about the success of the Great Barrier Reef Marine Park Authority's Reef Guardian program, as a means to informing and involving the community in issues of biodiversity conservation. The Australian Coral Reef Society (ACRS) proposed that these successful arrangements should be initiated and receive long-term funding in other parts of Australia.³⁸
- 4.28 BirdLife Australia, in its submission, described the importance of investing in and promoting the fact that biodiversity conservation can positively contribute to carbon reduction, and assist in building ecosystem and species resilience, with initiatives such as the Biodiversity Fund and the NWCP being good first steps.³⁹ Further, that this can be done by using the best available scientific information to identify pathways for climate adaptation for threatened species, and providing adequate funding for land managers to pursue climate adaptation projects.⁴⁰
- 4.29 Greening Australia stated that improving connectivity is highly complementary to improvements in sustainable agricultural practices.⁴¹ The National Farmers' Federation (NFF) stated that:
- While the National Wildlife Corridors Plan might be a useful tool, NFF notes that there remain opportunities to marry existing conservation land with private land management efforts to deliver wins for biodiversity and agriculture. NFF remains supportive of market-based instruments such as Environmental Stewardship Program and the newly announced Biodiversity Fund.⁴²
- 4.30 The Committee heard from Mr Dunn that the GER Initiative was working with the Atlas of Living Australia to develop citizen science tools to help landowners do self-monitoring, indicating that additional investment was

36 Mr Leaman, DENR, *Transcript of evidence*, 17 May 2012, pp. 7-8.

37 Mr Rob Dunn, Chief Executive Officer, Great Eastern Ranges (GER) Initiative, *Transcript of evidence*, 2 March 2012, p. 13.

38 Australian Coral Reef Society (ACRS), *Submission 63*, p. [8].

39 BirdLife Australia (formerly Birds Australia), *Submission 40*, p. [8].

40 BirdLife Australia, *Submission 40*, p. [8].

41 Greening Australia, *Submission 24*, p. 4.

42 National Farmers' Federation (NFF), *Submission 43*, p. 16.

needed in order to continue this work.⁴³ The Committee heard that the challenge is how quickly they can respond to community enthusiasm – the potential and outline for the project are in place but the resources for expansion are not available in order to work effectively at a landscape scale, and are thereby slowing the progress of the initiative.⁴⁴

- 4.31 The Committee heard about the Perth Biodiversity Project from the Manager of the Project, Ms Renata Zelinova, being initially created as a set of guidelines for local governments, endorsed by the state government, on how to prioritise natural areas for conservation at the local level thereby helping local governments to consider biodiversity early in the land use planning stage.⁴⁵ Ms Zelinova described the benefits of the Project as providing:

... tools and increasing capacity through training and providing ... easy access to all spatial environmental information that is available in states through one easy online access rather than going to each individual agency to get that information. They can access it through this new platform that we have developed. Again, for many local governments that have limited GIS capacity that is a significant asset, saving their time and ensuring that the issues are considered. The critical point is that it is early in the land use planning stage, not when we are talking about a subdivision at a property level when it is very often too late and very difficult to have some real outcomes on the ground.⁴⁶

Challenges for connectivity conservation

- 4.32 The Committee is aware of several areas where caution is urged and where barriers to participation in connectivity conservation projects exist. Included in these are considerations of costs, land use, and appropriate planning, research and monitoring. While the Committee is aware that barriers exist to establishing connectivity in the marine environment, there is limited knowledge of dispersal in most species, which makes predicting

43 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 13.

44 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 14.

45 Mr Renata Zelinova, Manager, Perth Biodiversity Project, Western Australian Local Government Association (WALGA), *Transcript of evidence*, 7 November 2011, p. 12.

46 Mr Zelinova, WALGA, *Transcript of evidence*, 7 November 2011, p. 13.

the effects of climate change on marine connectivity difficult.⁴⁷ This section therefore focusses mainly on land-based connectivity challenges.

Costs of managing private land for conservation purposes

- 4.33 The Committee heard that landowners have a choice as to whether to manage their land as a protected area, and that the costs incurred are legitimate costs to be borne by the landowner. The Committee heard that a significant barrier to participation in private land conservation is funding for people to undertake conservation activities on their land.⁴⁸ It was acknowledged that there is assistance available for private landowners, and also scope for partnership projects between government and landowners.⁴⁹
- 4.34 The NWCP Advisory Group emphasised that private landowners join corridor initiatives voluntarily, and that the corridor forms part of the existing landscape arrangements. It was stated that the control of invasive pests and weeds needs to be an essential component of any corridor design, and that ongoing funding is needed for the ecosystem services provided by landowners and farmers.⁵⁰
- 4.35 Mr Kevin Evans, Chief Executive Officer of the NPA NSW, proposed that travelling stock routes should be recognised as a national heritage treasure and gain additional funding from the Federal Government in order to protect them as part of the national approach to climate change and biodiversity protection.⁵¹ Mr Evans explained that more federal funding would assist the farmers surrounding the routes; farmers are finding themselves unable to afford to pay the increased rates to fund the routes' management.⁵² This funding would assist governments who are faced with the challenge of how to maintain the routes and, according to Mr Evans, would 'do an amazing amount of good for protecting our biodiversity.'⁵³
- 4.36 According to ANEDO, in the face of ongoing climate change, private land conservation schemes will need to increase, and governments will need to
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47 AMSA, *Submission 17*, p. 4. Further, the Committee understands that the continental shelf south of the Great Barrier Reef also restricts the movement of corals southward.

48 Ms Nicola Rivers, Environmental Defender's Office Victoria, *Transcript of evidence*, 4 May 2012, p. 9.

49 Mr Leaman, DENR, *Transcript of evidence*, 17 May 2012, p. 11.

50 The Hon. Bob Debus, NWCP Advisory Group, *Transcript of evidence*, 12 October 2012, p. 25; Dr Henderson, NWCP Advisory Group, *Transcript of evidence*, 12 October 2012, p. 26.

51 Mr Kevin Evans, Chief Executive Officer, NPA NSW, *Transcript of evidence*, 28 March 2012, pp. 27-28.

52 Mr Evans, NPA NSW, *Transcript of evidence*, 28 March 2012, p. 27.

53 Mr Evans, NPA NSW, *Transcript of evidence*, 28 March 2012, pp. 27, 30.

address the barriers to participation, including the lack of appropriate incentives and benefits, and the long-term nature of some of the agreements.⁵⁴ ANEDO also called for greater coordination of the different private land conservation schemes, even between state and federal governments, in order to ensure that conservation investment is more strategically targeted, and to increase the likelihood of effective overall protection and management.⁵⁵ ANEDO suggested that more flexible short-term private land conservation schemes could be a way of introducing landholders interested in conservation, but reluctant to commit to a long-term scheme, into conservation programs, perhaps encouraging participation in longer-term schemes in future.⁵⁶

- 4.37 It was suggested that a source of funding, such as a national endowment fund, is needed for ongoing stewardship.⁵⁷ Ms Penelope Figgis, Vice Chair for Oceania of the IUCN WCPA, gave the example of a petrol levy in Costa Rica which provides a biodiversity support fund, which in turn provides stewardship payments to private landowners to hold forests on their land.⁵⁸

Land use considerations

- 4.38 The Committee heard from the Namoi CMA that:

Many investments in biodiversity conservation on private land, outside the formal reserve system, are undermined by surrounding land use decisions. Incentive and market-based mechanisms – often promoted as the solution – can be ineffective if not supported by an effective legislative regime. Existing private land conservation programs need greater support and resourcing and effective monitoring and evaluation needs to be prioritised.⁵⁹

- 4.39 Conservation covenants are voluntary agreements between a state/territory government and a landowner to conserve the natural environment on the property. They are available all around the country

54 ANEDO, *Submission 57*, p. 25.

55 ANEDO, *Submission 57*, p. 25.

56 ANEDO, *Submission 57*, pp. 25-26.

57 Ms Penelope Figgis, Vice Chair for Oceania, International Union for Conservation of Nature, World Commission on Protected Areas (IUCN WCPA), *Transcript of evidence*, 28 March 2012, p. 22.

58 Ms Figgis, IUCN WCPA, *Transcript of evidence*, 28 March 2012, p. 22.

59 Namoi CMA, *Submission 31*, p. [3].

and exist in perpetuity, with future owners of the land being bound to the conservation covenant.⁶⁰

- 4.40 Each jurisdiction handles conservation covenants differently. The Committee heard about the South Australian Government's Protected Areas on Private Land project that promotes cooperation and partnerships between the state government and private landowners and Indigenous groups. The private protected areas were being established without a statutory framework in place, with the state government looking to expand and update heritage agreements in order to allow private landowners to enter into agreements focussed on conservation and biodiversity.⁶¹ Mr Dunn of the GER Initiative stated the objective of conservation covenants as being to better facilitate and encourage private landowners to manage their land for conservation purposes, by making it easier for them to enter into transparent, formal statutory arrangements that would exist in perpetuity.⁶²

Planning, management, research and monitoring

- 4.41 The Committee understands from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) that there are governance barriers that could impact upon the effective management of populations and survival of species in future. Dr Craig James of the CSIRO stated that:

Currently a lot of our regulations are about not moving species across state borders for the point of introducing a species into a new place that will disadvantage agriculture, or moving endangered and highly threatened species across state boundaries because of the fauna acts and the regulations around them et cetera. Those sorts of things will eventually become barriers to effective management of the populations and the survival of the species in the future.

... that is one example of where the regulations about how we have it currently set up will be quite a disadvantage to the idea that things will move on their own if they can, or might need to be

60 DSEWPAC, 'The National Reserve System (NRS) – Private landholders', < <http://www.environment.gov.au/parks/nrs/getting-involved/private.html> > viewed 15 January 2012.

61 Mr Leaman, DENR, *Transcript of evidence*, 17 May 2012, p. 9.

62 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 9.

assisted to move if we think it is such a high priority that we want to do that.⁶³

4.42 The Committee heard from some inquiry participants that it should not be assumed 'that most species can or will move along corridors in response to climate change'.⁶⁴ Mr Tim Low, an environmental consultant and science writer, in his submission, further argued that a focus on connectivity should not detract from the importance of isolated habitats serving as refugia, and that 'many species will benefit more from protection of these refugia than from increases in connectivity'.⁶⁵ It was further argued by the National Parks Association of Queensland and Mr Low, in their submissions, that there is little evidence to suggest widespread species migration in response to past climate changes so they cannot be expected to do so in future.⁶⁶

4.43 According to the IUCN WCPA:

... enhanced connectivity may also favour some native species perhaps to the detriment of other high conservation value species as well as favouring exotic invasive species, thus requiring more effort to control weeds and pests. The scale and pattern of connectivity must be tailored to the needs of priority species, considered on a bioregional basis.⁶⁷

4.44 The Committee heard from some inquiry participants about the possibility that corridors will facilitate the movement of invasive species, especially those that benefit from an 'edge effect'.⁶⁸ Edge effects are the structural changes that occur at the points where contrasting land types or habitats meet. In a submission that the Invasive Species Council made on the draft National Wildlife Corridors Plan, it stated that:

For corridors to function as productive habitat for native species, it will be important to ensure their width considerably exceeds the distance over which edge effects are experienced. This distance will vary depending on the type of vegetation and pressures.

63 Dr Craig James, Research Theme Leader, Managing Species and Natural Ecosystems, Commonwealth Scientific and Industrial Research Organisation, *Transcript of evidence*, 16 August 2012, p. 5.

64 See, for example, Mr Tim Low, *Submission 67*, p. [7].

65 Mr Tim Low, *Submission 67*, p. [7].

66 National Parks Association of Queensland Inc., *Submission 12*, p. [4]; Mr Tim Low, *Submission 67*, pp. [2], [7].

67 IUCN WCPA, *Submission 30*, p. 9.

68 Coast and Wetlands Society Inc., *Submission 51*, p. 3; National Parks Association of Queensland Inc., *Submission 12*, p. 4

Where corridors serve as buffers to protected areas and other intact habitat – and this is one of the three corridor elements mentioned in the plan – they are likely to reduce the edge effects for those core areas, achieving a positive outcome.

Corridors should also be wide enough to prevent domination by problematic edge-favouring animals, whether exotic or native.⁶⁹

- 4.45 The Invasive Species Council also further stated that the difficulties and costs of fire and invasive species management ‘will be considerably greater in corridors due to their high edge to core ratios’.⁷⁰ It was concerned that funding for invasive species management in corridors would be contingent on grants that are not renewed, stating that ‘the plan should place more emphasis on invasive species as management problems associated with corridor development’.⁷¹ The Hon. Bob Debus, Chair of the NWCP Advisory Group, told the Committee that ‘the control of invasive plants and animals ought to be an essential component of the design of any corridor’.⁷²
- 4.46 The Committee heard that ‘corridors can be ideal habitat for some invasive species where they benefit from an edge effect’.⁷³ Mr Dunn of the GER Initiative also described how to limit that possibility by creating an environment that is not ideal for many invasive species, which can be achieved by building on national parks to create a gradual shift in vegetation into productive areas with a ‘patchwork’ effect.⁷⁴ This system of protecting remnant areas, or a patchwork of refuges for different species, can help land management and farm productivity.⁷⁵
- 4.47 The management of invasive species and fire patterns is increasingly important in an unpredictable climate. Effective management of invasive species, such as phytophthora dieback, will assist with the success of connectivity attempts between ecosystems.⁷⁶
- 4.48 The Committee heard of the need to have a quantitative understanding of the resources being managed, the need to measure and understand
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69 Invasive Species Council, *Corridor risk assessment needed: A submission about the draft National Wildlife Corridors Plan*, Fairfield, Victoria, April 2012, p. 8.

70 Invasive Species Council, *Corridor risk assessment needed: A submission about the draft National Wildlife Corridors Plan*, Fairfield, Victoria, April 2012, p. 8.

71 Invasive Species Council, *Corridor risk assessment needed: A submission about the draft National Wildlife Corridors Plan*, Fairfield, Victoria, April 2012, p. 8.

72 The Hon. Bob Debus, NWCP Advisory Group, *Transcript of evidence*, 12 October 2012, p. 25.

73 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 12.

74 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 12.

75 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 12.

76 South Coast Natural Resource Management (South Coast NRM), *Submission 76*, p. [3]; Mr Tim Low, *Submission 67*, p. [8].

changes that occur to those resources, and the need to adapt and manage to deal with those changes.⁷⁷ The South Australian Government described the challenge as being to adopt a new model for the delivery of government programs, based on a comprehensive understanding of the resources in question.⁷⁸

- 4.49 Ms Kate Andrews, Chair of Territory Natural Resource Management highlighted the need to manage for uncertainty and risk, and to put our best efforts into understanding the tipping points and thresholds within our system.⁷⁹ Representatives of the Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health discussed the need to be innovative and use the resources, 'knowledge and remote sensing tools that we have to look at areas that are protectable from fragmentation, from drought, from phytophthora dieback'.⁸⁰ Professor Hardy, Director of the Centre, explained that these areas need to be maintained as intact ecosystems, linked through corridors with other ecosystems that need minimal input to try and keep them healthy.⁸¹ Professor Dell, also of the Centre, stated that the focus should be on the ecosystems that are declining and approaching tipping points of no return.⁸²
- 4.50 The Australian Marine Sciences Association stated that, similar to terrestrial environments, in an ocean environment it cannot always be assumed that migration to new habitats is possible.⁸³ The Committee heard from the ACRS that the boundaries of the MPAs may need to change as the climate changes, in order to provide stepping stones to enhance connectivity and migration.⁸⁴ ACRS also stated that little is known about inter-reefal areas, which are critical in the functioning of an ecosystem, except that much of the fauna is sedentary and cannot migrate in the face of increasing water temperatures.⁸⁵ ACRS explained the effects

77 Dr Graeme Worboys, Vice-Chair, Mountains and Connectivity Conservation, IUCN WCPA, *Transcript of evidence*, 2 March 2012, p. 2.

78 DENR, *Submission 80*, p. 3.

79 Ms Kate Andrews, Chair, Territory Natural Resource Management (Territory NRM), *Transcript of evidence*, 4 July 2012, pp. 7-8.

80 Professor Bernard Dell, Chief Investigator, and Professor Giles Hardy, Director, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Transcript of evidence*, 7 November 2011, p. 40.

81 Professor Hardy, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Transcript of evidence*, 7 November 2011, p. 40.

82 Professor Dell, Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, *Transcript of evidence*, 7 November 2011, p. 41.

83 AMSA, *Submission 17*, p. 4.

84 ACRS, *Submission 63*, p. [8].

85 ACRS, *Submission 63*, p. [6].

of decreasing levels of aragonite saturation (the amount of carbonate in the seawater which enables organisms to build calcium carbonate). Aragonite saturation has 'dropped around the globe dramatically since pre-industrial times and will drop further as the carbon dioxide concentrations increase further'.⁸⁶

- 4.51 Ms Andrews highlighted the need to invest in people in the long-term, in order that we have the human capacity to deal with issues relating to biodiversity and threats to biodiversity, including climate change.⁸⁷ The IUCN WCPA stated that policy must reflect this need for investment in capacity building for conservation management, including skills development for people working on IPAs, connectivity corridors, protected areas and other conservation lands.⁸⁸
- 4.52 Monitoring the success and progress of the corridor is one of the key challenges for the GER Initiative, and it requires large investment.⁸⁹ Mr Dunn of the GER Initiative explained that:

Corridors or connectivity conservation needs to increasingly become a filter for Caring for our Country and for the Biodiversity Fund. A gap at the moment is providing direction ... at a continental scale as well as investing at a continental scale to look at monitoring, evaluation and building the science.⁹⁰

Conclusions and recommendations

- 4.53 The Committee considers connectivity conservation initiatives, such as the National Wildlife Corridors Plan, as vital tools in addressing the effects that climate change will have on Australia's biodiversity. There is a strong opportunity for national leadership on connectivity conservation, with the Australian Government providing the framework and direction, then encouraging and allowing local implementation. The Committee notes that placing additional lands into reserves to form connectivity corridors is an important part of Australia's conservation effort and agrees with the general goal of establishing a single national reserve system to facilitate better integration of off-reserve conservation with protected areas, as outlined in the 2009 report on the vulnerability of Australia's biodiversity

86 ACRS, *Submission 63*, p. [6].

87 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 9.

88 IUCN WCPA, *Submission 30*, p. 3.

89 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 13.

90 Mr Dunn, GER Initiative, *Transcript of evidence*, 2 March 2012, p. 14.

to climate change.⁹¹ The Committee highlights the need to focus on proper, science-based and adequate management of corridors to prevent fire and invasive species risk.

- 4.54 The Committee recommends an overall approach which would:
- be strategic in managing for the unpredictable effects of climate change
 - ensure the required research is undertaken into tipping points and system thresholds
 - improve understanding in communities of connectivity conservation, through local education programs
 - collect the information from evaluation and monitoring of connectivity conservation projects, including via citizen science projects
 - aggregate, analyse and evaluate the data gathered against regional and national objectives
 - provide long-term funding for ongoing environmental stewardship
 - address barriers to take up of private land conservation initiatives.
- 4.55 A critical aspect of the continued development of the NRS is the need to focus on ecosystems in decline and those reaching the tipping point of no return. Research, planning, engagement, monitoring, evaluation, and storage of the evaluative data are key elements of an effective adaptive management approach to connectivity conservation projects that should be outlined by the Australian Government and promoted to the community at large.
- 4.56 While connectivity corridors can provide vital refugia and the ability for animals to move and adapt to different areas in the face of climate change, they can also allow ready transfer of feral pests and weeds to places they may not have otherwise had the chance to reach. Connectivity corridors may also present significant costs and planning challenges. The Committee agrees with the Invasive Species Council that ongoing funding for invasive species management, incorporated as part of the National Wildlife Corridors Plan, is important, and with the need to adequately address the management issues that threatening processes such as fire and invasive species pose.

91 Biodiversity and Climate Change Expert Advisory Group, *Australia's biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change – Summary for policy makers 2009*, Summary of a report to the Natural Resource Management Ministerial Council commissioned by the Australia Government, Department of Climate Change and Energy Efficiency, Canberra, 2009, p. 14.

Recommendation 3

- 4.57 **The Committee recommends that ongoing funding for threatening processes, including fire and invasive species management, be provided under the National Wildlife Corridors Plan.**
- 4.58 Private landowners participating in a corridor initiative or conservation program on their land may or may not have access to government assistance, and issues regarding land use in adjacent areas can have further financial impacts for governments and private landowners.
- 4.59 The Committee understands the critical importance of planning connectivity corridors in areas and situations in order to limit the possibility of the creation of unforeseen circumstances and problems, such as the facilitation of the spread of invasive species. Adaptive management principles must be in place to deal with such issues if they arise, and processes in place to protect adjacent landowners and, indeed, participating landowners, from suffering such problems.
- 4.60 Ongoing environmental stewardship and environmental endowment funding for private land conservation is important in order to provide the funds necessary to support these important connectivity conservation projects, and also in case of unforeseen circumstances.
- 4.61 As discussed above, the Committee understands that governance barriers to protecting Australia's biodiversity could impact upon the continued successful expansion of connectivity corridors. The Committee agrees that a consistent approach to connectivity conservation is required, with cooperation between jurisdictions to ensure that the required quality of management of connectivity conservation areas is upheld.

Recommendation 4

- 4.62 **The Committee recommends that national marine and terrestrial biodiversity corridors be included on the agenda of the Council of Australian Governments.**
- 4.63 Education and engagement of the community as a next step is vital in order to encourage the uptake of connectivity conservation projects. The Committee acknowledges the enthusiasm and persistence of Landcare groups, Greening Australia, regional NRM organisations, and local NRM groups. These groups, together with national parks staff and museums, are vital to convey to communities the importance of biodiversity and

connectivity conservation to our way of life, and help people understand their place within the environment and not as separate to it.

- 4.64 In the Committee's view, the Great Barrier Reef Marine Park Authority's Reef Guardian program may prove a successful template on which to base wider programs which inform and engage communities in connectivity conservation issues. The Committee considers that the program may translate well to other management authorities and ecosystem types, as well as to other reef ecosystems. The Committee would welcome a report on the viability of such programs in other terrestrial and marine environments, such as the Australian Alps.

Climate change adaptation strategies

Introduction

[I]f you do not understand your backyard well, how can you manage it?¹

[P]henomena that remain unmeasured cannot be fully understood and therefore cannot be reliably predicted.²

- 5.1 As the effects of climate change on Australia's biodiversity continue to become apparent, governments and communities must be ready to adapt our ways of living to suit a new environment. Mitigation strategies should be adopted, to lessen the impact on the environment of these inevitable changes. Important mitigation strategies include reaching the global targets for reduction in greenhouse gas emissions, increasing the resilience of our ecosystems, and developing adaptive management approaches in order to respond to and accommodate these uncertain future climatic events.
- 5.2 The Committee gathered a vast array of evidence and suggestions on different ways to approach biodiversity conservation in the face of climate change. Instead of managing individual species and individual refuges in isolation from each other, focus should be consolidated on connectivity conservation and adaptive management practices. The overriding theme arising out of the evidence was a need for a nationally coordinated approach to biodiversity conservation, environmental research and baseline monitoring.

1 Dr Graeme Worboys, Vice-Chair, Mountains and Connectivity Conservation, International Union for the Conservation of Nature World Commission on Protected Areas (IUCN WCPA), *Transcript of evidence*, 2 March 2012, p. 7.

2 Australian Bureau of Statistics (ABS), *Submission 53*, p. [1].

New approaches to biodiversity conservation

- 5.3 Given the relatively recent development of, and fast moving phenomenon that is climate change, new approaches to biodiversity conservation are currently being debated and developed.
- 5.4 The Commonwealth Scientific and Industrial Research Organisation (CSIRO) suggested the need for a society-wide debate about what future conservation objectives should be and how they should be included, prioritised and implemented in future policy and management plans and practice.³
- 5.5 It was suggested that the objectives of 'no species loss' will need to change to 'minimising loss and maintaining ecological processes', and further of the need to focus on 'appropriate connectivity'.⁴
- 5.6 The Committee heard further from CSIRO of the need to manage at the geographic scale at which change is being driven, anticipate complex system interactions and ensure coordination between sectors, and establish adaptive management approaches for successful and rapid adaptation to change.⁵
- 5.7 The Committee heard of the need for a nationally coordinated approach to research and monitoring that is not limited by short-term funding cycles.
- 5.8 Climate modelling experiments were also discussed as providing vital information about potential environmental change and as the basis for assessing impacts of climate change on biodiversity.⁶
- 5.9 The Committee heard that the science of adaptation to climate change is in a developmental stage, and that a consolidated focus on adaptation and a well-structured approach to identifying and prioritising adaptation options to assist decision making in future are needed.⁷ CSIRO stated the value of longitudinal data sources – like its Atlas of Living Australia (the Atlas) project – in determining how change has occurred and providing a basis for modelling possible responses in future.⁸

3 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission 23*, pp. 3, 14, 15; supported also by the Australian Network of Environmental Defender's Offices, *Submission 57*, p. 11.

4 Dr Craig James, Research Theme Leader, Managing Species and Natural Ecosystems, and Dr Andy Sheppard, Research Theme Leader, Building Resilient Australian Biodiversity Assets, CSIRO, *Transcript of evidence*, 16 August 2012, p. 4.

5 CSIRO, *Submission 23*, p. 3.

6 Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), *Submission 79*, p. [5].

7 CSIRO, *Submission 23*, p. 5.

8 CSIRO, *Submission 23*, p. 5.

Biodiversity conservation objectives

- 5.10 The Committee heard about the need for significant change to biodiversity conservation policy and management in order to meet the challenges of climate change. Some of these suggestions included: changing management priority to maintaining ecosystem services through a diversity of well-functioning ecosystems; enhancing ecosystem resilience through connectivity conservation and more effective control of invasive species; using risk assessments to identify vulnerable species and ecosystems; supporting integrated regional management approaches tailored for regional environmental, climate change and socioeconomic differences; and supporting rapid and effective mitigation of the impacts of climate change.⁹
- 5.11 The Western Australian Local Government Association (WALGA) focussed on the need for development of a framework to evaluate and prioritise greenhouse gas mitigation and climate change adaptation strategies for local government decision-makers, which takes into account the differences in vulnerability, capacity and resourcing between local governments.¹⁰ WALGA further suggested a number of aspects to incorporate into such a framework, including: identifying and quantifying actions that could support mitigation and adaptation efforts; developing an economic model to assess the impacts on biodiversity of different climate change scenarios; prioritising strategies, policies and actions with immediate, medium and long-term rankings for climate change impacts on biodiversity assets; and assisting local government decision-makers to incorporate such information into the financial, social and environmental assessment framework of the relevant local government body.¹¹
- 5.12 The Committee heard from the New South Wales Aboriginal Land Council of the need to facilitate the involvement of Aboriginal people in biodiversity conservation planning, support Indigenous peoples' sustainable use of biodiversity, and appropriately use Indigenous Ecological Knowledge in governance arrangements and biodiversity and climate change policy.¹² The NSW Aboriginal Land Council also stated as essential the need to recognise the unique status of Aboriginal peoples in all aspects of land and resource management.¹³ The Committee heard from Professor Jon Altman and Dr Seán Kerins of the Australian National University that Indigenous Australians hold land and/or native title

9 Australian Academy of Science, *Submission 32*, pp. 3-4.

10 Western Australian Local Government Association (WALGA), *Submission 37*, pp. 10-11.

11 WALGA, *Submission 37*, p. 11.

12 New South Wales Aboriginal Land Council, *Submission 5*, p. [3].

13 NSW Aboriginal Land Council, *Submission 5*, p. [3].

rights over an estimated 23 per cent of the country, or 1.7 million square kilometres.¹⁴

Development of national environmental datasets

- 5.13 The issue of the development of national environmental and biodiversity datasets was raised on numerous occasions during the inquiry, with many suggestions on how to improve on current datasets and develop new and comprehensive datasets being canvassed. The Committee met with representatives of the Western Australian Museum, the Melbourne Museum and the Australian Museum, all of whom outlined the importance of measuring our biodiversity and having the appropriate resources to do so.
- 5.14 Dr Patricia Hutchings of the Australian Museum outlined one of the major roles of museums as being 'to accurately identify the Australian fauna – that is, document our biodiversity ... ' as well as to 'understand how the biota has evolved over time and predict how it is going to change in the future'.¹⁵
- 5.15 The Committee heard of the need to integrate disparate sets of data using analytical tools, so that the available information can be easily synthesised and translated into forms useful for decision making.¹⁶ The Committee heard also that digitisation infrastructure is critical for maximising the benefit of Australia's significant investment in biological collections.¹⁷
- 5.16 Having adequate capabilities in place to measure our biodiversity, and sufficient digitisation infrastructure available to transform the numerous records that remain to be digitised, will assist with the development of comprehensive environmental and biodiversity datasets.

Climate change mitigation strategies

- 5.17 Mitigation strategies are an important means of reducing the likelihood or impacts of changes to biodiversity due to climate change. A number of strategies were suggested, some including the need for:
- a reduction in greenhouse gas emissions
 - management of existing environmental stressors
 - increasing the number of protected areas in the National Reserve System (NRS) and improving off-reserve conservation
-

14 Professor Jon Altman and Dr Seán Kerins, *Submission 10*, p. 2.

15 Dr Patricia Hutchings, Senior Principal Research Scientist, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 3.

16 Australian Museum, *Submission 27*, p. 2.

17 Australian Museum, *Submission 27*, p. 2.

- adequate legislation on biodiversity protection
- ensuring biodiverse carbon capture
- education and community awareness
- routine modelling of biodiversity assets and introduced species
- integrated regional planning activities.¹⁸

Reduction of greenhouse gas emissions

- 5.18 The Committee heard that there needs to be deep cuts in global greenhouse emissions by 2020 at the latest, in order to prevent mass extinctions later in the century,¹⁹ and that the reduction of greenhouse gases in the atmosphere is the ultimate solution to reducing the threat of climate change.²⁰
- 5.19 CSIRO stated that it is working to understand where the carbon storage already is in Australia and where the capacity is to increase it. The next step was stated as being to understand how biodiversity can be maximised at the same time. Further, that in order to use resources effectively, it is important to understand where to plant so as to maximise carbon storage for investment, where it is better to maximise biodiversity outcomes, and where you can do both.²¹
- 5.20 The Committee observed the Savannah fire burning project in Northern Australia, carried out from Cape York to the Kimberley. This project has been successful in reducing carbon emissions and has been described as being capable of delivering about a million tonnes a year of reduced emissions from poorly managed fire and capable of delivering sequestration over the longer term several times that amount.²² The large-scale fire management methodology was developed by the Northern Australian Indigenous Land and Sea Alliance (NAILSMA), in association with Indigenous groups and pastoralists.

Management of existing environmental stressors

- 5.21 The South West Catchments Council, as one of the regional natural resource management (NRM) organisations, stated that it employs mitigation activities across its region to control weed invasions, support

18 Australian Academy of Science, *Submission 32*, p. 3; Goulburn Broken Catchment Management Authority (CMA), *Submission 6*, p. [5]; South West Catchments Council, *Submission 13*, p. 11.

19 Ecological Society of Australia, *Submission 15*, p. 8.

20 National Climate Change Adaptation Research Facility (NCCARF) National Adaptation Research Network – Terrestrial Biodiversity, *Submission 20*, p. [3].

21 Dr James, CSIRO, *Transcript of evidence*, 16 August 2012, p. 8.

22 Dr Peter Whitehead, Advisor, Northern Australian Indigenous Land and Sea Management Alliance (NAILSMA), *Transcript of evidence*, 4 July 2012, pp. 13-14.

the community with knowledge and skills, and carry out revegetation projects and riparian restoration works.²³ It also suggested that regions should promote similar activities and coordinate and collaborate with communities on local projects.²⁴

- 5.22 The Committee heard that in the Australian Alps the most profound changes are likely to occur because of the interaction between climate change and other stressors.²⁵
- 5.23 The Committee also heard that in order to minimise loss of key species and their habitat, and to help native species respond and adapt to climate change, we need to more effectively manage threats such as fire, weeds and feral animals in protected areas.²⁶
- 5.24 The Committee understands the importance of managing existing environmental stressors as an effective mitigation strategy.

Benefits of mitigation

- 5.25 The Committee heard from the Centre for Tropical Biodiversity and Climate Change that mitigation remains the most important factor in reducing the impacts on biodiversity, given that strong mitigation scenarios carried out in the wet tropics of Queensland could result in no species extinction as compared to the predicted 25 per cent of all species going extinct.²⁷
- 5.26 The Australian Marine Sciences Association (AMSA) stated that considering the ecological, socioeconomic, and management implications of climate change impacts before they occur is essential to mitigating their negative effects and developing effective adaptive response strategies.²⁸ It also stated the need for strategies for non-extractive use of marine resources outside of Marine Protected Areas (MPAs), such as aquaculture and ecotourism, and management of the associated impacts.²⁹

Increasing resilience in ecosystems and human communities

- 5.27 There is a marked crossover between mitigation strategies and projects undertaken to increase resilience in ecosystems and human communities. Increasing resilience will strengthen the capacity of these systems to deal

23 South West Catchments Council, *Submission 13*, pp. 10-11.

24 South West Catchments Council, *Submission 13*, pp. 10-11.

25 Research Centre for Applied Alpine Ecology (RCAAE), *Submission 72*, p. 3.

26 CSIRO, *Submission 23*, p. 12.

27 Centre for Tropical Biodiversity and Climate Change, *Submission 29*, p. 4.

28 Australian Marine Sciences Association (AMSA), *Submission 17*, p. 5.

29 AMSA, *Submission 17*, p. 6.

with climate changes. The Committee heard that maintaining natural resilience to facilitate adaptation will benefit biodiversity regardless of future climate scenarios.³⁰

- 5.28 In order to build resilience, the Committee heard of the need to:
- maintain genetic diversity and structural complexity
 - support assisted colonisation
 - reduce the impact of current threats such as inefficient fire regimes and invasive species
 - reduce clearing and landscape fragmentation
 - assist in regeneration and revegetation
 - increase protected areas in the NRS
 - encourage private land biodiversity conservation
 - support the development of connectivity conservation.³¹

Resilience building frameworks

- 5.29 The Committee heard about the need to develop guidelines for revegetation programs, allowing for ongoing selection and ensuring that genotypes in the landscape match future climate conditions, as well as the need to focus reserve development and revegetation efforts on areas with climatic gradients, in order to allow for ongoing adaptation.³²
- 5.30 In relation to the Australian Alps, the Committee heard that it would be helpful to map connectivity and refugia patterns and link them to regional climate change predictions, and further that the information, including the conservation value of particular areas, should be incorporated into management plans.³³
- 5.31 In regards to threatened species, it was suggested that a framework be established to determine appropriate times when genetic translocation, and potentially species relocation, might be appropriate.³⁴ The Committee heard of the need to develop threatened species recovery programs that consider adaptive genetic diversity and the likely effects of climate change.³⁵
- 5.32 The Committee understands that it will be necessary to evaluate the potential of the NRS and build on it to maximise the biodiversity benefits

30 CSIRO, *Submission 23*, p. 14.

31 Goulburn Broken CMA, *Submission 6*, p. [7]; Australian Museum, *Submission 27*, p. 7.

32 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 5.

33 RCAA, *Submission 72*, p. 3.

34 RCAA, *Submission 72*, p. 3.

35 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 4.

in projected future climates.³⁶ The development of low-risk strategies for invasive species control and genetic translocation in order to assist in building resilience was also raised.³⁷

- 5.33 The Committee learned more about the important role played by Indigenous knowledge in strengthening cultural resilience and enhancing the capacity of communities to adapt and build resilience to climate change impacts.³⁸ The Committee acknowledges views that this Indigenous knowledge should be included in education programs, and of the need for investment in cultural and NRM programs within schools to teach Indigenous children the skills needed to more effectively participate in the long-term environmental monitoring and climate change responses.³⁹
- 5.34 According to the Australian Museum, the resilience of marine ecosystems can be increased by reducing other impacts such as pollution, habitat destruction and over-exploitation,⁴⁰ as well as increasing highly protected, marine national park (green) zones and improving water quality. The Committee also heard that these are the types of measures that will give reef ecosystems the best chance of coping with climate change. AMSA stated that MPAs are recognised as an important tool in improving resilience of marine ecosystems, and as being important in providing 'a benchmark against which anthropogenic impacts may be disentangled from other drivers and stressors'.⁴¹
- 5.35 The Australian Museum stated that in order to enhance numbers and resilience in amphibian populations in freshwater ecosystems, we need to enhance or restore breeding sites or core habitat, and create suitable refugia in droughts by using irrigation systems or creating artificial shelter sites to counter the drying wetlands.⁴²

36 NCCARF National Adaptation Research Network – Terrestrial Biodiversity, *Submission 20*, p. [3].

37 NCCARF National Adaptation Research Network – Terrestrial Biodiversity, *Submission 20*, p. [4].

38 Professor Jon Altman and Dr Seán Kerins, *Submission 10*, p. 5.

39 Professor Jon Altman and Dr Seán Kerins, *Submission 10*, p. 6.

40 Australian Museum, *Submission 27*, p. 7.

41 AMSA, *Submission 17*, p. 5.

42 Australian Museum, *Submission 27*, p. 8.

Projects underway

- 5.36 The Committee heard that that some Catchment Management Authorities (CMAs), across NSW and elsewhere, are working to establish the levels of acceptable disturbance and associated thresholds of local ecosystems.⁴³
- 5.37 The Committee also received evidence of the need for additional resourcing in order to establish these levels in a timely manner, given that if the shock experienced is great enough, a threshold may be crossed and the result is often a change in the state or function of a particular ecosystem.⁴⁴
- 5.38 The Committee heard of the Goulburn Broken CMA's Indigenous seed production program, aimed at increasing genetic diversity, and developed to increase the numbers of plants for revegetation purposes, to reconnect existing populations and improve ecosystem resilience.⁴⁵
- 5.39 The Australian Seedbank Partnership stated that it was researching into restoring species and developing more holistic approaches to restoration by integrating research disciplines (including seed science, soil invertebrates, soil microbes, seed storage and germination), with the outcomes having significant implications for building ecosystem resilience.⁴⁶

Adaptive management approaches

- 5.40 The Goulburn Broken CMA advised the Committee that adaptation planning must be flexible and constantly monitored to assess the effectiveness of actions undertaken.⁴⁷ Further, adaptation will need to occur in response to obvious threats and change, as well as to slower, more gradual change.⁴⁸
- 5.41 The Ecological Society of Australia set out several adaptive management approaches, including those related to:
- engaging the community throughout the development of the adaptation process
 - improving the ability to value ecosystem services by developing market instruments, and undertaking regulatory and taxation reform to promote environmental stewardship and create incentives to reduce carbon emissions

43 Border Rivers-Gwydir CMA, *Submission 7*, p. 2.

44 Border Rivers-Gwydir CMA, *Submission 7*, pp. 2-3.

45 Goulburn Broken CMA, *Submission 6*, p. [2].

46 Australian Seed Bank Partnership, *Submission 19*, p. 5.

47 Ecological Society of Australia, *Submission 15*, p. 7.

48 Goulburn Broken CMA, *Submission 6*, p. [6].

- incorporating ecosystem management into broader, cross-sectoral adaptation policies in order to assist more sustainable adaptation across the sectors
 - multiple use planning for heavily exploited environments, such as ocean and inland floodplains.⁴⁹
- 5.42 The Committee heard about various adaptive strategies that should be implemented in order to promote resilience in ecosystems and human communities. The Queensland Murray-Darling Committee suggested that strategies identifying areas of regional research and amendments or improvements to development conditions will serve to promote this purpose.⁵⁰
- 5.43 CSIRO advised the Committee that a comprehensive, adequate and representative NRS will assist adaptation of biodiversity to climate change, with new additions to the NRS needing to target a diversity of ecosystems across poorly protected environment types, with a particular focus on minimising loss of key species. Further, of the need to aim to conserve a high diversity of native habitats, as well as a large area of habitat, especially that threatened by local activities.⁵¹
- 5.44 CSIRO explained the need to ensure that policy and management plans consider a wide range of possible changes resulting from climate change; anticipate how various threats to biodiversity may change so that we can be prepared to respond in ways that minimise biodiversity losses; and increase coordination of different conservation and NRM programs so as to enable improved management at landscape and regional scales, and ensure that NRM governance processes are adaptive.⁵²
- 5.45 The Committee heard of the need to focus on species with high evolutionary adaptability, requiring decisions to be made as to which species should be abandoned, based on better intelligence gathering, monitoring and risk assessment processes.⁵³ Professor Ary Hoffman of the University of Melbourne, and Dr Carla Sgro of Monash University, in their submission, described that 'the challenge for biodiversity management is to pick winners and losers so that outcomes can be managed'.⁵⁴ Professor Hoffman and Dr Sgro described how particular characteristics of groups of species, such as plant flowering times, can help predict whether they

49 Ecological Society of Australia, *Submission 15*, pp. 2, 7-8.

50 Queensland Murray-Darling Committee, *Submission 14*, p. 9.

51 CSIRO, *Submission 23*, pp. 11, 15.

52 CSIRO, *Submission 23*, p. 15.

53 Goulburn Broken CMA, *Submission 6*, p. [7].

54 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 2.

- are winners or losers; this information can be collected through long-term ecological research, which to date has been poorly funded in Australia.⁵⁵
- 5.46 The Committee understands that species distribution models have serious limitations, in that they do not explicitly consider species adaptability. The Committee was advised of the need to develop predictive models for key representative species – those that are highly threatened and those that drive ecological processes in ecosystems – that allow aspects of adaptability to be included in the models.⁵⁶ Professor Hoffman and Dr Sgro also stated that assessment is needed of the adaptability in terms of evolution of representative species from key Australian plant and animal groups.⁵⁷
- 5.47 CSIRO explained the need to revisit the definitions of invasive species in different circumstances and how emerging novel ecosystems will need to be valued in their own right, highlighting the need for society to determine what we will value in future, what conservation objectives should be prioritised, and how to implement them.⁵⁸ The Committee also heard about the need to develop ways of reclassifying communities based on climate change resilience, and identifying species likely to increase and decrease under climate change based on resilience and adaptability.⁵⁹
- 5.48 The Committee heard about the need for human intervention in maintaining biodiversity and resilience in the form of genetic translocation, and that this adaptive management strategy, which may involve mixing gene pools across wide geographic areas, needs to be considered in order to increase the adaptability of threatened species.⁶⁰ The Committee also heard that genetic translocation of endangered or threatened species may assist in species conservation, such as that achieved by increasing the genetic diversity for resilience of the mountain pygmy-possum by relocating it from Mt Hotham to Mt Buller.⁶¹ Professor Kristine French, President of the Ecological Society of Australia, discussed the need for human intervention in order to maintain biodiversity because of the need to move some of these species, stating that '[i]t is just not going to happen unless we do it.'⁶²

55 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 2.

56 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, pp. 2-3.

57 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, pp. 2-3.

58 CSIRO, *Submission 23*, p. 15.

59 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 1.

60 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 4.

61 RCAA, *Submission 72*, p. 2. Translocation is also discussed in terms of governance of species in chapter seven.

62 Professor Kristine French, President, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 16.

- 5.49 The Committee heard that Indigenous people play a critical role in monitoring, abatement and adaptation, knowing what is changing and how to manage those changes.⁶³ Dr Lisa Strelein, Director of Research, Indigenous Country and Governance at the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), explained that Indigenous experiences and ecological knowledge could better be incorporated into land management programs by researchers engaging with Indigenous communities and exchanging knowledge so that the whole community can benefit.⁶⁴ Dr Strelein also stated that in addition to the effective utilisation of Indigenous knowledge, there are opportunities to empower and engage Indigenous communities by providing economic opportunities and employment opportunities in line with Indigenous aspirations for country.⁶⁵

Marine and freshwater ecosystems

- 5.50 The Committee heard from the CSIRO and the Water Resources and Freshwater Biodiversity Adaptation Research Network (WRAFBARN) about some of the adaptive management approaches necessary to maintain biodiversity in marine and freshwater ecosystems.
- 5.51 According to the WRAFBARN, a key adaptation strategy for freshwater biodiversity is having water planning arrangements that incorporate provisions for environmental flows. Further, that adaptation decisions need to consider a range of climate projections.⁶⁶
- 5.52 CSIRO stated that improvements in coastal development and planning regimes relating to predicted impacts of climate change on marine biodiversity are likely to help with conservation of coastal wetland habitats.⁶⁷ Further, that more consistent, integrated and ecologically sensitive coastal planning and development rules may result in protection of coastal habitats as sea levels rise.⁶⁸
- 5.53 As the Committee had heard previously in relation to terrestrial species knowledge, the level of information available for many fisheries and

63 Dr Lisa Strelein, Director of Research, Indigenous Country and Governance, Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), *Transcript of evidence*, 20 September 2012, pp. 5-6.

64 Dr Strelein, AIATSIS, *Transcript of evidence*, 20 September 2012, p. 5.

65 Dr Strelein, AIATSIS, *Transcript of evidence*, 20 September 2012, p. 6.

66 Water Resources and Freshwater Biodiversity Adaptation Research Network (WRAFBARN), *Submission 22*, p. [1].

67 CSIRO, *Submission 23*, p. 16.

68 CSIRO, *Submission 23*, p. 16.

aquaculture species is poor, and that improving knowledge of species is required.⁶⁹

- 5.54 Dr Alistair Hobday, a Research Scientist at the CSIRO also raised the potential market for carbon trading through carbon sequestration in the ocean.⁷⁰ 'Blue carbon' – the natural process by which atmospheric carbon is captured and stored by marine environments – is an important opportunity for ecosystem-based climate mitigation as it preserves the essential ecosystem services of marine habitats.⁷¹ It was stated that significant science background and policy reform would be required to develop this into reality, as valuing the carbon sequestered by coastal ecosystems would require research into the opportunity costs and market price for preserving intact coastal ecosystems and the application of offsets and compensation when coastal ecosystems are to be modified.⁷²
- 5.55 In relation to the marine environment, the Committee heard from Dr Nic Bax, a Research Scientist for CSIRO Marine and Atmospheric Research, about the need to consider the kinds of governance requirements for translocating species, so that a translocation could improve the ecosystem function of that area, and improve the ability of that area to adapt to climate change in future.⁷³

New approaches require new resources

Requirement for long-term baseline environmental monitoring

- 5.56 One of the consistent messages arising out of the evidence presented to the inquiry was the lack of sufficient long-term baseline environmental information available to researchers and natural resource managers. This basic foundation was stated as being vital to many different areas of environmental management, some of which are canvassed below. The Committee heard that understanding our biodiversity is critical and that most of our biodiversity is unrecorded.

69 CSIRO, *Submission 23*, p. 16.

70 Dr Alistair Hobday, Research Scientist, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 41.

71 CSIRO, *Submission 23.1*, p. 3.

72 CSIRO, *Submission 23.1*, p. 3.

73 Dr Nic Bax, Research Scientist, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 42.

Current state of environmental information

- 5.57 Many inquiry participants described the need for development of the current state of environmental information available in Australia as an urgent requirement. While different characterisations were made, all expressed a common view of the need for a comprehensive, consistent, nationwide database of environmental information that is widely available for use for different purposes.
- 5.58 The following two characterisations focussed on the assessment and monitoring of the environment, and assessment of the impacts of climate change on biodiversity loss, and are representative of many views raised:
- ... there is an urgent need to develop base-line biodiversity and ecological data to allow assessment of the environmental condition of Australia at appropriate scales and for the long-term monitoring of performance against environmental targets.
- This should be undertaken in partnership with Indigenous people, especially those living on the Indigenous estate, who, through long histories of occupation, are well placed to monitor and report on the ecological impacts of climate change.⁷⁴
- ...
- Australia urgently needs to establish a long-term monitoring and auditing framework for biodiversity across the continent to assess the impacts of climate change and other drivers of terrestrial, freshwater and marine biodiversity loss. Australia needs to support the sustainable management and use of our natural resources through investment in scientific research, Indigenous knowledge and education.
- An expanded Land, Water and Biodiversity authority should be based on the model pioneered by Land and Water Australia, a core agency investing in and brokering research. Partnerships and formal alliances with research organisations in universities, national scientific organisations such as CSIRO, and others with capacity to undertake and implement research should underpin the work of such an authority.⁷⁵
- 5.59 The Ecological Society of Australia stated that 'there is an urgent need for integrated, long-term ecological monitoring':
- The availability of long-term ecological datasets in the northern hemisphere has enabled extensive documentation of recent climate
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74 Professor Jon Altman and Dr Seán Kerins, *Submission 10*, p. 6.

75 Boobook Declaration Steering Committee, *Submission 11*, pp. 9-10; Conservation Council of South Australia, *Submission 58*, p. [5].

and biological trends. There are fewer datasets from Australia, but they show that similar impacts are underway'.⁷⁶

- 5.60 The National Parks Australia Council (NPAC) called for a system of national environmental accounts that includes information on biodiversity so that it can be managed effectively.⁷⁷ Ms Christine Goonrey, President of NPAC, further stated that an effective national data collection and reporting system is needed, possibly established similarly to the Australian Institute of Health and Welfare, which she described as:

where the states and territories come together with the Commonwealth in an independent body that is responsible for collecting health data and social service data without any of the political wrangling, and that informs the states' roles and of course the Commonwealth's role in how it can best value-add to the health services.⁷⁸

- 5.61 NPAC suggested that '... regional reporting systems [like that demonstrated in the Australian Alps] could be aggregated into a national database which informs management and policy development with sound scientific data', and further, that the use of sound comparative data and a common review process will help to address issues such as inappropriate fire management practices.⁷⁹
- 5.62 Mr Matt Ruchel, a member of NPAC, stated that both the biophysical data and the management and performance issues are important in environmental monitoring and that one of the problems with the current system is that it is difficult to compare between jurisdictions and get a clear picture of who is responsible for what, how much is being spent and whether that money is being used effectively.⁸⁰ The Australian Bureau of Statistics (ABS) observed in its submission that it is difficult to articulate the state of the environment, or address issues spanning jurisdictions and regions, and it is also difficult to forecast the impact of policy intervention across environment, economy and society.⁸¹
- 5.63 The ABS stated that there are many individuals and organisations collecting environmental information, which results in fragmented sets of data that suffer from:
- inconsistent definitions and standards

76 Ecological Society of Australia, *Submission 15*, pp. 5-7.

77 National Parks Australia Council (NPAC), *Submission 18*, p. 4.

78 Ms Christine Goonrey, President, NPAC, *Transcript of evidence*, 2 March 2012, pp. 26-27.

79 NPAC, *Submission 18*, pp. 3-4.

80 Mr Matt Ruchel, Member, NPAC, *Transcript of evidence*, 2 March 2012, p. 27.

81 ABS, *Submission 53*, p. [2].

- independence from any framework facilitating data linkage and interconnectivity
- inconsistent frequency and timing of produced data
- poor spatial representation
- low levels of visibility, discoverability and accessibility
- lack of time series and therefore lack of stability over time
- poor capacity to support modelling and forecasting.⁸²

The ABS stated further that the quality and extent of biophysical information on environmental issues varies from being comprehensive and good quality in relation to temperature and rainfall to patchy and inconsistent in areas relating to ecosystems, with national data sets typically unavailable.⁸³

- 5.64 Dr Peter Whitehead, an Advisor for NAILSMA, told the Committee that some work has been done on aggregating climate observations using electronic monitoring devices called 'itrackers', as steps towards trying to amalgamate the scientific approach with the traditional approach.⁸⁴

Understanding climate change impacts

- 5.65 As well as noting the importance of collecting baseline environmental information for a variety of uses, the Committee heard that national coordination and a large increase in funding is required for the effort to understand the impacts on biodiversity of climate change, including the rising carbon dioxide concentration.⁸⁵ Associate Professor Mark Hovenden, from the University of Tasmania, also stated in his submission that this could be achieved by the establishment of a national repository or database of published information on the responses of native species and ecosystems to the increasing carbon dioxide, which database could also indicate current areas of research activity.⁸⁶ Associate Professor Hovenden commented that:

... there has been an overemphasis on funding research into climate change adaptation well before we understand the impacts well enough for that adaptation research to be effective for and relevant to Australia's biodiversity.⁸⁷

82 ABS, *Submission 53*, p. [2].

83 ABS, *Submission 53*, p. [3].

84 Dr Whitehead, NAILSMA, *Transcript of evidence*, 4 July 2012, p. 15. See also House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 2*, November 2012, p. 50.

85 Associate Professor Mark Hovenden, University of Tasmania, *Transcript of evidence*, 4 May 2012, p. 32.

86 Associate Professor Mark Hovenden, *Submission 9*, p. 48.

87 Associate Professor Hovenden, *Transcript of evidence*, 4 May 2012, p. 32.

- 5.66 The Committee heard also from the Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) that it is important to build the knowledge base on the impacts of climate change on ecosystems and to provide tools for the decision makers and natural resource managers to be able to act based on the best available information.⁸⁸ DSEWPAC advised that the National Climate Change Adaptation Research Facility (NCCARF) had developed plans for research into marine, terrestrial and freshwater environments and their management:

Further research will improve our understanding of climate change impacts, likely responses of species and ecosystems and their outlook over time, and this knowledge can be continually incorporated into policy, planning and management practices.⁸⁹

- 5.67 The Committee heard from the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) that climate modelling experiments can provide vital information about potential environmental change, and can also provide the basis for assessing impacts of climate change on biodiversity.⁹⁰
- 5.68 ACE CRC described the Climate Futures for Tasmania project as the most comprehensive climate modelling project of its kind yet undertaken in Australia, with the methodologies being applicable to all of Australia.⁹¹

Funding requirements

- 5.69 Mr John Gunn, Chief Executive Officer of the Australian Institute of Marine Science stated that the Australian Government should focus on measuring the long-term baseline, just as has been done for the atmosphere at the Bureau of Meteorology (BOM) Cape Grim baseline air pollution station in Tasmania.⁹²
- 5.70 The Terrestrial Biodiversity Research Adaptation Network discussed the need to:
- ... ensure that the necessary resources for long-term monitoring, evaluation and data infrastructure are in place, co-ordinated and have guaranteed longevity to provide reliable and comprehensive

88 Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), *Submission 66*, p. 11.

89 DSEWPAC, *Submission 66*, p. 11.

90 ACE CRC, *Submission 79*, p. [5].

91 ACE CRC, *Submission 79*, p. [5].

92 Mr John Gunn, Chief Executive Officer, Australian Institute of Marine Science, *Transcript of evidence*, 5 July 2012, p. 22.

access to the information necessary for effective and timely decision making.⁹³

- 5.71 The Australian Seed Bank Partnership suggested that an independent consultative process into future funding and stewardship could assist in ensuring that there is investment in a wider range of research on biodiversity and climate change.⁹⁴
- 5.72 The Committee heard from AIATSIS of the benefits of regional coordination of information, and that:
- [i]nvestment into regionally appropriate social and environmental monitoring and evaluation systems would enable groups to identify how effective their activities are in delivering biodiversity outcomes and monitoring climate changes. As a result, development of climate change adaptation strategies based on aggregated monitoring and evaluation information.⁹⁵
- 5.73 AIATSIS further suggested that:
- Funding for equipment and training in environmental monitoring supported by strong information management frameworks is also an ongoing necessity. Ensuring ranger programs have the capacity and to engage with the research and innovation sector is also important to ongoing improvement in practice and knowledge transfer. This requires strong research agreements based on ethical research practices and benefit sharing that build the capacity of and transfer knowledge to ranger groups to ensure best practice management of country.⁹⁶
- 5.74 The Committee heard that the level of funding provided to the Australian Research Council is not high enough, that perhaps 15 per cent of researchers in Australia receive funding from it, with a small percentage of those researchers being ecologists.⁹⁷ Professor French, from the Ecological Society, further stated that a lot of the funding from Caring for our Country is for on-ground works rather than research, and that we need to be more organised and strategic about providing funds to research the questions that need to be answered.⁹⁸ Further, knowledge base

93 NCCARF National Adaptation Research Network – Terrestrial Biodiversity, *Submission 20*, p. 3.

94 Australian Seed Bank Partnership, *Submission 19*, pp. 6-7.

95 AIATSIS, *Submission 34.1*, p. [7].

96 AIATSIS, *Submission 34.1*, p. [7].

97 Professor French, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 19.

98 Professor French, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 19.

- requirements should be separated from on-ground requirements, and the right funding balance needs to be understood.⁹⁹
- 5.75 The Healesville Environment Watch stated that a substantial increase in investment in biodiversity and ecosystem protection, restoration and management was required, as well as the establishment of an independent, widely consultative process into future funding and stewardship of biodiversity.¹⁰⁰ In order to do this, its members support the Boobook Declaration in its call for restoration and increased ‘... capacity for publicly funded biodiversity research, auditing, monitoring, accounting and communication, including through an expanded independent Land, Water and Biodiversity Authority’.¹⁰¹
- 5.76 The Academy of Science stated that a national effort is needed to describe the species that are affected by climate change and their complex interactions with the environment.¹⁰² The Academy sees it as vital to find out the important refugia to conserve biodiversity in a changing climate, how these should be appropriately managed, and what species will need to and be able to disperse to new locations.¹⁰³ The Academy emphasised that if we do not fill in gaps in our knowledge of the species affected by climate change and their interaction with the environment, then our efforts to protect and conserve biodiversity will be flawed.¹⁰⁴
- 5.77 The Academy also stated that better funding is required for fundamental research supporting management programs and conservation strategies, including finding out what the most appropriate species and ecosystem indicators for climate change are and how they should best be monitored, with ongoing monitoring being vital.¹⁰⁵ The Academy went on to say that we need to:
- build baseline datasets with key indicators, to measure biodiversity conditions and trends over time
 - build a national set of long-term monitoring protocols and sites
 - catalogue, study and understand the variety and diversity of undiscovered species.¹⁰⁶

99 Professor French, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 19.

100 Healesville Environment Watch Inc., *Submission 16*, p. [2].

101 Healesville Environment Watch Inc., *Submission 16*, p. [3].

102 Academy of Science, *Submission 32*, p. 1.

103 Academy of Science, *Submission 32*, p. 5.

104 Academy of Science, *Submission 32*, p. 5.

105 Academy of Science, *Submission 32*, p. 4.

106 Academy of Science, *Submission 32*, pp. 4-5.

- 5.78 WALGA stated that further research is required to ensure that areas retained to connect conservation reserves facilitate movement across the landscape, such research being to:
- determine species' responses to climate change
 - identify potential refugia
 - identify species that are likely to persist in local areas
 - understand how interactions with other threats will affect species' adaptations.¹⁰⁷
- 5.79 WALGA noted that it is critical that these research results are clearly communicated to land managers to allow for adaptive management.¹⁰⁸
- 5.80 WALGA stated that funding for further research needs to be made available for medium and long-term studies because most of the current research programs, including those undertaken through NCCARF, do not provide adequate funding or time periods for long-term monitoring.¹⁰⁹
- 5.81 The Australian Conservation Foundation (ACF) stated that investment time frames for 'people and institutions caring for priority ecosystems are too short and inconsistent in order to secure long-lasting environmental benefits, and institutional capabilities'.¹¹⁰
- 5.82 The Committee heard that national funding initiatives could be directed toward museum infrastructure to support the deteriorating collections, and to attracting more people into studying taxonomy at university.¹¹¹ Dr Jane Fromont, Head of Department of Aquatic Zoology at the Western Australian Museum also stated that there are very few young taxonomists, that significant training in this area is required, and that funding should be redirected to this type of research.¹¹²
- 5.83 The Committee heard from the Australian Museum that our capabilities in identifying pest species, for example, are in decline due to an ageing workforce, restricted funding availability, and a lack of adequate training and tertiary courses to attract people into taxonomy.¹¹³ It was suggested that we need to increase our taxonomic capacity if we are to understand our biodiversity, how it will respond to climate change, how changes will

107 WALGA, *Submission 37*, p. 5.

108 WALGA, *Submission 37*, p. 5.

109 WALGA, *Submission 37*, p. 11.

110 Australian Conservation Foundation (ACF), *Submission 64*, p. 1.

111 Dr Jane Fromont, Head of Department of Aquatic Zoology, Western Australian Museum, *Transcript of evidence*, 7 November 2011, p. 23.

112 Dr Fromont, Western Australian Museum, *Transcript of evidence*, 7 November 2011, p. 23.

113 Australian Museum, *Submission 27*, p. 2.

affect our ecosystems, economy and society, and how we can mitigate the effects of climate change on our biodiversity.¹¹⁴

- 5.84 Dr Bax of CSIRO echoed the observation that there is a critical lack of alpha taxonomy done in museums.¹¹⁵ Mr Gunn of the Australian Institute of Marine Science also stated:

The possibility ... is that genetics will be the answer ... At some stage, rather than having to write the colour of its eyes and the size of it, you may be able to scratch it and get a gene tissue sample and within seconds have it on your laptop or your iPhone.¹¹⁶

The Committee heard about DNA technology being utilised at the Melbourne Museum that is making it possible to identify the source of previously unknown specimens.¹¹⁷

- 5.85 The Australian Museum suggested that the challenge of species identification could be partially addressed by technological developments such as a molecular approach, but that an integrative and prioritised approach to improving our taxonomical capabilities, with appropriate emphasis placed on education and training, is required.¹¹⁸
- 5.86 Dr Karen Miller, secretary of AMSA, explained the need for appropriate resources to train the next generation of marine scientists, in order that we have the skills to continue doing necessary research and gathering information into the future.¹¹⁹ The need to increase community understanding of the importance of marine science and encourage philanthropic support of some of the research was highlighted as important, and an approach that is very apparent overseas.¹²⁰
- 5.87 In a marine environment context, the Australian Museum called for more resources for state museums to document biodiversity.¹²¹ Dr Hutchings gave as an example the need to appropriately identify marine invasive species: 'First of all, we must accurately identify which are invasive species and which are undescribed native species'.¹²²

114 Australian Museum, *Submission 27*, p. 2.

115 Dr Bax, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 39.

116 Mr Gunn, Australian Institute of Marine Science, *Transcript of evidence*, 5 July 2012, p. 22.

117 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 7.

118 Australian Museum, *Submission 27*, p. 2.

119 Dr Karen Miller, Secretary, AMSA, *Transcript of evidence*, 31 January 2012, p. 29.

120 Dr Miller, AMSA, *Transcript of evidence*, 31 January 2012, p. 29.

121 Australian Museum, *Submission 27*, p. 9.

122 Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 4.

Research coordination

- 5.88 The Committee heard of the important relationship between research capacity and adaptive management for climate change. The WRAFBARN, in its submission, stated that there is no strong leadership in research coordination in the water sector, and that the closure of Land and Water Australia in 2009 resulted in the loss of a key research purchaser and agency that was able to respond to government policy and program needs.¹²³ It was suggested that a partnership model of research delivery could be effective in providing the knowledge needs for adaptive management of climate change.¹²⁴
- 5.89 The Committee heard from Dr Bax that promoting research coordination requires providing useful information to government and stakeholders by working in partnership to discover what the research questions are, and providing open data access, through national infrastructure like the Australian Ocean Data Network used for collecting oceanographic data.¹²⁵
- 5.90 The Committee heard that the ACE CRC made sure that all of the information from its climate modelling project was made publicly available, and it worked closely with the Tasmanian government to ensure that the same information was available to and being used by the government.¹²⁶ Dr Anthony Press, Chief Executive Officer of ACE CRC, also stated that it will cease to exist in 2014 and it does not have the capacity to continue this climate modelling work as an ongoing program, further indicating that climate services will be very important in the future and the responsibility should fall between the functions of the BOM and the CSIRO.¹²⁷ Dr Press further stated that one of the big challenges for Australia is to have the resources and the capacity – which we do not have at the moment – to provide detailed climate services to farming communities, water holders and natural area managers.¹²⁸
- 5.91 Dr Bax described the need to promote the gradual change that is happening in the scientific community in relation to the sharing of information and ensuring that information is collected in a common format so that it can be shared.¹²⁹ Dr Bax further stated that this requires educating scientists and encouraging them to undertake broader national

123 WRAFBARN, *Submission 22*, p. [8].

124 WRAFBARN, *Submission 22*, p. [8].

125 Dr Bax, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 38.

126 Dr Anthony Press, Chief Executive Officer, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

127 Dr Press, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

128 Dr Press, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

129 Dr Bax, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 38.

- collaborations, looking to a common set of data being collected around the country, which will inform national environmental reporting.¹³⁰
- 5.92 Prof Edward Lefroy of the University of Tasmania suggested that citizen science initiatives provided useful opportunities to access local observations and expertise and that expertise could be used in larger scale analyses.¹³¹ Dr Press of ACE CRC suggested that the Range Extension and Database Mapping (REDMAP) project could be duplicated in areas outside of marine ecosystems.¹³² A number of other citizen science initiatives were canvassed during the course of the inquiry, including the BOM, which has over 100 years of records, many of which have been collected by volunteers, and BirdLife Australia, where many volunteers have a standard method to input information into their databases.¹³³ Prof Lefroy observed that it is beyond the capacity of most institutions to set up ideal monitoring scenarios, 'but we can tap into the local expertise'.¹³⁴
- 5.93 The Australian Seed Bank Partnership stated that there needs to be greater support for longitudinal studies as part of applied research; that greater research is needed on the monitoring and evaluation of restoration activities; and that findings from such longitudinal research need to be made publicly available and accessible to inform and guide future practices.¹³⁵ The Partnership also stated that three-year grants do not consider the need for research using such different time frames as biological processes or climatic cycles. The Partnership also called for ongoing investment in the development and maintenance of biological collections like seed banks, herbaria and botanic gardens, with biological collections being physical databases that support the understanding of the variability of biodiversity.¹³⁶
- 5.94 In highlighting the need for further research into the impact of rising carbon dioxide levels on specific organisms and ecosystems, Associate Professor Hovenden explained that further research should proceed in a different manner than has been conducted previously, which was for specific purposes, locally driven and in an unstable environment due to short-term funding cycles.¹³⁷ The Committee heard evidence that, in

130 Dr Bax, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 38.

131 Professor Edward Lefroy, University of Tasmania, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

132 Dr Press, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

133 Professor Lefroy, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

134 Professor Lefroy, ACE CRC, *Transcript of evidence*, 31 January 2012, p. 8.

135 Australian Seed Bank Partnership, *Submission 19*, p. 6.

136 Australian Seed Bank Partnership, *Submission 19*, pp. 6-7.

137 Professor Mark Hovenden, *Transcript of evidence*, 4 May 2012, p. 32.

relation to various biodiversity research areas, a 10 year funding cycle is much more suitable than a three year cycle.¹³⁸ Associate Professor Hovenden described the need for a 10 year experiment on the impacts of increasing carbon dioxide levels on native heathlands to be conducted with multiple institutions nationwide.¹³⁹

Current programs

- 5.95 The Committee heard about the International Tundra Experiment undertaken by the Research Centre for Applied Alpine Ecology (RCAAE) with Australian Research Council funding, with the research showing that 'fewer species are able to survive as you go to a higher altitude'.¹⁴⁰ Representatives of the Centre described the challenge of maintaining long-term monitoring in order to assess the results as circumstances change.
- 5.96 The Committee heard that, in contrast with the 200-year records that have been kept in the United States, data on monitoring of the timing of flowering and the timing of seed sets of species in Australia is available from the 1940s, and that monitoring of the timing of flowering and the timing of seed sets in alpine plants only started six years ago.¹⁴¹
- 5.97 The Committee was told about the long history of ecological research on land use in the Australian Alps, research which could be useful when observing the effects of climate change. The RCAAE, in its submission, identified a need for further investment in the research infrastructure – namely the network of plots across the entire area – given the dramatic changes expected and the value of long-term monitoring in decision making.¹⁴² In representing the Centre, Prof Hoffmann explained the purpose of the plots is to ensure necessary data is obtained to effectively make adaptive management decisions.¹⁴³ Prof Hoffmann also described the need for continuity of funding, and a longer term funding cycle, in order to train people to a certain level of expertise.¹⁴⁴ He explained that:
- ... this year, for the first time, we have finally been able to separate those two effects from a scientifically rigorous point of view. We

138 Ms Penelope Figgis, Vice Chair for Oceania, IUCN WCPA, *Transcript of evidence*, 28 March 2012, p. 23.

139 Professor Hovenden, *Transcript of evidence*, 4 May 2012, p. 36; Professor Mark Hovenden, *Submission 9*, p. 47.

140 Professor Hoffman, University of Melbourne, Dr Ewen Silvester, La Trobe University, and Dr Carl-Henrik Wahren, La Trobe University, *Transcript of evidence*, 2 March 2012, pp. 17-19.

141 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 19.

142 RCAAE, *Submission 72*, p. 2.

143 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 22.

144 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 22.

can finally say: 'This is due to climate change and this is due to grazing. It is very clear what sort of patterns you are going to get.' That has only happened because of these long-term plots.¹⁴⁵

- 5.98 The Committee heard from Professor Graham Edgar of the Institute for Marine and Antarctic Studies that, from a monitoring perspective, it is critical to have areas of no fishing and areas of fishing in marine protected areas, in order to track the changes occurring in the different areas and be able to disentangle the effects of fishing from the effects of climate change.¹⁴⁶

Knowledge sharing

- 5.99 The ABS stated that '[i]t is widely recognised that the information used to support policy development and decision-making in relation to Australia's environment is inadequate', and that we need to commit to a lengthy time series of comparable data.¹⁴⁷ Mr Sullivan, Acting Deputy Secretary of DSEWPAC, acknowledged that the environment field is far behind economics and social policy in terms of data collection.
- 5.100 The Committee is aware of the National Plan for Environmental Information (the Plan), a whole-of-government initiative to improve quality and coverage of environmental information, aiming to:
- develop national environmental standards
 - identify potential gaps in our existing environmental information capabilities
 - develop an Environmental Information System to collate, manage and provide public access to national environmental datasets
 - in the first four years – from 2010 – establish the BOM as the Australian Government Authority for environmental information and begin building priority national environmental datasets and the infrastructure to deliver them.¹⁴⁸
- 5.101 Mr Sullivan explained that the Plan is aimed at trying to build the credibility of environment data, get access to the data that is already collected and make it more transparent and open, building on the monitoring regimes that are in place and building the capability so it is long-term.¹⁴⁹

145 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 23.

146 Professor Graham Edgar, Institute for Marine and Antarctic Studies, *Transcript of evidence*, 31 January 2012, p. 21.

147 ABS, *Submission 53*, pp. [1], [7].

148 DSEWPAC, *Submission 66*, p. 11.

149 Mr Sean Sullivan, DSEWPAC, *Transcript of evidence*, 12 October 2012, pp. 34-35.

- 5.102 The Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) stated that it invests in eResearch infrastructure for the research sector to address data management, sharing, access and availability of data, capture, aggregation, transmission, storage and reuse, and the sharing of data between sectors.¹⁵⁰ The Australian National Data Service promotes access to public sector data sets, finds and transforms data to structured collections, with its Research Data Storage Infrastructure project building a national network of distributed data stores to enable ready access to research data for universities, research institutions and individual researchers.¹⁵¹ The Australian Research and Education Network, National Research Network project connects universities, central and remote research institutions, and to overseas national research networks, these connections being described as essential to the movements of environmental and biodiversity research data, including that collected through the Integrated Marine Observing System (IMOS) and from the Terrestrial Ecosystem Research Network (TERN).¹⁵²
- 5.103 The Committee heard of the need to renew investment in our natural capital, and that an 'effective monitoring network would be best achieved via a national collaborative program with a commitment to ongoing, adequate resourcing'.¹⁵³
- 5.104 The ABS stated that it is capable of contributing to information requirements related to managing biodiversity in a changing climate, stating that information should be spatially explicit, comparable across multiple time periods and linked to relevant socioeconomic data.¹⁵⁴ The ABS described its experience in the measurement of economic, social and environmental matters, and particularly 'the development of integrated information systems so that ... data on environmental performance can be linked to the various socioeconomic factors that affect ecosystems, and which are themselves impacted by changes in biodiversity'.¹⁵⁵
- 5.105 The ABS explained that a comprehensive national environmental information system should have essential biophysical information on the

150 Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE), *Submission 87*, p. 11.

151 DIISRTE, *Submission 87*, pp. 11-12.

152 DIISRTE, *Submission 87*, p. 13.

153 Biodiversity and Climate Change Expert Advisory Group, *Australia's biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change – Summary for policy makers 2009*, Summary of a report to the Natural Resource Management Ministerial Council commissioned by the Australia Government, Department of Climate Change and Energy Efficiency, Canberra, 2009, p. 20 (Exhibit 2).

154 ABS, *Submission 53*, p. [1].

155 ABS, *Submission 53*, p. [1].

state of the environment and complementary socioeconomic information on drivers, pressures, impacts and responses, with the information integrated by the use of common definitions, concepts, classifications and frameworks, in order that it can be considered in policy formulation and other decision making.¹⁵⁶

- 5.106 The ABS stated that it was contributing to the development of the United Nations' System of Environmental-Economic Accounting, which includes the development of standardised ecosystem reporting through Land and Ecosystems Accounting.¹⁵⁷ The ABS also discussed its own Land Accounts, describing them as powerful tools that can be used for planning by industry, government and the community, and its Water Accounts, stating that they provide a much clearer picture for policymakers.¹⁵⁸
- 5.107 In its submission, ACF recommended that information about the environment be integrated into Australia's national accounts in order to drive government decision making by ensuring adequate resourcing and support of the Plan to deliver a set of national environmental accounts.¹⁵⁹ Dr Paul Sinclair, Program Manager of the Healthy Ecosystems Program at ACF, was concerned that the work to create national environmental accounts was 'not proceeding with the urgency required'.¹⁶⁰ Dr Sinclair called for the accounts to be built 'from the bottom up', and be consistent across regions and states, noting that they require 'additional resources' and 'additional political momentum' to deliver.¹⁶¹ Dr Sinclair stated the importance of making the accounts simple to start with so they are easy to understand in the community, building sophistication over time.¹⁶² Dr Sinclair further stated that regional NRM organisations, work related to regional NRM strategies, and ABS and government programs should be used as opportunities to collect data to feed into the national system, ensuring that the data being collected to measure progress is consistent and can be simply communicated.¹⁶³

Atlas of Living Australia

- 5.108 The Atlas makes biodiversity information available online to a national audience. The data originates from museums and herbaria, BirdLife

¹⁵⁶ ABS, *Submission 53*, p. [3].

¹⁵⁷ ABS, *Submission 53*, p. [4].

¹⁵⁸ ABS, *Submission 53*, pp. [5]-[6].

¹⁵⁹ ACF, *Submission 64*, p. 8.

¹⁶⁰ Dr Paul Sinclair, Program Manager, Healthy Ecosystems Program, ACF, *Transcript of evidence*, 4 May 2012, p. 27.

¹⁶¹ Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, p. 28.

¹⁶² Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, pp. 27-28.

¹⁶³ Dr Sinclair, ACF, *Transcript of evidence*, 4 May 2012, p. 28.

Australia and other biological collections, as well as from IMOS and from TERN projects. The Atlas also provides data to the Global Biodiversity Information Facility. Dr John La Salle, Director of the Atlas, told the Committee that the Atlas was officially funded until June 2012, with an agreement in place allowing any unspent funds to be carried over to June 2013.¹⁶⁴

5.109 In its submission, the Atlas stated the potential scope of the database:

Australia's biological collections actually represent the most significant *potential* source of historical data – with over 60 million specimens held in collections Australia-wide and only about 20 per cent of these being digitised and therefore available via the Atlas. The Atlas has been funded for the provision of *infrastructure* and is now capable of mobilising collection data whenever additional digitalisation activities within institutions can be funded.¹⁶⁵

5.110 The Atlas described the success of the 'rapid digitisation' project run by the South Australian and Australian Museums, which incorporates volunteers in the transcript of specimen labels, field notebooks and other materials – with over 16 000 specimens being fully digitised by over 100 volunteers.¹⁶⁶

5.111 The Volunteer Digitisation Project (DigiVol) run through the Australian Museum, with initial funding from the Atlas and short term funding now being provided by the Australian Museum Foundation makes label data accessible without having to go to the physical collection, and uses volunteers to transcribe the labels.¹⁶⁷ Also initially funded by the Atlas, the South Australian Museum uses volunteers to photograph and database the holotypes from the Terrestrial Invertebrate Collection.¹⁶⁸

5.112 The Atlas stated that data can be used to analyse the historical and potential distribution of species, given a range of environmental factors, and generate predictive models.¹⁶⁹ The Atlas indicated that it would welcome the opportunity to incorporate future climate change scenarios

164 Dr John La Salle, Atlas of Living Australia (the Atlas), *Transcript of evidence*, 21 June 2012, p. 3.

165 The Atlas, *Submission 83*, p. 2.

166 The Atlas, *Submission 83*, p. 2.

167 Australian Museum, 'DigiVol (Volunteer Digitisation Project) – Australian Museum', <<http://australianmuseum.net.au/Digitisation-Project-Volunteers>> viewed 6 February 2013.

168 South Australian Museum, 'Digitisation Project – South Australian Museum', <http://www.samuseum.sa.gov.au/index.php?option=com_content&Itemid=171&catid=35&id=403&view=article> viewed 6 February 2013.

169 The Atlas, *Submission 83*, p. 2.

and additional analysis tools that would allow the impacts of climate change on biodiversity to be studied.¹⁷⁰

- 5.113 The Atlas stated that there was an opportunity to combine its base species data with IMOS, TERN and other National Collaborative Research Infrastructure Strategy (NCRIS) funded data.¹⁷¹ Many submitters referred to the Atlas as providing a good base for environmental information that can be expanded to cater to environmental information requirement needs in a changing climate.
- 5.114 The Australian Seed Bank Partnership stated the key priorities for future ongoing investment in the integration and accessibility of biodiversity data as being:
- 'long-term operational stability for the nationally significant data sets which support research, policy and education' – wider adoption of the Atlas is hampered by the perceived instability of its funding model
 - using the Atlas infrastructure to build a comprehensive national biodiversity reference data set to support research and decision making.¹⁷²
- 5.115 The Committee heard that the Australian Seed Bank Partnership and the Atlas are working together to create national standards for recording data on wild species collections, and to build an accessible online seed resource to support conservation, restoration ecology and plant diversity research in Australia.¹⁷³
- 5.116 Dr Brian Lassig, Assistant Director of the Research and Collections Division at the Australian Museum stated that 'collaborative research using information from a variety of sources is becoming increasingly important.' Therefore, 'the imperative of making our information available, accessible and useful is a very strong driver for us at the moment, and the atlas provides us with a vehicle to do that.'¹⁷⁴ The Committee heard from the CSIRO of the need for the Atlas to develop the capability of being able to draw out temporal data in order to understand how species distribution and abundance has changed, for it to provide a useful resource in future.¹⁷⁵

170 The Atlas, *Submission 83*, p. 2.

171 The Atlas, *Submission 83*, p. 2.

172 Australian Seed Bank Partnership, *Submission 19*, p. 6.

173 Australian Seed Bank Partnership, *Submission 19*, p. 6.

174 Dr Brian Lassig, Assistant Director, Research and Collections Division, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 6.

175 Dr Sheppard, CSIRO, *Transcript of evidence*, 16 August 2012, p. 7.

- 5.117 The Australian Museum strongly supported the continued funding of existing integrative platforms such as the Atlas.¹⁷⁶ Dr Hutchings said that if she was funded to update the information she provides to the Atlas she would update it every year, whereas it probably would not happen if she was left to do so for free.¹⁷⁷ Dr Hutchings said further that the Atlas was looking to cooperative ventures and at alternative ways of being funded.¹⁷⁸

Marine environment

- 5.118 AMSA explained to the Committee that shallow waters are better understood than deep sea waters because it is more difficult and expensive to study the deep sea. It was noted by Dr Miller of AMSA that the deep sea will be one of the first ecosystems to be affected by climate change.¹⁷⁹ Dr Miller described the means of addressing those data gaps as one of the greatest challenges for the organisation:

... our prediction of what will happen from the marine biodiversity perspective is really limited by a lack of knowledge in most ecosystems. And so not understanding the diversity or the ecology properly certainly limits our ability to predict what might happen ...¹⁸⁰

- 5.119 The Committee also heard that the limited investment in large-scale and long-term monitoring of Australia's marine living resources in the past has meant that our baseline knowledge of the distribution of many species is poor or unknown.¹⁸¹ AMSA advised the Committee of the Reef Life Survey, which aims to improve biodiversity conservation and management through producing high-quality survey information.¹⁸² According to AMSA, funding towards the Reef Life Survey and monitoring mechanisms such as IMOS needs to be improved in order to have the capacity to generate the knowledge required to effectively manage biodiversity in a changing climate.¹⁸³ The Committee heard from Associate Professor Neil Holbrook that it is essential that IMOS continue into the future.¹⁸⁴

176 Australian Museum, *Submission 27*, p. 2.

177 Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 6.

178 Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 6.

179 Dr Miller, AMSA, *Transcript of evidence*, 31 January 2012, p. 31; AMSA, *Submission 17*, p. 7.

180 Dr Miller, AMSA, *Transcript of evidence*, 31 January 2012, p. 27.

181 AMSA, *Submission 17*, p. 6.

182 AMSA, *Submission 17*, p. 6.

183 AMSA, *Submission 17*, p. 6.

184 Associate Professor Neil Holbrook, Private capacity, *Transcript of evidence*, 31 January 2012, p. 14.

- 5.120 The Committee heard that conservation measures will need to be adaptive as new information becomes available. As an example, the boundaries of existing MPAs may need to be flexible, as our current knowledge of many marine ecosystems and species is basic.¹⁸⁵ The Australian Museum described the need for a system which allows for the boundaries of the marine parks to be changed as climate changes start to impact upon marine ecosystems (for example, when species have to move south).¹⁸⁶
- 5.121 The Committee heard from Dr Hobday at CSIRO that funding coordination of climate change programs, in a marine context, is difficult because of the different avenues to research through numerous bodies including the Australian Research Council, Fisheries Research and Development Corporation, Australian Fisheries Management Authority and the Department of Agriculture, Fisheries and Forestry.¹⁸⁷ Dr Hobday also stated that revegetation of marine environments, including salt marshes, Important Bird Areas, seagrass meadows and kelp forests, is not covered under the Biodiversity Fund.¹⁸⁸ Dr Hobday further stated that current funding for NCCARF marine adaptation finishes in June 2013.¹⁸⁹

Multi-disciplinary approaches to biodiversity conservation in a changing climate

- 5.122 Multi-disciplinary approaches to biodiversity conservation were discussed at length throughout the inquiry, with inquiry participants outlining the need for consistent cross-sectoral government policies, integrated environmental and socioeconomic development, integrated appropriate land use planning with NRM planning, integrated coastal management, integrated national databases and Indigenous engagement in NRM and economic development. These issues are discussed briefly below.
- 5.123 WALGA outlined a number of collaborative and coordinated approaches to biodiversity management, including:
- prioritising integration and coordination to ensure consistency in policies and management actions of sectors, governments and departments

¹⁸⁵ AMSA, *Submission 17*, pp. 6-7.

¹⁸⁶ Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 6.

¹⁸⁷ Dr Hobday, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 37.

¹⁸⁸ Dr Hobday, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 41.

¹⁸⁹ Dr Hobday, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 41.

- involving stakeholders in planning, implementing, evaluating and improving programs for biodiversity management
 - developing national legislation and/or state planning policies that facilitate the effective implementation of appropriate adaptive land use planning mechanisms.¹⁹⁰
- 5.124 WALGA further outlined the importance of integrating land use planning with NRM planning for the sustainability of environmental assets. The Perth Biodiversity Project (as discussed in chapter four) provides local governments with access to spatial environmental information through a central online access point, rather than having to go through each individual agency, which is useful in the early stages of land use planning.¹⁹¹
- 5.125 CSIRO stated that future economic development is linked with environmental and social considerations.¹⁹² In relation to marine ecosystems, CSIRO described some benefits of developing a Blue Economy, including:
- providing protection and restoration of ocean ecosystems and biodiversity
 - recognising and adopting ocean and coastal carbon sinks and creating a 'blue carbon' trading market
 - integrated coastal management and adaptation to sea level rise and climate change.¹⁹³
- 5.126 In relation to freshwater biodiversity, the Committee heard about the need for collaboration on adaptation initiatives and programs by affected sectors, including primary industries, water management and use, infrastructure, and settlement development and use. According to WRAFBARN, such collaborations should take into account economic and social factors, ensure investments are well directed, and aim to avoid perverse outcomes.¹⁹⁴

190 WALGA, *Submission 37*, p. 9.

191 Ms Renata Zelinova, Manager, Perth Biodiversity Project, and Mr Mark Batty, Executive Manager, Environment and Waste, 7 November 2011, WALGA, *Transcript of evidence*, pp. 12-13, 14.

192 CSIRO, *Submission 23.1*, p. 3.

193 CSIRO, *Submission 23.1*, p. 3.

194 WRAFBARN, *Submission 22*, p. [6].

- 5.127 Dr Hobday from the CSIRO stated that species are moving south along the coastline, and if refugia are located in areas where coastal development is proceeding rapidly, opportunities to look after those areas will be lost.¹⁹⁵
- 5.128 The Committee heard that cross-sectoral government policies should better align with Indigenous aspirations and environmental and conservation goals.¹⁹⁶ The Committee heard that, for example, in terms of securing access to carbon on a pastoral lease, the Carbon Farming Initiative recognises people with registered native title interests but not claims in process.¹⁹⁷ The Committee also heard of the need to integrate biodiversity conservation with Indigenous social and economic development. Jointly managed parks such as Kakadu National Park, and Indigenous Protected Areas provide good examples, but, according to Dr Whitehead of NAILSMA, they need to be spread wider through the landscape.¹⁹⁸
- 5.129 Dr Whitehead explained that income can drive the capacity to adapt, and that for Indigenous peoples who are looking for a means to get back onto their country and to meet their obligations to it, programs such as the Carbon Farming Initiative and Working on Country increase that potential.¹⁹⁹ Dr Whitehead further stated that ‘any talk of improved governance will require incentives that give real reasons for Indigenous people ... to integrate their search for livelihoods on their country with these efforts to protect biodiversity’.²⁰⁰

Conclusions and recommendations

- 5.130 The Committee understands the importance of implementing climate change adaptation strategies that are integrated between levels of government, regional bodies and local communities. Society must be ready to adapt as climate changes continue to affect the current state of our environment. Climate change mitigation strategies should consolidate focus on future biodiversity objectives, include a national approach to research and environmental monitoring, prioritise development of

195 Dr Hobday, CSIRO Marine and Atmospheric Research, *Transcript of evidence*, 31 January 2012, p. 41.

196 Professor Jon Altman and Dr Seán Kerins, *Submission 10*, p. 4.

197 Dr Whitehead, NAILSMA, *Transcript of evidence*, 4 July 2012, p. 15.

198 Dr Whitehead, NAILSMA, *Transcript of evidence*, 4 July 2012, p. 15.

199 Dr Whitehead, NAILSMA, *Transcript of evidence*, 4 July 2012, p. 14.

200 Dr Whitehead, NAILSMA, *Transcript of evidence*, 4 July 2012, p. 14.

national environmental and biodiversity datasets, and incorporate future climate modelling and forecasting.

- 5.131 Mitigation strategies are an important part of lessening the inevitable impacts of climate change on the environment and must incorporate, most importantly, an effort to reduce our greenhouse gas emissions and effectively manage our existing environmental stressors. Increasing the resilience of ecosystems and human communities will also strengthen the capacities of these systems to deal with climate changes. Significant development of resilience projects is still required, and the Committee encourages the Australian Government to provide adequate long-term funding for programs currently underway, and those in development.
- 5.132 There is a pressing requirement to collect long-term baseline environmental information. The Committee heard that 'long term ecological research 'has been poorly funded in this country.'²⁰¹
- 5.133 Not only is there a lack of data, but the ongoing need to reapply for funding also has a detrimental effect on long term research. The time spent seeking funding deducts from time which could be spent on the actual research. Further, the system creates perverse incentives:
- Over the 10 years I have run the TasFACE experiment, I have had to reinvent it three times, since grants are for three years only and each subsequent grant must demonstrate and test new ideas and be innovative. Continuing an important long-term experiment is very difficult under such circumstances.²⁰²
- 5.134 In the course of site inspections, the Committee discussed some long-term data collection projects, including:
- long-term phenology monitoring alpine plots and International Tundra Experiment plots as part of TERN in the NSW Snowy Mountains region, and the ideal of a longer term funding cycle;²⁰³
 - regular bird surveys undertaken by volunteer birdwatchers, contributing their data to the Atlas of Australian Birds – a long-term BirdLife Australia project;²⁰⁴
 - the need for such projects in Kakadu National Park and the potential for further development of collaborative partnerships in this area;²⁰⁵

201 Professor Ary Hoffman and Dr Carla Sgro, *Submission 8*, p. 2.

202 Professor Hovenden, *Transcript of Evidence*, 4 May 2012, p. 32.

203 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 22; CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, pp. 40-41.

204 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 12.

205 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 52-54.

- long-term altitudinal gradient monitoring and remote sensor towers set up to measure environmental factors relating to drought and fire patterns, as well as species distribution modelling at the Daintree Rainforest Observatory in Tropical North Queensland.²⁰⁶
- 5.135 The Committee urges the Australian Government to support the long term continuation of such vitally important projects, and support the instigation of new ones that are identified as being required for collection of long-term baseline environmental data in order to monitor and assess the effects of climate change on biodiversity.
- 5.136 The Committee is concerned about the apparent lack of environmental information that has been collected and documented, particularly in the marine environment. The Committee is also concerned that it is hard to quantify and qualify the information that has been collected and documented because of the inaccessibility and fragmented nature of that collected data.
- 5.137 The Committee is further concerned about the lack of long-term environmental monitoring data collected to date. The Committee sees sustained collection of this data as a priority for the Australian Government, in order to establish comprehensive environmental accounts which provide an accurate picture of the state of the environment, therefore helping to adequately adaptively manage our biodiversity in a changing climate. The Committee understands, however, that extended funding carries extended responsibilities.

Recommendation 5

- 5.138 **The Committee recommends that the Australian Government ensure funding cycles for environmental and biodiversity data collection programs are long enough to allow a proper baseline to be developed. This may be up to 10 years.**

The Committee also recommends that funded research needs to comply with proper governance requirements such as reporting, acquittal, and ensuring that the original project goals are still being met.

A national biodiversity database

- 5.139 The Committee acknowledges that the National Plan for Environmental Information aims to create and integrate useful, comprehensive, consistent and nationally coordinated environmental accounts. The Committee

206 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 67-69.

recognises that the BOM and DSEWPAC are scoping the requirements for development of national environmental accounts. In November 2011, the Government commissioned an Independent Review of Australian Government Environmental Information Activity, which reported in November 2012. To the Committee, the Review appears to be a roadmap for operationalising the National Plan for Environmental Information. Its recommendations include:

- improving Government coordination, both within and across agencies;
- prioritising policy requirements based on significance across government, the work required and timeline involved;
- developing workplans to support these policy requirements;
- engaging the states and territories; and
- addressing technical and legal barriers.²⁰⁷

5.140 The Committee is of the view that the recommendations of the Independent Review are timely and provide the Government with practical ways in which the Plan can be realised. The Government is considering the Review's recommendations; the Committee would like to see them implemented.

5.141 Another feature of the Plan is that some time has elapsed since it was announced in May 2010. The fact that it is taking time to implement is not surprising given the scale of the task and the innovation required. Because of this, the Committee sees value in the lead agencies publishing information about project scope and timelines as a means of encouraging timely implementation.

5.142 Finally, the type of information that the Plan collects needs to be relevant to users, which will be a broad cross-section of the Australian community, but with particular priority to scientists and other technical experts. The Independent Review focussed on consultation and coordination within the Australian Government. The Committee believes that consultation with users will also be very important. The Committee did receive evidence from the scientific community about the sorts of features that such a database should have, including data on species, seeds, species distribution, connectivity and refugia. However, these requirements may change over time and also the best people to articulate these requirements are the users themselves. Therefore, the Committee would like to see that robust consultation processes inform key decisions in the design and operation of the Plan.

207 Dr S. Morton and Ms A. Tinney, *Independent Review of Australian Government Environmental Information Activity: Final Report*, DSEWPAC, Canberra, November 2012, pp. xii-xv.

Recommendation 6

- 5.143 **The Committee recommends that the Australian Government ensures the success of the National Plan for Environmental Information by:**
- **implementing the recommendations of the Independent Review of Australian Government Environmental Information Activity**
 - **publishing information about project scope and timelines as a means of helping the Plan being conducted in a timely manner**
 - **consulting widely with the scientific community and other stakeholders, such as the Australian Bureau of Statistics, on the design of the Plan.**
- 5.144 The Committee understands that the science of adaptation to climate change is still developing, and recognises the need for a well-structured approach to adaptation to assist future decision-making. The Committee recognises the importance of longitudinal data sources in this regard.
- 5.145 The Atlas of Living Australia has made its mark and the Committee heard a great deal of evidence about how it is assisting researchers in describing Australia's biodiversity. The Atlas was funded to June 2012 and has been allowed to carry over unspent funds until June 2013. Although it has received a great deal of support across the sector, this has been limited by the perceived instability of its funding model. The Committee also notes that the Atlas is examining other means of securing funding, such as cooperative ventures.
- 5.146 The Committee believes there is value in continuing the Atlas and that it will most likely continue in some form or another. However, the Committee believes that the contribution that the Atlas can make is very significant and that this will be placed at risk unless it can secure longer term resources. Therefore, the Committee supports the provision of further public funding for the time being, provided the Atlas develops a suitable funding model for the future. The Committee also believes that the Australian Government can provide support to the Atlas in developing a sustainable funding model, such as identifying possible partners outside the environmental sector.

Recommendation 7

- 5.147 **The Committee recommends that the Australian Government work with the Atlas to develop a sustainable funding model for it, which could include the involvement of non-government partners.**
- 5.148 The Committee would like to see further progress made on incorporating biological data into national environmental and biodiversity datasets. The Committee acknowledges that there are projects underway involving digitisation of already collected data – such as the Volunteer Digitisation Projects through the Australian Museum and the South Australian Museum discussed above. The Committee considers that the Australian Government should prioritise the digitisation of Australia's biological specimens, and provide funding for that purpose.

Recommendation 8

- 5.149 **The Committee recommends that the Australian Government provide funding to the CSIRO and Atlas of Living Australia to:**
- **assess the current level of digitisation of biological collections in Australia**
 - **coordinate the digitisation of biological data into the Atlas.**
- 5.150 Over the years, this Committee has regularly received evidence about the shortage of taxonomists and that those who remain in the profession are nearing retirement. Once again, the Committee received evidence to this effect during the inquiry. It is obvious to the Committee that the biodiversity impacts of climate change cannot be properly managed if we have not properly documented the thousands of species in Australia. The Committee is of the view that action needs to be taken now so that the knowledge of current practitioners can be transferred to the next generation of taxonomists.

Recommendation 9

- 5.151 **The Committee recommends that the Australian Government consult with the museum and education sectors to develop a strategy to attract, train, and retain taxonomists.**
- 5.152 The Committee agrees with the need to facilitate the involvement of Indigenous people in biodiversity conservation planning and

appropriately use Indigenous ecological knowledge in biodiversity conservation programs. The Committee was impressed by the South Australian Department of Environment, Water and Natural Resources' approach to incorporating cultural heritage and Traditional Owner perspectives in formulating biodiversity management initiatives.²⁰⁸ The Committee recommends as follows:

Recommendation 10

- 5.153 **The Committee recommends the Australian Government include a focus on incorporating Indigenous ecological knowledge into federal biodiversity conservation and land management programs.**

The Committee acknowledges the importance of further support and development of climate change adaptation practices in Australia's response to climate change. The Committee agrees that ongoing funding for long-term monitoring programs, including for the management of climate change adaptation initiatives, is important and requires certainty. As discussed above, the Committee supports the development and funding of the National Plan for Environmental Information, the Atlas of Living Australia, the Online Zoological Collections of Australian Museums,²⁰⁹ the REDMAP project, the Australian Seed Bank Partnership and the extension of projects such as the Perth Biodiversity Project into other regional areas. The Committee recommends that the Australian Government continue funding these projects.

Recommendation 11

- 5.154 **The Committee recommends that the Australian Government continue funding the Australian Seed Bank Partnership.**
- 5.155 In closing, the Committee would also like to recognise the important work being conducted by CRCs in this field. During the inquiry, the Committee noted that the CRCs it dealt with are collaborating more with organisations and researchers internationally. The Committee regards this as a positive development and a natural extension of their work. The Committee does not wish to make a specific recommendation on this point, but would like to place on the record its view that CRCs and the

208 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 33.

209 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 9.

wider Australian public benefit from CRCs working with international partners.

Natural resource management

Introduction

- 6.1 Natural resource management (NRM) is ‘the sustainable management of Australia’s natural resources (our land, water, marine and biological systems) to ensure our ongoing social, economic and environmental wellbeing’.¹ NRM involves those at the individual, local, regional, state and national levels, from the private, community and government sectors.
- 6.2 NRM governance has become increasingly complex since the 1970s, when NRM issues were largely dealt with by individual states and territories, and soil conservation was a high priority. The 1980s saw the introduction of coordinated national arrangements, including the Landcare network. The 1990s saw an increase in the number of environmental non-government organisations (NGOs), the creation of the Council of Australian Governments (COAG) and national strategies including the Natural Heritage Trust (NHT), and the introduction of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). From 2000, the focus shifted to regional knowledge and integration, with the formation of 56 regional NRM organisations, the creation of integrated regional NRM plans, and a focus on on-farm biodiversity conservation and environmental management.
- 6.3 The NRM governance structure has developed through the following Australian Government programs:
- National Soil Conservation Program (1983-1992)
 - National Landcare Program (1992-2008)

1 Australian Government, *Caring for our country business plan 2012-13*, Department of Agriculture, Fisheries and Forestry, and Department of Sustainability, Environment, Water, Population and Communities, Canberra, 2011, p. 95.

- Natural Heritage Trust (1997-2008)
 - National Action Plan on Water Quality and Salinity (2001-2008)
 - Caring for our Country (from 2008).
- 6.4 Over the past 20 years the devolution of responsibility to regional and local levels has been evident, with the Australian Government moving towards an integrated, landscape-scale approach to conservation and NRM, using a regional delivery model, and realising the need for 'effective and adaptive management regimes' to support targets in different management contexts.²

Regional delivery model

- 6.5 The current system of NRM governance is a regional delivery model. There are 56 NRM regions in Australia, each based on catchments or bioregions. The boundaries are agreed by the Federal Government in association with the state and territory governments. Each region is overseen by a management body – known as a regional NRM organisation, NRM group or Catchment Management Authority (CMA) – and has a NRM plan.
- 6.6 In Queensland, Western Australia and the Northern Territory, regional NRM organisations are based in the community sector. In the remaining states and territories, regional NRM organisations are based in the government sector, and some have statutory responsibilities.

National framework

- 6.7 The national framework within which regional NRM organisations and NRM bodies operate comprises a range of initiatives and strategies (some of which are listed below) that cover funding, coordination and governance arrangements.
- 6.8 The **Caring for our Country** (CFOC) initiative is the Federal Government program for funding environmental management of Australia's resources. Baseline funding for regional NRM organisations, provided through CFOC, is due to cease in June this year. Organisations may apply for Open Call funding, provided through CFOC, which also provides resources for the Environmental Stewardship Program for private land managers, the Working on Country program for Indigenous ranger groups, and Community Action Grants.

2 Australian Government, *Australia's Strategy for the National Reserve System 2009-30*, endorsed by the Natural Resource Management Ministerial Council, Canberra, May 2009, p. 4. This example referred to 'effective and adaptive management regimes' as supporting actions to meet national targets for a National Reserve System.

- 6.9 The **Clean Energy Future Package** includes:
- The Biodiversity Fund, which is designed to support landholders to undertake restoration and conservation projects, and control pests and weeds
 - The Regional NRM Planning for Climate Change Fund, which provides funding to identified regional NRM organisations to incorporate climate change mitigation and adaptation approaches into existing NRM plans, in order to guide regional NRM planning in a nationally consistent way.
- 6.10 The **Carbon Farming Initiative** encourages sustainable farming practices and provides funding for landscape restoration projects. Farmers and land managers may earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land.³
- 6.11 Some of the nationally agreed strategies relevant to natural resource managers include:
- Australia's Biodiversity Conservation Strategy 2010-30 (Biodiversity Strategy), which includes 10 interim national targets for the first five years, to be formally reviewed in 2015
 - Australian Pest Animal Strategy
 - Australia's Strategy for the National Reserve System 2009-30 (NRS Strategy)
 - Australian Weeds Strategy
 - National framework for the management and monitoring of Australia's native vegetation.
- 6.12 The Standing Council on Environment and Water – as part of the COAG council system, having replaced the NRM Ministerial Council after a review of the ministerial council system undertaken by COAG in 2010 – considers matters of national significance on environment and water issues.

Benefits of NRM delivery at local and regional levels

- 6.13 The Committee received submissions from 11 regional NRM organisations, met with the South West Catchments Council (SWCC) and South Coast NRM in Bunbury, and spoke with a representative from Territory NRM at a public hearing in Darwin. The Committee heard from these bodies about some of the benefits of having NRM delivered at local and regional levels.

3 Department of Climate Change and Energy Efficiency, 'Carbon Farming Initiative – Think Change', <<http://www.climatechange.gov.au/cfi>> viewed 3 January 2013.

- 6.14 The SWCC stated that regional bodies have an advantage in dealing with the changes to biodiversity due to climate change because, while supported at a federal level, they have good relationships with state government agencies, rural community groups (such as Landcare groups), NGOs, and local shires.⁴
- 6.15 The Committee heard examples and suggestions of the successful collaboration and engagement between the local community and regional NRM organisations.⁵ Ms Kate Andrews, Chair of Territory NRM, cited the success of the Territory conservation agreements (voluntary 10-year binding agreements entered into by pastoral landholders) as a good example of working in a collaborative way as an NGO.⁶ Ms Andrews also stated that Territory NRM funds four pastoral Landcare positions, and that they are more trusted in the community as they are not necessarily recognised as being funded by the Federal Government.⁷
- 6.16 The Goulburn Broken CMA stated that members of the community are often more willing to engage with Conservation Management Networks – made up of private landholders, public agencies and the broader community – and Landcare Australia, as they are not perceived to be government agencies.⁸ The Border Rivers-Gwydir CMA stated that it had established meaningful relationships to enable effective delivery of biodiversity conservation programs.⁹
- 6.17 Another of the benefits of NRM delivery by local groups is the level of engagement engendered in the community, as demonstrated by the fact that, as at August 2012, around 93 per cent of farmers were practicing Landcare on their farms.¹⁰

4 South West Catchments Council (SWCC), *Submission 13*, pp. 11-12.

5 Mr Mark Batty, Executive Manager, Environment and Waste, Western Australian Local Government Association (WALGA), *Transcript of evidence*, 7 November 2011, p. 10; Dr Jeremy VanDerWal, Senior Research Fellow, Centre for Tropical Biodiversity and Climate Change, *Transcript of evidence*, 5 July 2012, p. 6; Mr Andrew Maclean, Executive Director, Wet Tropics Management Authority (WTMA), *Transcript of evidence*, 5 July 2012, p. 29.

6 Ms Kate Andrews, Chair, Territory Natural Resource Management (NRM), *Transcript of evidence*, 4 July 2012, p. 9.

7 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 10.

8 Goulburn Broken CMA, *Submission 6*, p. [3].

9 Border Rivers-Gwydir CMA, *Submission 7*, p. 4.

10 National Landcare Facilitator, *Australian farmers embrace Landcare, but call for innovation*, media release, Chatswood, NSW, 9 August 2012.

Is the system working?

- 6.18 The Committee encountered widespread support for the regional NRM delivery model, but also heard about many areas in which improvements could be made, especially in the areas of governance coordination and integration, and program delivery with regard to baseline monitoring and funding.

Integration between levels of governance

- 6.19 There was much discussion during the course of the inquiry about the need for better coordination between the different levels in the NRM system. The Australian Conservation Foundation (ACF) suggested that the Federal Government increase coordination with the state and territory governments in relation to the Biodiversity Strategy, the NRS Strategy, the National Wildlife Corridors Plan (NWCP) and the CFOC initiative, possibly by providing incentives for reforms that align state and territory government laws, policies and practices to the achievement of agreed national biodiversity targets.¹¹ Dr Judy Henderson, a Member of the NWCP Advisory Group suggested the need for a uniform standard of governance across the various regional areas, and for the regional planning process to be integrated with Federal Government programs.¹²
- 6.20 The Committee heard that more integration at the regional level was required, with local governments, regional NRM organisations and Landcare groups all needing to play important roles in environmental management.¹³ The Border Rivers-Gwydir CMA observed that: '[s]ignificant additional coordination of other governance arrangements, knowledge support and collaborative partnerships is required to ensure that the regional delivery model continues to be effective', and that there is a need for knowledge to be provided, relating to the resilience and disturbance thresholds of the ecosystems for which regional NRM organisations are responsible.¹⁴
- 6.21 The Queensland Murray-Darling Committee stated that its regional NRM plan was not consistently referred to or considered by key stakeholder organisations or institutions when they are formulating new regional policies, strategies and plans.¹⁵

11 Australian Conservation Foundation (ACF), *Submission 64*, pp. 9-10.

12 Dr Judy Henderson, Member, National Wildlife Corridors Plan (NWCP) Advisory Group, *Transcript of evidence*, 12 October 2012, pp. 23, 26.

13 Border Rivers-Gwydir CMA, *Submission 7*, p. 3.

14 Border Rivers-Gwydir CMA, *Submission 7*, p. 4.

15 Queensland Murray-Darling Committee, *Submission 14*, p. 12.

- 6.22 Ms Andrews from Territory NRM stated that decisions needed to be made at the most appropriate level, where people have an understanding of the context that the decisions are being made in.¹⁶ Similarly, the South Australian Government stated that 'government is able to create the institutional frameworks and provide the guidance at a high level' and that, for the Australian Government, opportunities lie in providing 'frameworks at the high level and providing the support to enable those people closest to the ground to progress what they see as important at the time.'¹⁷ Ms Penelope Figgis, Vice Chair for Oceania for the International Union for Conservation of Nature World Commission on Protected Areas (IUCN WCPA) stated that 'big picture national leadership is critical'.¹⁸
- 6.23 The Committee heard that implementation of NRM plans in non-statutory jurisdictions (such as WA) can be difficult where there is conflict between NRM plans and any land-use planning powers of the local jurisdiction. In the event of any conflict, local planning powers will generally override a NRM plan, which means that the best environmental outcomes are not always achievable due to conflicting governance powers.¹⁹
- 6.24 The Committee was advised that, in WA, local governments are successfully engaging with NRM regions on issues such as the impacts that land-use planning decision making is having on the environment.²⁰ The Western Australian Local Government Association (WALGA) stated that regional NRM organisations need to understand the land-use planning framework, and suggested that provision of the right expertise could achieve this.²¹
- 6.25 The Committee heard views which compared the operation of CFOC to other funding programs, such as the National Heritage Trust (NHT). Mr Keiran McNamara, Director General of the WA Department of Environment and Conservation, told the Committee that, compared to the former operation of the NHT, CFOC is being run in less of a partnership way, and that now there was more of a direct relationship between regional NRM organisations and the Federal Government.²²

16 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 12.

17 Mr Greg Leaman, Executive Director, Policy, Department of Environment and Natural Resources (South Australian Government), *Transcript of evidence*, 17 May 2012, p. 12.

18 Ms Penelope Figgis, Vice Chair for Oceania, International Union for Conservation of Nature World Commission on Protected Areas (IUCN WCPA), *Transcript of evidence*, 28 March 2012, p. 25.

19 Mr Batty, WALGA, *Transcript of evidence*, 7 November 2011, p. 10.

20 Mr Batty, WALGA, *Transcript of evidence*, 7 November 2011, p. 10.

21 Mr Batty, WALGA, *Transcript of evidence*, 7 November 2011, pp. 9, 11.

22 Mr Keiran McNamara, Director General, Department of Environment and Conservation (Western Australian Government) (DEC), *Transcript of evidence*, 7 November 2011, p. 4.

Mr McNamara was concerned that there was no longer discussion about CFOC at the COAG ministerial council level, as there used to be during the NHT.²³ The SWCC stated that CFOC allowed past strong local NRM planning to lapse.²⁴

- 6.26 The Committee also received evidence from Greening Australia about the more competitive nature of CFOC, as compared to the NHT, with community groups now having to compete with the NRM bodies for funding.²⁵ Mr Sean Sullivan, Acting Deputy Secretary of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC) gave evidence to the effect that expression of interest processes could be expected in future for funding application requirements, in order to foster cooperation and collaboration between regions to address shared issues.²⁶

Regional program delivery

- 6.27 The Committee heard that regional NRM organisations have had varied success in delivering NRM programs, due to the differences in the level of skills and knowledge within the organisations, particularly on biodiversity and connectivity conservation, but also on land-use planning legislation.²⁷ The SWCC stated that 'NRM governance has become increasingly complex over time and will require people with good analysis, able leadership and good knowledge'.²⁸
- 6.28 Professor Kristine French, President of the Ecological Society of Australia stated on her own behalf that inserting ecologists into CMAs would boost the level of skill and help lead and guide the community a little better, but indicated that the lack of available funding prevented those people being engaged in working in the field.²⁹
- 6.29 BirdLife Australia and the Conservation Council of South Australia suggested that the Federal Government roll out biodiversity education and training programs to all sectors of the community, in order to

23 Mr McNamara, DEC, *Transcript of evidence*, 7 November 2011, p. 7.

24 SWCC, *Submission 13*, p. 12.

25 Mr Hamish Jolly, Advisor and former Chief Executive Officer, Greening Australia, *Transcript of evidence*, 7 November 2011, p. 34.

26 Mr Sean Sullivan, Acting Deputy Secretary, Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), *Transcript of evidence*, 12 October 2012, p. 29.

27 Professor Kristine French, President, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 18; Ms Figgis, IUCN WCPA, *Transcript of evidence*, 28 March 2012, p. 25; Mr Batty, WALGA, *Transcript of evidence*, 7 November 2011, p. 10.

28 SWCC, *Submission 13*, p. 12.

29 Professor French, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 18.

- 'upgrade ecological literacy, and improve skills in biodiversity management'.³⁰ Ms Andrews of Territory NRM suggested the need to invest in long-term training programs for people, to ensure that there is the human capacity to deal with biodiversity issues in future.³¹
- 6.30 Several regional NRM organisations discussed the successful local programs being undertaken. One such example described as having gained strong community acceptance is the enterprise-based conservation program being undertaken in the Western Division of NSW regions. The program has established conservation as a viable alternative enterprise to grazing, recognising an economic value of the environmental services provided.³² The Namoi CMA stated that the program can be undermined by surrounding land-use decisions, and ineffective if not supported by an effective legislative regime.³³ Both the Western CMA and the Namoi CMA emphasised the need for greater and ongoing funding for such private land conservation programs.
- 6.31 It was suggested that the strong relationship enjoyed between Territory NRM and the Northern Territory Cattlemen's Association assists in successful program delivery in the Northern Territory region. Ms Andrews stated that Territory NRM holds an annual NRM forum, at which local groups and individuals can get together and discuss what is working.³⁴ The Conservation Management Networks and Landcare groups in the Goulburn Broken CMA's region also provide forums for community members to meet and exchange information. The Goulburn Broken CMA suggested that such forums, along with environmental grants and other instruments, needed to link in to state and federal programs in order to create confidence in the actions being undertaken as part of a bigger policy picture.³⁵
- 6.32 Terrain NRM from Queensland stated that the combination of the Carbon Farming Initiative and existing NRM arrangements is effective in ensuring carbon sequestration and abatement will improve landscape health and resilience.³⁶
- 6.33 The Committee heard that relationships between regional NRM organisations and local groups can work as a double-edged sword, in that

30 BirdLife Australia (formerly Birds Australia), *Submission 40*, p. [12]; Conservation Council of South Australia, *Submission 58*, p. [6].

31 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 9.

32 Western CMA, *Submission 42*, pp. 3-4.

33 Namoi CMA, *Submission 31*, p. 3.

34 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 11.

35 Goulburn Broken CMA, *Submission 6*, p. [3].

36 Terrain NRM, *Submission 47*, p. 7.

they can be more trusted in the community but not necessarily recognised as being funded by the Federal Government.³⁷

Baseline monitoring

- 6.34 One of the 10 interim national targets in the Biodiversity Strategy is to establish a national long-term biodiversity monitoring and reporting system by 2015.³⁸
- 6.35 It was suggested in evidence that the abolition in 2009 of the research and development corporation Land and Water Australia left a gap in natural environmental research. In 2010, a Productivity Commission report recommended the creation of a new rural research and development corporation, to invest in non-industry specific research and development that promotes productive and sustainable resource use by Australia's rural sector.³⁹ The Australian Government did not agree with this recommendation.⁴⁰
- 6.36 The 2011 Australian State of the Environment report stated that biodiversity indicators for national state of the environment reporting have differed since the first report in 1996, 'due largely to the lack of information available.'⁴¹
- 6.37 BirdLife Australia suggested that the reintroduction of a research and development corporation was required in order to undertake research into sustainable land and water management and 'establish a long-term monitoring and auditing framework for biodiversity across the continent to assess the impacts of climate change and other drivers of terrestrial, freshwater and marine biodiversity loss'.⁴²
- 6.38 The 2009 report by the Biodiversity and Climate Change Expert Advisory Group, commissioned by the Australian Government and prepared for the NRM Ministerial Council, outlined an approach proposing a new national institution to review the status of Australia's natural resources and advise on progress in achieving biodiversity targets. This institution could also

37 Ms Andrews, Territory NRM, *Transcript of evidence*, 4 July 2012, p. 10.

38 Natural Resource Management Ministerial Council, *Australia's Biodiversity Conservation Strategy 2010-30*, report prepared by the National Biodiversity Strategy Review Task Group, NRMCC, Canberra, 2010, p. 10.

39 Australian Government, *Rural Research and Development Corporations: Report no. 52, final inquiry report*, Productivity Commission, Canberra, 2011, pp. 218-20.

40 Australian Government, *Rural Research and Development Policy Statement*, Department of Agriculture, Fisheries and Forestry, Canberra, July 2012, p. 34.

41 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 576.

42 BirdLife Australia, *Submission 40*, p. [9].

provide advice at the COAG level in relation to the need to adjust targets and programs, based on the knowledge gained.⁴³

Funding

6.39 The Committee heard that one of the barriers to engaging the community with biodiversity conservation is a lack of consistent funding and the existence of grant application 'fatigue'. The Committee heard from Professor Mark Hovenden from the University of Tasmania, in relation to research on the impacts of rising carbon dioxide concentrations, that a lack of security and certainty in future funding of research tasks, created by short funding cycles, results in research being ad hoc and locally directed, and makes carrying out long-term experiments very difficult.⁴⁴ The Committee heard about the need for significant long-term investment for the success of NRM programs.⁴⁵ Ms Figgis from the IUCN WCPA suggested that:

... we should be looking at projects on 10-year contracts, where people have to report against indicators and perform as in any contract. I do not think they should be short term. I do not think they should be yearly. I think that is exhausting for people. No truly important land repair effort is going to take one year. The danger of that scatter-gun drip-feed approach is that you end up not achieving very much.⁴⁶

6.40 The Committee heard from Mr John Gunn, Chief Executive Officer of the Australian Institute of Marine Science that more investment is needed in sustained rather than three-year lapsing program measurements of the environment, in the terrestrial, marine and cryospheric environments.⁴⁷

6.41 The NSW Environmental Trust is an 'independent statutory body established by the NSW Government to fund a broad range of organisations to undertake projects that enhance the environment of NSW'.⁴⁸ Mr Kevin Evans, Chief Executive Officer of the National Parks Association of NSW informed the Committee that the Environmental

43 W. Steffen, A.A. Burbidge, L. Hughes, R. Kitching, D. Lindenmayer, W. Musgrave, M. Stafford Smith, P.A. Werner, *Australia's biodiversity and climate change*, CSIRO publishing, Collingwood, Victoria, 2009, p. 164.

44 Associate Professor Mark Hovenden, University of Tasmania, *Transcript of evidence*, Melbourne, 4 May 2012, p. 32.

45 Border Rivers-Gwydir CMA, *Submission 7*, p. 3.

46 Ms Figgis, IUCN WCPA, *Transcript of evidence*, 28 March 2012, p. 23.

47 Mr John Gunn, Chief Executive Officer, Australian Institute of Marine Science, *Transcript of evidence*, 5 July 2012, p. 22.

48 NSW Government, 'Environmental Trust: NSW Environment and Heritage', <<http://www.environment.nsw.gov.au/grants/envtrust.htm>> viewed 9 April 2013.

Trust had – for the round of funding at the time Mr Evans spoke to the Committee in March 2012 – changed the length of funding provided for on-ground regeneration programs from one year to six years:

So initiatives that require a long-term commitment to restore the habitat can now have a guarantee that it is not going to be one year of funding and then the challenge of doing it again; it is now six years for some of the large scale projects, which we believe is a big step in the right direction.⁴⁹

- 6.42 Mr Jolly from Greening Australia suggested a fixed and variable component to funding could be introduced, for the groups that NRMs select to work with.⁵⁰
- 6.43 The Committee heard from the Australian Institute of Aboriginal and Torres Strait Islander Studies that Indigenous communities are very grants-driven and that ‘more consistent long-term funding with appropriate administrative, community engagement and management support is required to ensure delivery of high quality outcomes’.⁵¹
- 6.44 The Federal Government provided \$711 million in baseline funding to the 56 regional NRM organisations in the first five years of CFOC.⁵² This baseline funding will cease from July 2013.⁵³ The Committee heard that CFOC had provided very little funding for local governments. For example, about 0.08 per cent of the program’s funding has gone to local governments in Western Australia.⁵⁴
- 6.45 The Committee understands that, from July 2013, a new five year funding plan for Caring for our Country will come into operation, with the Australian Government committed to providing more than \$2 billion over that period.⁵⁵ The funding model offers two streams, relating to

49 Mr Kevin Evans, Chief Executive Officer, National Parks Association of NSW, *Transcript of evidence*, 28 March 2012, p. 29.

50 Mr Jolly, Greening Australia, *Transcript of evidence*, 7 November 2011, p. 34.

51 Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS), *Submission 34.1*, p. 7; Dr Lisa Strelein, Director of Research, Indigenous Country and Governance, AIATSIS, *Transcript of evidence*, 20 September 2012, p. 2.

52 Australian Government, *Caring for our country business plan 2012-13*, Department of Agriculture, Fisheries and Forestry, and Department of Sustainability, Environment, Water, Population and Communities, Canberra, 2011, p. 12.

53 Australian Government, Caring for our Country, ‘Regional base-level funding’, <<http://www.nrm.gov.au/funding/previous/regional-base-level/index.html>> viewed 9 April 2013.

54 Mr Batty, WALGA, *Transcript of evidence*, 7 November 2011, p. 10.

55 Australian Government, Caring for our Country, ‘Funding’, <<http://www.nrm.gov.au/funding/index.html>> viewed 9 April 2013.

sustainable environment and sustainable agriculture, with funding programs including:

- community environment grants available to 'help community groups and organisations to contribute to the sustainable management of Australia's environment'
- target area grants to provide funding for projects 'to maintain ecosystem services, protect our conservation estate, and enhance the capacity of Indigenous communities to conserve and protect natural resources across six target areas'
- community Landcare grants to 'help local community-based organisations and groups take on-ground action and build their capacity and skills to manage their natural environment and productive lands'.⁵⁶

6.46 One of the issues raised in the review of Caring for our Country was that the competition for funding did not promote cooperation between regions. Mr Sullivan of DSEWPAC stated that the Department was looking at ways to promote cooperation and, as referred to above:

... you can envisage some programmatic funding being put out to more expression-of-interest processes, where we are saying, 'Look, we're interested in your ideas', and then fostering the cooperation and also promoting the fact that we are looking for cooperation between regions, particularly where those issues are shared.⁵⁷

Conclusions and recommendations

Natural resource management program delivery

- 6.47 The Committee encountered widespread support for the regional NRM delivery model. Evidence suggested the need for a strategic and large scale plan that is locally driven. This requires long term, stable arrangements in order to be successful, including more collaborative relationships across state and territory borders.
- 6.48 The Committee heard about the need for greater and longer term funding grants for regional NRM organisations and local NRM groups. Short funding cycles make it difficult for regional NRM organisations and local NRM groups to have certainty and confidence in planning for the future,

56 Australian Government, Caring for our Country, 'Funding', <<http://www.nrm.gov.au/funding/index.html>> viewed 9 April 2013.

57 Mr Sullivan, DSEWPAC, *Transcript of evidence*, 12 October 2012, p. 29.

and to maintain competent and consistent human capital. It was suggested that longer funding cycles would be more beneficial.

- 6.49 The Committee heard that the application process for funding was too competitive between regional NRM organisations and local NRM groups, as well as across regions. DSEWPAC gave evidence to the effect that expression of interest processes could be expected for future funding application requirements, in order to foster cooperation between regions in getting together to address shared issues.
- 6.50 Overall, the Committee was impressed by the professionalism and commitment of the NRM organisations and local NRM groups that participated in the inquiry. However, the Committee is also aware that, because NRM bodies originated in different jurisdictions and with different capacities nationwide, their consistency, standards and quality are inevitably variable. As recipients of public funds, all NRM organisations and local NRM groups should be able to demonstrate that those resources will be used to best effect and the Committee believes there is scope for improvement.
- 6.51 The Committee would like the Australian Government to review NRM boards, in particular in relation to these three areas.

Recommendation 12

- 6.52 **In recognising the importance that NRM boards operate effectively, the Committee recommends that the Australian Government conduct a review, with particular reference to:**
- **funding, including assessing claims that existing application processes result in ‘grant fatigue’, and can foster competition, rather than cooperation between NRM bodies**
 - **measures to improve consistency of standards between NRM bodies nationally**
 - **measures which may improve skills management, including sufficient capacity to attract and retain personnel, especially in regional areas.**

Research and development

- 6.53 The Committee notes that in evidence provided to the inquiry there was broad support for the re-establishment of a research and development corporation to continue the work of the now disbanded Land and Water Australia. However the Australian Government, in its response last year

to the Productivity Commission's recommendation to create such a body, stated that 'increased focus on collaboration and cross-sectoral research can be achieved within existing arrangements.' The Government also outlined some of its plans to achieve this.⁵⁸

- 6.54 In recognition of the expressed need for re-creating such a body, the Committee believes that it would be reasonable for the Australian Government to confirm that it is meeting these research and development needs through other means.

Recommendation 13

- 6.55 **That the Australian Government advise the Committee and stakeholders as to how the research and development needs formerly undertaken by Land and Water Australia are now being met.**

58 Australian Government, *Rural Research and Development Policy Statement*, July 2012, p. 34.

Governance issues

Introduction

- 7.1 The Committee was asked to assess whether current governance arrangements are well placed to deal with the challenges of conserving biodiversity in a changing climate.
- 7.2 Australia has a complex system of environmental governance, with national, state and local government policies, strategies and legislation in place. The Committee specifically looked at governance measures related to biodiversity conservation and the issues surrounding those measures.
- 7.3 The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) is Australia's principal piece of environmental legislation, providing a framework to protect and manage matters of national environmental significance.
- 7.4 Some of the policies and strategies in place that impact on biodiversity conservation include:
- Australia's Biodiversity Conservation Strategy 2010-2030
 - Australia's Strategy for the National Reserve System 2009-2030
 - Australian Pest Animal Strategy 2007
 - Australian Weeds Strategy 2007
 - Caring for our Country
 - state and territory biodiversity strategies.
- 7.5 Several governance issues have been discussed in previous chapters, specifically in relation to connectivity conservation, climate change adaptation strategies and natural resource management. This chapter will focus on the discussion and reactions surrounding the proposed changes to the EPBC Act; the current and required governance to manage invasive

species; Australia's obligations under various international biodiversity and climate change instruments; and cross-border management systems for national heritage places such as the Australian Alps and integrated forest management. In this chapter, conclusions and recommendations are made regarding all of these issues.

Environment Protection and Biodiversity Conservation Act

Outline of the EPBC Act

- 7.6 As stated above, the EPBC Act is Australia's principal piece of environmental legislation, providing a framework to protect and manage the eight matters of national environmental significance, namely:
- world heritage sites, including the Great Barrier Reef, Kakadu National Park, the Wet Tropics of Queensland and the Tasmanian Wilderness
 - national heritage places, including the Australian Alps National Parks and Reserves – Kosciuszko National Park
 - wetlands of international importance ('Ramsar' wetlands), including the Coorong and Lakes Alexandrina and Albert wetland in South Australia, Western Port in Victoria and Kakadu National Park
 - nationally threatened species and ecological communities, including the critically endangered orange-bellied parrot and the endangered mountain pygmy-possum
 - migratory species, including the curlew sandpiper, red-necked stint and eastern curlew
 - Commonwealth marine areas, that is any part of the sea that is within the exclusive economic zone or over the continental shelf, that is not part of state or Northern Territory waters
 - the Great Barrier Reef Marine Park
 - nuclear actions.

Evolution of proposed changes to the EPBC Act

- 7.7 On 31 October 2008, the Minister for the Environment, Heritage and the Arts commissioned an independent review of the EPBC Act, which was required to be undertaken within the first ten years of the commencement of the Act, pursuant to s. 522A.

- 7.8 In March 2009, the Senate Standing Committee on Environment, Communications and the Arts published its first report into the operation of the EPBC Act, with its second report published in April 2009.
- 7.9 On 29 June 2009, Dr Allan Hawke released the interim report of his independent review of the EPBC Act which identified the major themes for the review.
- 7.10 On 30 October 2009, Dr Allan Hawke delivered the final report of his independent review of the EPBC Act to government and the report was publicly released on 21 December 2009.
- 7.11 On 24 August 2011, the Minister for Sustainability, Environment, Water, Population and Communities released the Australian Government response to the Hawke review. At the same time, the Minister announced a national environment law reform package, with 12 key elements (including proposed changes to the EPBC Act), including:
- a more streamlined assessment process
 - new national standards for accrediting environmental assessment and approval processes
 - a new biodiversity policy for consultation, to deliver a more integrated approach to biodiversity conservation in a changing climate
 - improving the listing of species for protection by creating a single national list of threatened species and ecological communities
 - identifying and protecting ecosystems of national significance (as a new matter of national environmental significance), through regional environment plans, strategic assessments or conservation agreements.
- 7.12 Also in August 2011, the Council of Australian Governments (COAG) agreed to a national reform agenda on environment regulation, that included:
- creating more effective environmental assessment and approval processes, and developing national standards
 - developing a national threatened species list to reduce duplication and increase business certainty.
- 7.13 In September 2011, the Australian Government released its response to the Senate Standing Committee on Environment, Communications and the Arts' reports on the operations of the EPBC Act.
- 7.14 At the 13 April 2012 COAG meeting, it was agreed that governments would work together to develop bilateral agreements allowing the Australian Government to accredit state and territory assessment and approval processes.

- 7.15 On 8 June 2012, the Statement of Environmental and Assurance Outcomes was released.
- 7.16 In July 2012, the draft Framework of Standards for Accreditation of Environmental Approvals under the EPBC Act was provided to state and territory governments, and publicly released on 2 November 2012. This document was used as the basis for preliminary discussions for the development of bilateral agreements. These discussions identified challenges with the approach. According to Dr Kimberley Dripps, Deputy Secretary of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), at a Senate Committee hearing in February 2013, the Department was not progressing with approval bilateral agreements at that time.¹
- 7.17 At the 7 December 2012 COAG meeting, it was agreed that governments would work to eliminate duplication, avoid delayed approval processes, and utilise common information requirements for regulatory processes.

Bilateral agreements

- 7.18 The main issues in evidence received about changes to the EPBC Act concern the proposed new national standards for accrediting environmental assessment and approval processes, and thereby changes to bilateral agreements between the Commonwealth and state and territory governments.

Current arrangements

- 7.19 Bilateral agreements allow the Commonwealth to delegate to the states/territories the responsibility for granting environmental assessments and approvals under the EPBC Act. In order to be accredited, a state/territory process will need to meet 'best practice' criteria.
- 7.20 The EPBC Act currently provides for bilateral agreements that:
- protect the environment
 - promote the conservation and ecologically sustainable use of natural resources
 - ensure an efficient, timely and effective process for environmental assessment and approval of actions

1 Department of Sustainability, Environment, Water, Population and Communities (DSEWPAC), 'Reform of the Environment Protection and Biodiversity Conservation Act', <<http://www.environment.gov.au/epbc/reform/index.html>> viewed 8 February 2012; Dr Kimberley Dripps, DSEWPAC, Senate Environment and Communications References Committee Inquiry into the EPBC Amendment (Retaining Federal Approval Powers) Bill 2012 *Transcript of evidence*, 15 February 2013, p. 56.

- minimise duplication in the environmental assessment and approval process through Commonwealth accreditation of the processes of the state or territory (and vice versa).²

7.21 If a bilateral assessment of a proposed action is undertaken through an accredited state/territory process then the Minister still needs to give final approval of the proposed action under the EPBC Act. If a bilateral approval of a proposed action, pursuant to a management plan, is undertaken through an accredited state/territory process then there is no further requirement for approval by the Minister under the EPBC Act.

Concerns raised about proposed changes

7.22 Many inquiry participants were concerned that the proposed changes might give states/territories automatic accreditation, even though assessment and approval processes may not be up to the standard required by the Commonwealth legislation. Ms Christine Goonrey, President of the National Parks Australia Council (NPAC) explained that:

One of the biggest concerns is that it is pointing towards a devolution of decision making towards state agencies, and that is where our members are seeing a real return to anti-environmental values. There are a number of state jurisdictions which see very great political advantage in downplaying environmental values and the protection of biodiversity. So to have the EPBC Act actually take that backward step is deeply concerning to a large range of environmental organisations.³

7.23 Ms Goonrey was also concerned that there is currently no room for community involvement in approvals processes.⁴

7.24 Ms Nicola Rivers of the Environmental Defenders' Office Victoria expressed concerns with the proposed changes to the EPBC Act, specifically with the Commonwealth accrediting state/territory government processes to make assessments and approvals under the EPBC Act and therefore not having oversight.⁵

7.25 Another of the concerns raised was that state/territory governments are often the proponent of a development and therefore they would be

2 EPBC Act, s. 44.

3 Ms Christine Goonrey, President, National Parks Australia Council (NPAC), *Transcript of evidence*, 2 March 2012, p. 27.

4 Ms Goonrey, NPAC, *Transcript of evidence*, 2 March 2012, p. 28.

5 Ms Nicola Rivers, Law Reform Director, Environmental Defender's Office Victoria, Australian Network of Environmental Defender's Offices (ANEDO), *Transcript of evidence*, 4 May 2012, p. 8.

assessing their own developments, leading to a conflict of interest.⁶ The removal of checks and balances needed for impartial and rigorous assessment was also raised as a concern.⁷

- 7.26 Ms Julia Winefield, Campaign Coordinator of the Conservation Council of South Australia expressed concern about the COAG process, announced in April 2012, to have bilateral assessments and approvals ready by March 2013, and wanted to slow down the process to allow more consultation.⁸ Representatives of the Australian Network of Environmental Defender's Offices (ANEDO) stated the lack of time announced in the COAG time frame shows no intention to raise the standards of those state and territory processes, and were further concerned that the Commonwealth will not have any power to oversight individual projects.⁹
- 7.27 The Committee is aware of views that states and territories have lower levels of environmental protection standards than the Commonwealth, and the devolution of powers to the states and territories could increase the likelihood of further reduction of these environmental protection standards.¹⁰ Ms Elizabeth McKinnon of the Environmental Defenders' Office Victoria stated that standards in the states and territories must equal those of the Commonwealth, and that that is not the case in most states, and of the need for an EPBC standard requiring the Commonwealth not to accredit a state or territory process until satisfied it has adequate monitoring and enforcement in place.¹¹
- 7.28 Related concerns were expressed that devolution of powers to the states and territories may lead to competition between them for development projects, creating the potential for compromising environmental standards in order to gain revenue from projects.¹² Further:

The other huge concern there is that the EPBC Act is designed to provide protection in nationally significant environment matters

6 Ms Rivers, Environmental Defenders' Office Victoria, ANEDO, *Transcript of evidence*, 4 May 2012, p. 8; Liz Burton, *Submission 85*, p. 2; Miss Noriko Wynn, Policy and Communications Officer, Conservation Council of South Australia, *Transcript of evidence*, 17 May 2012, p. 17.

7 Liz Burton, *Submission 85*, p. 22.

8 Ms Julia Winefield, Campaign Coordinator, Conservation Council of South Australia, *Transcript of evidence*, 17 May 2012, p. 18.

9 Ms Elizabeth McKinnon and Ms Rivers, Environmental Defenders' Office Victoria, ANEDO, *Transcript of evidence*, 4 May 2012, pp. 10, 11.

10 Views were expressed by a range of inquiry participants, including from Liz Burton, *Submission 85*, p. 22.

11 Ms McKinnon, Environmental Defenders' Office Victoria, ANEDO, *Transcript of evidence*, 4 May 2012, p. 10.

12 Miss Wynn, Conservation Council of South Australia, *Transcript of evidence*, 17 May 2012, p. 17.

and in issues that are nationally important, that have a national perspective and that look at the national interest. That will now be delegated to the states and so the states will be, in effect, making decisions that are supposed to be in the national interest and looking at nationally important matters – matters that may cross borders into other states, for example. We have absolutely no confidence that a state government would take the national interest over the state's own interest.¹³

Suggested improvements to bilateral agreement process

7.29 According to ANEDO, bilateral approval agreements should not be made, but if they were, national standards and accredited state/territory processes should provide at least equivalent protection to matters of national environmental significance to that provided in the EPBC Act, suggesting many requirements be put in place for bilateral agreements. The suggested requirements included that the state/territory system being accredited must:

- improve or maintain all matters of national environmental significance
- provide a decision making framework that prevents significant environmental impacts where possible, mitigates unavoidable impacts, and offsets any impacts that will occur
- demonstrate active adaptive management in responding to emerging threats, non-compliance and public concerns
- clearly identify when considerations other than environmental impacts, for example social and economic considerations, are taken into account in decision making ...
- include timeframes and processes for meaningful public participation and input that are at least equivalent to those under the EPBC Act
- include the ability to make legally binding environmental conditions as part of project approvals
- not exclude judicial review of any decisions covered by the agreement ...
- contain a transparent and robust system of compliance monitoring to ensure project proponents are complying with project approvals and conditions, including minimum monitoring requirements that the states must meet
- contain enforcement powers at least equivalent to those under the EPBC Act to enforce breaches of approvals and conditions.¹⁴

13 Ms Rivers, Environmental Defenders' Office Victoria, ANEDO, *Transcript of evidence*, 4 May 2012, p. 9.

14 ANEDO, *Submission 57.1*, pp. [3]-[4].

7.30 ANEDO went on to suggest four principles that should apply in the case of bilateral approval agreements, namely:

- bilateral approval agreements will not apply when the State or Territory Government is the project proponent or major supporter of the project or stands to directly financially benefit from the project
- finalisation of bilateral approval agreements will be based on whether the State or Territory meets the national standard as set out in regulations, rather than on meeting artificial timelines (such as the March 2013 date proposed by COAG) ... This may include the need for the State or Territory to make legislative amendments
- the Commonwealth will retain the right to 'call in' the project for a separate Federal assessment and/or approval if it does not think the State has adequately assessed the project according to the bilateral agreement. (This is currently the case for assessment bilaterals and should be retained for approval bilaterals)
- include in the EPBC Act a requirement that bilateral approval agreements will be monitored by the Commonwealth and regular performance audits will be conducted to ensure that States are complying with bilateral agreements. An independent 'Commonwealth Environment Commission' should be established for this role. The Commonwealth must [be] prepared to terminate the agreement if States are not complying with it.¹⁵

7.31 The Urban Development Institute of Australia stated that a lack of coordination between the Commonwealth and state/territory governments often leads to significant delays, impacting upon land supply and increased costs affecting the level of affordable housing.¹⁶ The Institute supported the need to minimise the duplication of processes through strategic assessments and bilateral agreements by establishing processes enabling 'single strategic assessments' to occur prior to urban rezoning, thereby allowing developers to respond to requirements early in the development process.¹⁷

15 ANEDO, *Submission 57.1*, p. [4].

16 Urban Development Institute of Australia, *Submission 26*, p. [2].

17 Urban Development Institute of Australia, *Submission 26*, p. [2].

Governance of species and communities

Legislative effectiveness

- 7.32 The EPBC Act requires the Minister to establish a list of threatened species, a list of threatened ecological communities and a list of key threatening processes.¹⁸ Key threatening processes are those that threaten or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Two invasive species listed as key threatening processes include dieback caused by the root-rot fungus *phytophthora cinnamomi* and invasion of northern Australia by gamba grass and other introduced grasses. Another listed key threatening process is the loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- 7.33 The Committee received evidence that raised concerns about proposed changes to the EPBC Act related to the identification and listing of threatened species and ecological communities. ANEDO suggested that the EPBC Act needs to protect species and their habitats in anticipation of them becoming threatened or endangered.¹⁹ Many submitters were supportive of the premise of introducing protections for 'ecosystems of national importance', but one inquiry participant was concerned about the restricted nature in how they will be put forward and the little opportunity afforded for community input into the process.²⁰
- 7.34 The Senate Environment, Communications and the Arts Committee, in its first report on the operations of the EPBC Act published in March 2009, recommended that the process for nomination and listing of threatened species and ecological communities be amended to improve transparency, rigour and timeliness.²¹ The Australian Government responded to this recommendation in September 2011 by agreeing to establish a single list of nationally threatened species and ecological communities, working with state and territory governments to create a harmonised listing process, and agreeing to publicly release the advice of the relevant scientific advisory committee on decisions to list or not list a threatened species or ecological community.²²

18 EPBC Act, ss. 178, 181, 183.

19 Ms McKinnon, Environmental Defenders' Office Victoria, ANEDO, *Transcript of evidence*, 4 May 2012, p. 9; ANEDO, *Submission 57*, p. 16.

20 Miss Wynn, Conservation Council of South Australia, *Transcript of evidence*, 17 May 2012, p. 17.

21 Senate Standing Committee on Environment, Communications and the Arts, *The operation of the Environment Protection and Biodiversity Conservation Act 1999*, Canberra, March 2009, p. x.

22 Australian Government, Response to the Senate Standing Committee on Environment, Communications and the Arts Committee Report: *Operations of the Environment Protection and*

- 7.35 Threat abatement programs provide for actions necessary to reduce the impact of listed key threatening processes under the EPBC Act on native species and ecological communities. At a national level, the 2011 State of the Environment (SOE) report stated that cross-tenure delivery of threat abatement programs is necessary for landscape-scale approaches, and a sound understanding of the target species and communities is needed to be able to design and evaluate threat abatement programs.²³
- 7.36 In the 2008 Assessment of Australia's terrestrial biodiversity, it was found that data on invasive species is poor nationally and there are major gaps in our understanding of the impacts of invasive species and pathogens on biodiversity.²⁴ In relation to invasive species and pathogens, the 2011 SOE report, quoting the 2008 Assessment of Australia's terrestrial biodiversity, stated the following:
- ... [there is] 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. The scale of the impacts from threatening processes is such that the voluntary and uncoordinated approaches adopted to date will not be effective.²⁵
- 7.37 The 2011 SOE report stated that it was difficult to assess the effectiveness of management of invasive species and pathogens from state and territory SOE reports because of a lack of reporting on the effectiveness of processes or on outputs or outcomes.²⁶
- 7.38 The 2011 SOE report also stated that there are no institutions that conduct ongoing assessments of the impacts of weeds on biodiversity, and that the measures adopted to understand the invasion of weeds are not at the level required to plan strategies to mitigate the problems they create.²⁷ Professor

Biodiversity Conservation Act 1999 (First, Second and Final Reports), Canberra, September 2011, p. 5.

23 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 659.

24 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 634, 638.

25 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 656.

26 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 656.

27 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, pp. 633, 636.

Kristine French, President of the Ecological Society of Australia stated that there is a research gap in the response of weeds and their interaction with climate change.²⁸

Threatened species and translocation

- 7.39 The Committee heard about the potential for using translocations of threatened species in future, as part of the armoury for combating the effects of climate change on biodiversity and on threatened species in particular. The Committee understands that Australia needs regulations which allow the active movement of species to new places, particularly for iconic species.
- 7.40 The Committee notes that regulatory issues will need attention especially in light of the National Wildlife Corridors Plan and increasing number of large-scale wildlife corridors operating across state and territory borders (as discussed in chapter four).
- 7.41 The Committee heard from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) about some of the challenges associated with translocation across state borders and that governance impediments need to be removed in order to develop a comprehensive, adaptive response to climate change. Dr Craig James of CSIRO indicated that once a decision is made to keep a species from becoming extinct the next decision concerns when to undertake its translocation for it to be successful in terms of population size of the species, in relation to climate change and the risks involved, and in order to be cost effective.²⁹ Dr James explained that translocations had been successfully used in the past, but that a lot of regulation existed relating to crossing state borders, in order not to disadvantage the new area, and taking into account acts and regulations already in place.³⁰
- 7.42 The Committee heard from the Western Australian Local Government Association that a 'lack of information and a time consuming process mean species are not protected as quickly as possible and listing is usually done as a result of reactive pressures'.³¹ Dr James stated that legislation around threatened species requires that every listed species gets a management plan, which does not take into account the sorts of

28 Professor Kristine French, President, Ecological Society of Australia, *Transcript of evidence*, 28 March 2012, p. 17.

29 Dr Craig James, Research Theme Leader, Building Resilient Australian Biodiversity Assets, Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Transcript of evidence*, 16 August 2012, p. 3.

30 Dr James, CSIRO, *Transcript of evidence*, 16 August 2012, p. 5.

31 Western Australian Local Government Association, *Submission 37*, p. 10.

mechanisms that might be needed to manage species into the future, as the climate changes.³²

- 7.43 The Committee heard that management options available include genetic translocation and assisted migration, neither of which have been well examined but will have to be used in future.³³ Dr Ben Phillips, Senior Research Fellow at the Centre for Tropical Biodiversity and Climate Change, suggested that the Australian Research Council (ARC) could be responsible for funding research in these areas.³⁴

Biosecurity considerations

- 7.44 The Australian Quarantine and Inspection Service (AQIS) manages quarantine controls at Australia's borders, to minimise the risk of exotic pests and diseases entering the country. The Committee heard that biosecurity risk assessments for invasive species will need to be developed to take account of climate change.³⁵ In its second interim report the Committee commented on 'the importance of cooperation between all levels of government towards a national quarantine system which may limit the spread of diseases and invasive weeds in the future.'³⁶
- 7.45 On 18 December 2008, the Australian Government released the report of an independent review of Australia's quarantine and biosecurity arrangements (the Beale review). The report recommended:
- the need for improved partnerships with states/territories and with industry
 - improved governance, including an independent commission to assess biosecurity risks of imports
 - a national authority to undertake biosecurity operations, and an Inspector-General to audit the authority
 - new biosecurity legislation to replace the *Quarantine Act 1908* (Cth)

32 Dr James, CSIRO, *Transcript of evidence*, 16 August 2012, p. 5.

33 Dr Ben Phillips, Senior Research Fellow, Centre for Tropical Biodiversity and Climate Change, *Transcript of evidence*, 5 July 2012, p. 4.

34 Dr Phillips, Centre for Tropical Biodiversity and Climate Change, *Transcript of evidence*, 5 July 2012, p. 4.

35 CSIRO, *Submission 23*, p. 15.

36 House of Representatives Standing Committee on Climate Change, Environment and the Arts (CCEA Committee), *Case studies on biodiversity conservation: volume 2*, November 2012, pp. 60-61.

- more funding for biosecurity activities and upgraded information technology systems.³⁷
- 7.46 On 29 November 2012, the Biosecurity Bill 2012 and the Inspector-General of Biosecurity Bill 2012 were introduced in the Senate, and referred to the Senate Rural and Regional Affairs and Transport Committee for report by 27 February 2013 (extension granted to 24 June 2013).
- 7.47 The Invasive Species Council (ISC) stated that biosecurity legislation must focus on: prevention of unsafe introductions (deliberate and accidental); eradication and containment of new and emerging invaders; and control of entrenched, threatening invaders.³⁸
- 7.48 According to Mr Andrew Cox, President of the ISC, the main driver of the spread of invasive species is rapid transport, from air and road travel, to trade and tourism.³⁹ According to Professor Ary Hoffman from the University of Melbourne, the cheapest way to solve invasive species problems is 'to keep the things out in the first place'.⁴⁰ ISC described the need to control the introduction of invasive species, stopping them from entering the country, or moving into a suitable habitat, in order to keep management costs low.⁴¹
- 7.49 The 2011 SOE report stated that quarantine and preventive procedures in place in Western Australia have excluded some invasive species present in other states.⁴²
- 7.50 The Committee heard evidence about the need to identify invasive species very early on when they are introduced, the first job being to identify which are invasive species and which are undescribed native species. The Australian Museum recommended the need to develop appropriate species identification systems, tools and skills for early marine pest detection, with technologies for rapid species identification, such as DNA barcoding, warranting particular attention.⁴³ Dr Patricia Hutchings, Senior Principal Research Scientist from the Australian Museum, went on to discuss her work as part of a committee, looking at how quarantine,

37 Mr R. Beale, Dr J. Fairbrother, Mr A. Inglis and Mr D. Trebeck, *One Biosecurity, A working partnership: The independent review of Australia's quarantine and biosecurity arrangements report to the Australian Government*, Commonwealth of Australia, Canberra, 2008.

38 Invasive Species Council (ISC), *Submission 60*, p. 10.

39 Mr Andrew Cox, President, ISC, *Transcript of evidence*, 21 June 2012, p. 6.

40 Professor Ary Hoffman, University of Melbourne, *Transcript of evidence*, 2 March 2012, p. 21.

41 Mr Cox, ISC, *Transcript of evidence*, 21 June 2012, p. 7.

42 State of the Environment 2011 Committee, *Australia State of the Environment 2011: An independent report presented to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, DSEWPAC, Canberra, 2011, p. 659.

43 Australian Museum, *Submission 27*, p. 4; Dr Patricia Hutchings, Senior Principal Research Scientist, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 4.

fisheries and port authorities officers can identify new arrivals of invasive species, and prevent them from entering the country.⁴⁴ Dr Hutchings stated that:

We are going to be looking at using both morphological and molecular data so that the people out there on the ground can actually say, 'I've never seen that species before.' We are going to have a register of where to send it and within two or three days we are going to get identification to say whether that is an introduced species or whether it is on that list.⁴⁵

- 7.51 The Committee heard that Indigenous ranger groups perform many land management roles, including quarantine patrols and weed control, burning and feral animal control, and need security of resources to continue that work.⁴⁶ Dr Alaric Fisher from the Northern Territory Department of Natural Resources, Environment, the Arts and Sport further stated that AQIS have relationships with Indigenous ranger groups to undertake quarantine activities, including looking out for feral animals as early indicators of invasive diseases and pathogens.⁴⁷
- 7.52 Dr Fisher stated that one of the major biodiversity values in the Northern Territory is its islands to the north, and that protecting them from the spread of invasive species is a key conservation strategy.⁴⁸
- 7.53 NPAC stated that feral pests and diseases do not end at state borders but planning and management practices do, and that managers of protected areas need to be able to develop and implement strategies that work across borders.⁴⁹
- 7.54 Mr Cox stated that a risk management approach should be adopted for all plants, and stated the need to undertake a risk assessment of the 30 000 listed approved species, with efforts made to remove those determined to be high risk plants.⁵⁰ Mr Cox indicated that the Western Australian Government had costed the project.⁵¹

44 Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 4.

45 Dr Hutchings, Australian Museum, *Transcript of evidence*, 28 March 2012, p. 4.

46 Dr Alaric Fisher, Executive Director, Biodiversity Conservation, Department of Natural Resources, Environment, the Arts and Sport (Northern Territory), *Transcript of evidence*, 4 July 2012, p. 5.

47 Dr Fisher, Department of Natural Resources, Environment, the Arts and Sport (Northern Territory), *Transcript of evidence*, 4 July 2012, p. 6.

48 Dr Fisher, Department of Natural Resources, Environment, the Arts and Sport (Northern Territory), *Transcript of evidence*, 4 July 2012, p. 2.

49 NPAC, *Submission 18*, p. 3.

50 Mr Cox, ISC, *Transcript of evidence*, 21 June 2012, p. 7.

51 Mr Cox, ISC, *Transcript of evidence*, 21 June 2012, p. 7.

- 7.55 In relation to improving the resilience of ecosystems to withstand changes resulting from a changing environment by reducing the stress imposed by invasive species – as discussed in chapter five – the ISC advocated for stronger invasive species programs, including: enhancing the fox control programs for the alpine areas, and the need for voluntary shooters in NSW national parks as part of a feral control program, rather than a game management program.⁵²
- 7.56 Mr Cox proposed the introduction of an environmental biosecurity equivalent of Plant Health Australia and Animal Health Australia, called Environmental Health Australia, to set contingency plans for future invasions, align research priorities, and review existing laws.⁵³ Mr Doug Laing, a Member of the ISC, was also critical of the funding withdrawal for the weeds research cooperative research centre in South Australia, and stated the need to control invasive species that contribute to greenhouse gas emissions, such as the listed key threatening process and invasive species gamba grass, which emits carbon dioxide when burned, and destroys the plants that can take up carbon at other times.⁵⁴
- 7.57 Mr Cox stated the need for alignment and collaboration between the agricultural sector, some state research stations of which are still introducing invasive species and not doing risk assessments, and the environmental sector.⁵⁵

International obligations

Introduction

- 7.58 Australia is signatory to numerous international conventions which have been in development since 1972 and which, since that time, have influenced national biodiversity conservation policies. These international agreements include:
- Convention Concerning the Protection of the World Cultural and Natural Heritage (1972) (World Heritage Convention)
 - United Nations Convention on Biological Diversity (1992)
 - United Nations Framework Convention on Climate Change (1992)
 - The Convention on Wetlands of International Importance (Ramsar, Iran, 1971) (Ramsar Convention)

52 Mr Cox, ISC, and Mr Doug Laing, Member, ISC, *Transcript of evidence*, 21 June 2012, pp. 8, 12.

53 Mr Cox, ISC, *Transcript of evidence*, 21 June 2012, p. 8.

54 Mr Laing, ISC, *Transcript of evidence*, 21 June 2012, p. 9.

55 Mr Cox, ISC, *Transcript of evidence*, 21 June 2012, p. 9.

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)
 - Convention on the Conservation of Migratory Species of Wild Animals (Bonn, Germany, 1979) (Bonn Convention)
 - Japan-Australia Migratory Bird Agreement (1974)
 - China-Australia Migratory Bird Agreement (1986)
 - Republic of Korea-Australia Migratory Bird Agreement (2006)
- 7.59 In addition, Australia has committed to reducing greenhouse gas emissions by between 5 and 15 per cent or 25 per cent compared with 2000 levels by 2020 – formally submitted to the Copenhagen Accord in January 2010. The Australian Government has also committed to reducing emissions by 80 per cent compared with 2000 levels by 2050.

International cooperation on migratory birds

- 7.60 The Committee noted its concerns in the second interim report about the 'adequacy of international agreements for the protection of migratory bird habitats' outside Australia.⁵⁶ In addition, the Committee heard concerns from the Conservation Council of South Australia about proposed changes to the EPBC Act that would serve to wind back protections under the Bonn II list of migratory species.⁵⁷ This could have implications for Australia's international obligations under its international migratory species agreements. As mentioned, the Committee would welcome a review of the proposed changes to the EPBC Act, including any changes which may affect migratory species listing and protection.

International cooperation on research

- 7.61 Australia collaborates with several countries on environmental research projects. ARC indicated that over two thirds of biodiversity and conservation projects commencing in the years 2008-11 involved international collaboration.⁵⁸
- 7.62 The Committee heard that, since 2008, the ARC had awarded \$7.3 million in grants to 21 proposals involving taxonomy.⁵⁹ The Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) outlined projects funded through various programs it administers which

56 CCEA Committee, *Case studies on biodiversity conservation: volume 2*, November 2012, p. 17.

57 Miss Wynn, Conservation Council of South Australia, *Transcript of evidence*, 17 May 2012, p. 17.

58 Australian Research Council, *Submission 86*, pp. [2]-[3].

59 Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE), *Submission 87*, p. [6].

involve collection and storage of taxonomic and biodiversity data, some of which involve international collaborations:

- Atlas of Living Australia/CSIRO
- Global Biodiversity Information Facility/CSIRO
- Scientific Collections International/South Australian Museum
- Terrestrial Ecosystem Research Network/University of Queensland
- Integrated Marine Observing System/University of Tasmania
- Tropical Marine Research Facilities/Australian Institute of Marine Science
- Daintree Rainforest Observatory/James Cook University
- Hawkesbury Institute for the Environment/University of Western Sydney.⁶⁰

7.63 DIISRTE also advised of projects relating to taxonomy and collection of biodiversity data supported by DSEWPAC:

- National Environmental Research Program
- Environmental Stewardship
- Australian Collaborative Rangelands Information System
- National Biological Resources Study which is managed by DSEWPAC and provides grants for taxonomy research.⁶¹

7.64 DIISRTE also advised the Committee of ongoing collaborative involvement in the following areas:

- the Global Biodiversity Information Facility (of which Australia is a financial member), administered by CSIRO through the Atlas, encourages electronic access to biodiversity data through a network of countries and organisations
- the Integrated Marine Observing System (IMOS) is internationally recognised as best practice for collaborative research infrastructure, and the IMOS ocean portal allows marine and climate scientists, as well as other users, to discover and explore the data coming from the facilities.⁶² There is an Australia-New Zealand Arrangement on Marine Observation that is intended to 'improve knowledge of regional climate and ocean systems, effectiveness of marine resource and environmental management and enhance food security.'⁶³

60 DIISRTE, *Submission 87*, p. 4.

61 DIISRTE, *Submission 87*, p. 5.

62 DIISRTE, *Submission 87*, p. 9.

63 DIISRTE, *Submission 87*, p. 9.

- Australia is also involved in the Australia-India and Australia-China research funds on biodiversity and climate change.⁶⁴

Cross-border management

7.65 Cross-border management was discussed in the Committee's first interim report, in relation to the Australian Alps and specifically Kosciuszko National Park. The Committee highlighted the need to:

... strengthen the current cooperative arrangements to allow joint management. This would enable cross-border programs to be funded to tackle threats to biodiversity that extend across all jurisdictions, such as weeds and feral animals. There may be a role for the Commonwealth in facilitating or delivering such programs.⁶⁵

In the course of its inquiry, the Committee continued to hear observations, criticisms and proposals for change to the way in which cross-border issues are managed. Several of these are canvassed below, relating to budgets and terminology in legislation as well as a range of observations which have specific resonance for certain areas but which may also have wider applicability.

7.66 ANEDO stated that it is essential that the budgets for national park management agencies are increased.⁶⁶ Mr Matt Ruchel, a Member of NPAC, stated that national parks should be made into a matter of national environmental significance, thereby ensuring a legitimate role for the Commonwealth.⁶⁷ Mr Kevin Evans, Chief Executive Officer of the National Parks Association of NSW, advised the Committee that the federal government's involvement with the reserves system is 'in name only', as they are funded by state governments, whose 'smaller budgets allocated to deal with onground management and acquisition are getting smaller and smaller'.⁶⁸ Mr Evans also described the need for increased government funding and influence, in order to ensure that the national parks and reserves systems remain to protect biodiversity.⁶⁹

64 DIISRT, *Submission 87*, pp. 8, 9, 16-18.

65 CCEA Committee, *Case studies on biodiversity conservation: volume 1*, May 2012, p. 41.

66 ANEDO, *Submission 57*, p. 15.

67 Ms Matt Ruchel, Member, NPAC, *Transcript of evidence*, 2 March 2012, p. 27.

68 Mr Kevin Evans, Chief Executive Officer, National Parks Association of NSW, *Transcript of evidence*, 28 March 2012, p. 26.

69 Mr Evans, National Parks Association of NSW, *Transcript of evidence*, 28 March 2012, p. 26.

- 7.67 The Committee heard about the confusion in terminology between state environment legislation and the EPBC Act, particularly in the marine environment. Mr Evans stated that the National Parks Association of NSW had advocated for COAG to try to resolve these definitional differences to reduce confusion, but that the proposals had not been adopted.⁷⁰
- 7.68 NPAC claimed that nationally consistent cross-border management systems will improve coordination of fire management activities across state boundaries, and help to review and assess long-term impacts of fire management practices with a view to adopting best practice in fire management across all jurisdictions.⁷¹
- 7.69 The Committee heard about the management of the Australian Alps National Parks, and the Memorandum of Understanding between Victoria, NSW, the ACT and the Commonwealth. Mr Roger Good, a participant in the Australian Alps Liaison Committee, stated his concern about the cross-border relationship as being:
- ... that the Alps liaison committee and the Alps interstate and Commonwealth program is not based on an agreement. It has been a wonderful example of how state and territory management agencies can work together, but it is based on a memorandum of understanding only.⁷²
- 7.70 The Research Centre for Applied Alpine Ecology stated that:
- The Australian Alps Liaison Committee is a good concept for sharing information on management but it lacks authority, scientific knowledge and funding, and does not effectively engage private and corporate bodies.⁷³
- 7.71 A special management plan for the Australian Alps was suggested, that would include scientists embedded with the people making management decisions. Professor Hoffman noted that the Great Barrier Reef management arrangements have 'excellent communication', and that the Wet Tropics of Queensland arrangements are 'starting to work really well'.⁷⁴ Professor Hoffman further stated that the Alps needed to be taken out of the hands of the state agencies and uniform guidelines to manage

70 Mr Evans, National Parks Association of NSW, *Transcript of evidence*, 28 March 2012, p. 30.

71 NPAC, *Submission 18*, p. 4.

72 Mr Roger Good, *Transcript of evidence*, 2 March 2012, p. 7.

73 Research Centre for Applied Alpine Ecology, *Submission 72*, p. 4.

74 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 20.

the area created.⁷⁵ Professor Hoffman also stated that management needed to occur much more easily across state boundaries.⁷⁶

7.72 A model similar to that administered by the Great Barrier Reef Marine Park Authority (GBRMPA) was suggested as a good example to replicate in the Australian Alps.⁷⁷

7.73 When asked whether the Great Barrier Reef management model was transportable to other environmentally sensitive areas, Dr David Wachenfeld, Director, Ecosystem, Conservation and Sustainable Use of GBRMPA, responded:

The strength of the Great Barrier Reef Marine Park Act model is that when you look at a sensitive and iconic environmental area that is subject to multiple impacts from multiple sources that are under multiple different governments and other jurisdictions to manage, it is probably extremely helpful to have one central body that might not have direct legislative control over all the impacts but has a mandate to look after, coordinate and report on everything to do with the health of the system, and it gives you a point of focus, if you like. In answer to your question about its transportability, I think it depends on the nature of the environment. I do not necessarily mean the ecological environment but the social, political and economic environment.

...

I could imagine the model would be useful in an area where there are difficulties with a complex environment, with complex human impacts and with complex jurisdictional issues and you want a body to try to overarch all of that and bring it together.⁷⁸

Integrated forest management

7.74 The Committee is aware of the range of views regarding forest management, and the impacts on biodiversity, weed management and fire management regimes.

7.75 The Department of Agriculture, Fisheries and Forestry (DAFF) referred to research by the Australian Bureau of Agricultural and Resource

75 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 17.

76 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 21.

77 Professor Hoffman, *Transcript of evidence*, 2 March 2012, p. 21.

78 Dr David Wachenfeld, Director, Ecosystem, Conservation and Sustainable Use, Great Barrier Reef Marine Park Authority, *Transcript of evidence*, 12 October 2012. pp. 18-19.

Economics and Sciences which predicts that climate change will impact upon native and planted forests, wood production and investment, more strongly in some regions.⁷⁹ DAFF also noted that, since 2009, the federal and state governments have been examining the effects of climate change on the forest and wood products industry.⁸⁰ The Committee notes that evidence and possible approaches to forest management are contested by various organisations and individuals.

- 7.76 Ms Lorraine Bower, a spokesperson for the Australian Forests and Climate Alliance stated that the Alliance wanted to see:

... all public native forests protected by legislation from commercial logging, and for commercial logging to cease with a transition to a plantation based logging industry that is available to serve all domestic and export needs.⁸¹

- 7.77 The exit from native forest logging and a transition into plantations was supported by the South East Forest Rescue.⁸²

- 7.78 The Committee heard that overharvesting of native forests had resulted in the growth of weeds, and 'clearly linked to the emergence of a pathogen called *bell miner associated dieback* that is affecting increasingly large areas of forest by killing large standing trees'.⁸³ Mr Pepe Clarke, Chief Executive Officer of the Nature Conservation Council of NSW, further stated that there is a real opportunity to consider biodiversity and forest management together with climate change.⁸⁴

- 7.79 The Committee heard of the opportunity to bring fire management objectives of risk management to protect life and property, together with objectives of improving or restoring biodiversity over time and to manage threats such as invasive plants.⁸⁵ The Committee also heard from Ms Bower that 'biodiverse forests will help to make landscapes less, not more, fire prone'.⁸⁶ Ms Bower informed the Committee about the fragmented nature of the national park system:

In our forests we have a national park system but it is [a] very fragmented system. We have 9.4 million-hectares of native forests

79 Department of Agriculture, Fisheries and Forestry (DAFF), *Submission 73*, pp. 2, 12-13.

80 DAFF, *Submission 73*, p. 16.

81 Ms Lorraine Bower, Spokesperson, Australian Forests and Climate Alliance, *Transcript of evidence*, 28 March 2012, p. 9.

82 South East Forest Rescue, *Submission 39*, p. 1.

83 Mr Pepe Clarke, Chief Executive Officer, Nature Conservation Council of NSW, *Transcript of evidence*, 28 March 2012, p. 10.

84 Mr Clarke, Nature Conservation Council of NSW, *Transcript of evidence*, 28 March 2012, p. 11.

85 Mr Clarke, Nature Conservation Council of NSW, *Transcript of evidence*, 28 March 2012, p. 11.

86 Ms Bower, Australian Forests and Climate Alliance, *Transcript of evidence*, 28 March 2012, p. 8.

that are open for logging, which we obviously believe should be part of the reserve system ... We are asking for a system that is much less fragmented that allows our biodiversity to become a lot more resilient.⁸⁷

- 7.80 The Institute of Foresters of Australia stated the need for a national inquiry into the role and management of Australia's native forests.⁸⁸ Dr Ross Florence, an Honorary Member and Fellow of the Institute suggested that:

... we are yet to address in a comprehensive way the basic issue of the future of our native forests, in particular the role, and management, of native forests and ways in which an appropriate balance between wood production and environmental conservation might be achieved.⁸⁹

- 7.81 In a private briefing towards the end of the inquiry, the Committee heard about the value of integrated forest management, with the need for decision making processes which adequately take into account the role of wood production forests in conservation. Dr Florence outlined the role for an inquiry to investigate the extent to which a forestry industry is needed, and the important role to be played by national parks, which are currently under-resourced for the crucial role they perform in biodiversity conservation. Dr Florence outlined the matters that such an inquiry might address:

- the compatibility of wood production and environmental conservation within different forests and under different circumstances
- silvicultural and other management practices which effectively integrate wood production, environmental and social values
- the extent to which national conservation objectives can be met through a balanced mix of conservation reserves and production forests
- the range of economic, social, and other contributions the wood production forest can make to society
- the extent to which wildfire management will be enhanced within the wood production forest
- the formulation of an objective and transparent land use review process which takes full account of all relevant circumstances bearing on land use decisions

87 Ms Bower, Australian Forests and Climate Alliance, *Transcript of evidence*, 28 March 2012, p. 12.

88 The Institute of Foresters of Australia, *Submission 89*, p. [1].

89 The Institute of Foresters of Australia, *Submission 89*, p. [1].

- the extent to which governments will, in recognising their duty of care for the nation's forests, accept management costs beyond returns realised through commercial operations.⁹⁰

Conclusions and recommendations

Conditions for bilateral agreements

- 7.82 There was a high level of concern expressed about the proposed changes to the EPBC Act affecting bilateral agreements, and particularly bilateral approval processes. The Committee notes the April 2012 COAG announcement that bilateral approvals would not be progressed at the present time, but provides the following issues for consideration in the case that they are pursued at a later date:
- the Commonwealth's level of continued involvement in the assessment/approval process and the implications of 'vacating the field'
 - the standards applied to state/territory processes being equivalent to that applied to the Commonwealth
 - the extent of community involvement in approvals processes
 - potential conflicts of interest in states/territories assessing and approving their own developments and the procedures and safeguards put in place to avoid such conflicts
 - sufficient negotiation time through the COAG process to develop bilateral agreements
 - potential for competing states/territories compromising environmental standards to gain revenue from developments
 - ability of states/territories to make decisions in the 'national interest' and ensuring the maintenance of the Commonwealth's integrity.
- 7.83 The Committee reiterates its views expressed above in relation to its intention to discuss the proposed changes to the EPBC Act in relation to its assessment of whether current governance arrangements are well placed to deal with the challenges of conserving biodiversity in a changing climate. The Committee also reiterates that it would welcome the opportunity to review the EPBC Amendment Bill, in order to assess the changes made in light of the COAG announcements, and the Australian Government's reform announcements and response to the report of the Independent review of the EPBC Act.

90 The Institute of Foresters of Australia, *Submission 89*, p. [1].

Recommendation 14

- 7.84 **The Committee recommends that the Minister refer an exposure draft of the EPBC Amendment Bill to the Committee for review prior to introduction in the Parliament.**

Governance of species

- 7.85 The Committee supports the Australian Government's agreement to move to a single national list of threatened species.
- 7.86 The Committee understands that the Senate Rural and Regional Affairs and Transport Committee is inquiring into the Biosecurity Bill 2012 and the Inspector-General of Biosecurity Bill 2012 and is expected to report by June 2013. The Committee highlights the following as important considerations to be taken into account in any biosecurity legislation:
- focus on prevention of unsafe introductions by identifying invasive species early on, with appropriate identification systems
 - biosecurity risk assessments for invasive species must be developed to take into account climate change, and be undertaken on all listed approved species in order to determine and remove high risk species
 - possibility of introducing an environmental biosecurity body to set contingency plans for future invasions, align research priorities, and review existing laws. Some of these issues may be covered by the proposed Inspector-General of Biosecurity.
- 7.87 The Committee agrees that any biosecurity legislation must provide for the active movement of species to new places. This is especially relevant in light of the increasing need to put adaptive management processes in place to combat the threatening effects of climate change on biodiversity, and in light of the National Wildlife Corridors Plan and more large-scale wildlife corridors operating across borders.

Recommendation 15

- 7.88 **The Committee recommends that the Australian Government publish a progress report on developing a single national list of threatened species as part of the changes to the EPBC Act, as well as expected future timelines.**

Cross-border management

- 7.89 The Committee agrees that nationally consistent cross-border management is vital for issues such as fire management practices and invasive species control. Assisting to create such nationally consistent cross-border management practices should be a priority for the Australian Government, especially in areas of national environmental significance, such as the Australian Alps National Parks and Reserves.
- 7.90 The Committee considers that the Australian Government should review the current management arrangements in the Australian Alps with a view to determining whether a different model – such as the Great Barrier Reef Marine Park Authority model – would improve coordination and priority management of the area’s biodiversity. In the event that the current arrangements are determined as satisfactory, the Australian Government should consider revising the structure of the Memorandum of Understanding to strengthen coordination and allow joint management, and create uniform guidelines to manage the area with greater authority and readily available scientific knowledge.

Recommendation 16

- 7.91 **The Committee recommends that the Australian Government review the current co-management arrangements in the Australian Alps with a view to determining whether a different model – such as the Great Reef Marine Park Authority model – would improve coordination and priority management of the area’s biodiversity.**

Integrated forest management

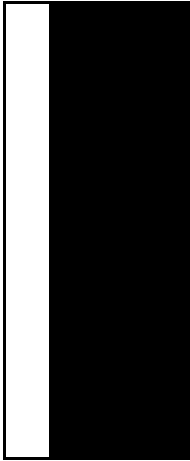
- 7.92 The Committee acknowledges the current opportunity for urgent consideration of biodiversity and forest management together with the effects of climate change. Any future inquiry could consider aligning fire management practices with objectives of safety, biodiversity protection and invasive species management, with a focus on connectivity and opportunities for forest managers to trade carbon credits to reduce carbon pollution.
- 7.93 The Committee agrees that integrated forest management could be beneficial to maintaining and protecting biodiversity in a changing climate. The Committee considers that an inquiry into the role and management of Australia’s native forests is required, as is a comprehensive assessment of forest health.

- 7.94 An inquiry into the role and management of Australia's forests could include considerations of the issues outlined earlier in this chapter, as well as:
- the need for a multi-use policy for Australia's forests
 - how forests should be managed and the extent of Australia's national park and reserve systems
 - how decisions should be made; whether we take into account the fact that wood production forests are as important as national parks, and that wood production forests have a role to play in conservation
 - the role of sustainable fire management
 - the role of timber production
 - the potential need for a body such as Land and Water Australia.

Recommendation 17

- 7.95 **The Committee recommends that the Australian Government establish an expert panel, including representatives of the timber industry and national parks, to inquire into and report on options for Australia's future integrated forest management.**

Mr Tony Zappia MP
Chair
30 May 2013



Minority Report – Nola Marino MHR – Member for Forrest

The Standing Committee on Climate Change, Environment and the Arts in its inquiry into “Australia's biodiversity in a changing climate” was presented with a range of information that outlined the various local approaches to manage the impact of climate change on local environments.

The good work of a range of local stakeholders is to be acknowledged and applauded, and this is recognized in the majority report.

Climate change policy is rightly divided into climate change mitigation and climate change adaptation. Climate change mitigation refers to attempts to limit climate change and its impacts, and has been the focus of activity at the national and international level.

However whilst there are good examples of localized action on preparing for the effects of climate change and the development of adaptation strategies, there is a completely inadequate national response in the same area. I believe we need a national approach to climate change adaptation.

1. The need to focus on climate change adaptation.

There must be a considerable focus on climate change adaptation, which in my opinion has not received adequate attention to date.

The current national agenda of climate change mitigation has completely dwarfed the policy and action on climate change adaptation. This cannot continue if Australia is to adequately manage the effects of climate change into the future.

Finding

Climate change adaptation has been under-prioritised in Australia's climate change response. The decision to remove support for the National Climate Change Adaptation research Facility is regrettable and should be reversed.

Recommendation

Given current world wide emissions growth projections climate change adaptation must be given higher priority.

2. The need to greater engage the Natural Resource Management system in a nationally coordinated climate change adaptation plan.

As evidenced by the Committee in its interim reports, there is a range of at risk ecosystems for which the current management response to changing climate is inadequate.

The current Federal Government vehicle for local environmental action that engages local communities in that action is the Natural Resource Management program. This program was introduced by the Howard Government and under a range of names has been supported by all recent Australian governments.

The good climate adaptation work at a local level should be part of a nation-wide plan, whose ultimate goal would be to future proof vulnerable Australian ecosystems and species against the impacts of climate change.

A national stock-take of vulnerable and at risk ecosystems is vital. An adequate response to those risks is even more so.

This program needs to be focused on delivering climate change adaptation and preparedness strategies that are coordinated at a national level.

Recommendation

That climate change preparation and adaptation is made a primary objective of the national Natural Resource Management agenda.

3. The need to develop proper accountability for invasive species control for land managers.

The majority report of the Committee identifies that weed control is not a success story for land managers across Australia.

This repetitive failure to control invasive weed species must be addressed.

In the South West of Western Australia the long term drying trend was clearly identified as a threat to biodiversity, especially in native jarrah and karri forests. This threat is exacerbated by *Phytophthora* dieback and the invasion of weed and pest species.

Changing rainfall patterns and invasive species are also having detrimental impacts in the Tasmanian Midlands, and New South Wales Snowy River region.

Invasive plant and animal species are also major threats to Kakadu in the Northern Territory.

The feral horse population in the New South Wales Snowy River region is a matter of great urgency that needs to be resolved.

The current systems in place at a state and federal level, including those within the Natural Resource Management program, have not been able to address these issues.

The requirement to control invasive species currently exists in the legislation of most jurisdictions, but needs to be used to greater effect. Because of this few invasive species are actually eliminated or properly controlled. Most simply move down classification lists from required control, via attempted control, to an acknowledgement that they have become endemic.

Finding

The response in Australia to the threat to biodiversity of changing weather patterns and invasive plants, animals and disease has been inadequate.

Recommendation

Include on the COAG agenda the need for the Commonwealth and State Governments to prioritise the containment and/or elimination of invasive species, and that land managers including public entities be required to control identified and targeted invasive species on their lands.

Ms Nola Marino MHR
Member for Forrest



Appendix A: List of submissions

- 1 Professor Will Steffen
- 2 Wet Tropics Management Authority
- 3 Northern Rivers Catchment Management Authority
- 4 Environment East Gippsland Inc.
- 5 New South Wales Aboriginal Land Council
- 6 Goulburn Broken Catchment Management Authority
- 7 Border Rivers - Gwydir Catchment Management Authority
- 8 Professor Ary Hoffmann and Dr Carla Sgro
- 9 Associate Professor Mark Hovenden PhD
- 10 Professor Jon Altman and Dr Sean Kerins
- 11 Boobook Declaration Steering Committee
- 12 National Parks Association of Queensland Inc.
- 13 South West Catchments Council
- 14 Queensland Murray-Darling Committee Inc.
- 15 Ecological Society of Australia
- 16 Healesville Environment Watch Inc.
- 17 Australian Marine Sciences Association
- 18 National Parks Australia Council
- 19 Australian Seed Bank Partnership
- 20 National Climate Change Adaptation Research Facility, Adaptation
Research Network - Terrestrial Biodiversity
- 21 Planet Ark Environmental Foundation
- 22 Water Resources and Freshwater Biodiversity Adaptation Research
Network

- 23 Commonwealth Scientific Industries Research Organisation
 - 23.1 Supplementary
 - 23.2 Supplementary
- 24 Greening Australia
- 25 Condamine Alliance
- 26 Urban Development Institute of Australia
- 27 Australian Museum
- 28 Great Barrier Reef Marine Park Authority
 - 28.1 Supplementary
- 29 Centre for Tropical Biodiversity and Climate Change
- 30 International Union for Conservation of Nature World Commission on Protected Areas
- 31 Namoi Catchment Management Authority
- 32 Australian Academy of Science
- 33 Northern Territory Government
- 34 Australian Institute of Aboriginal and Torres Strait Islander Studies
 - 34.1 Supplementary
- 35 Dr Paul Williams
- 36 Coastwatchers Association
- 37 Western Australian Local Government Association
- 38 Australian Forests and Climate Alliance
- 39 South East Forest Rescue
- 40 BirdLife Australia (formerly Birds Australia)
 - 40.1 Supplementary
 - 40.2 Supplementary
- 41 Associate Professor Neil Holbrook, Dr Julie Davidson and Ms Laura Purcell
- 42 Western Catchment Management Authority
- 43 National Farmers' Federation
- 44 Dr Prue Acton
- 45 National Parks Association of NSW
- 46 Dr Don Driscoll
- 47 Terrain Natural Resource Management
- 48 The Western Australian Farmers Federation

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- 49 Climate and Health Alliance
- 50 National Climate Change Adaptation Research Facility
- 51 Coast and Wetlands Society Inc.
- 52 The Local Government Association of NSW and Shires Association of NSW
- 53 Australian Bureau of Statistics
- 54 Wimmera Catchment Management Authority
- 55 Western Australian Museum
- 55.1 Supplementary
- 56 Department of Infrastructure and Transport
- 57 Australian Network of Environmental Defender's Offices
- 57.1 Supplementary
- 58 Conservation Council SA
- 58.1 Supplementary
- 59 Australian Institute of Marine Science
- 60 Invasive Species Council
- 61 Australian Coastal Society Ltd
- 62 Australian Psychological Society
- 63 Australian Coral Reef Society Inc.
- 64 Australian Conservation Foundation
- 64.1 Supplementary
- 65 Conservation Land Trusts Alliance
- 66 Department of Sustainability, Environment, Water, Population and Communities
- 67 Mr Tim Low
- 68 Dr Graeme L. Worboys
- 69 Monash Sustainability Institute
- 70 Department of Environment and Resource Management, Queensland Government
- 71 Yarra Ranges Council
- 72 The Research Centre for Applied Alpine Ecology
- 73 Department of Agriculture, Fisheries and Forestry
- 73.1 Supplementary

- 74 Department of the Premier and Cabinet, Government of Western Australia
 - 74.1 Supplementary
- 75 ACT Government
- 76 South Coast Natural Resource Management
- 77 Institute for Marine and Antarctic Studies
 - 77.1 Supplementary
 - 77.2 Supplementary
- 78 Tasmanian Department of Primary Industries, Parks, Water and Environment
- 79 Antarctic Climate and Ecosystems Cooperative Research Centre
- 80 South Australian Department of Environment and Natural Resources
- 81 Mr Ed Riley
- 82 Tom Farrell Institute for the Environment
- 83 Atlas of Living Australia
- 84 Northern Territory Natural Resource Management
- 85 Liz Burton
- 86 Australian Research Council
- 87 Department of Industry, Innovation, Science, Research and Tertiary Education
- 88 Dr Graeme B. Martin
- 89 Institute of Foresters of Australia



Appendix B: List of exhibits

- 1 Professor Will Steffen
Australia's biodiversity and climate change: Technical Synthesis
(Related to Submission No. 1)

- 2 Professor Will Steffen
Australia's biodiversity and climate change: Summary for policy makers
2009
(Related to Submission No. 1)

- 3 Wet Tropics Management Authority
Climate Change in the Wet Tropics - Impacts and Responses
(Related to Submission No. 2)

- 4 Border Rivers - Gwydir Catchment Management Authority
Plant Performance
(Related to Submission No. 7)

- 5 Boobook Declaration Steering Committee
Boobook Declaration and signature group
(Related to Submission No. 11)

- 6 Queensland Murray-Darling Committee Inc
Climate Refugia within the Stanthorpe Plateau
(Related to Submission No. 14)

- 7 Condamine Alliance
Climate Change and Terrestrial Biodiversity in the Condamine Catchment
(Related to Submission No. 25)

- 8 Condamine Alliance
An Analysis of the Impact of Predicted Climate Change on Agriculture and
Fish in the Condamine Catchment
(Related to Submission No. 25)

- 9 Condamine Alliance
Influencing Policy and Building Leadership Capacities of Rural Women:
Recognising Women Farmers
(Related to Submission No. 25)

- 10 Centre for Tropical Biodiversity and Climate Change
Gap analysis of environmental research needs in the Australian Wet Tropics
(Related to Submission No. 29)

- 11 Centre for Tropical Biodiversity and Climate Change
Guide for design of refugia conservation in the Wet Tropics: practical
strategies to minimize loss of biodiversity under climate change
(Related to Submission No. 29)

- 12 Australian Institute of Aboriginal and Torres Strait Islander Studies
Water Planning and Dispossession
(Related to Submission No. 34)

- 13 Australian Institute of Aboriginal and Torres Strait Islander Studies
Connectivity
(Related to Submission No. 34)

- 14 Australian Institute of Aboriginal and Torres Strait Islander Studies
First National Prescribed Bodies Corporate Meeting: Issues and Outcomes
Canberra 11-13 April 2007
(Related to Submission No. 34)

- 15 Australian Institute of Aboriginal and Torres Strait Islander Studies
Karajarri: A West Kimberley experience in managing native title
(Related to Submission No. 34)
- 16 Australian Institute of Aboriginal and Torres Strait Islander Studies
Second National Meeting of Registered Native Title Bodies Corporate:
Issues and Outcomes Melbourne, 2 June 2009
(Related to Submission No. 34)
- 17 Australian Institute of Aboriginal and Torres Strait Islander Studies
Guidelines for Ethical Research in Australian Indigenous Studies 2011
(Related to Submission No. 34)
- 18 Australian Institute of Aboriginal and Torres Strait Islander Studies
Solid work you mob are doing
(Related to Submission No. 34)
- 19 Australian Institute of Aboriginal and Torres Strait Islander Studies
Final Report of the Indigenous Facilitation and Mediation Project July 2003-
June 2006 - research findings, recommendations and implementation
(Related to Submission No. 34)
- 20 Australian Institute of Aboriginal and Torres Strait Islander Studies
Hope Vale Digital Storytelling Project Using the Camera: Telling Stories our
Way
(Related to Submission No. 34)
- 21 Insurance Australia Group Limited
Insurance Australia Group: Submission to Natural Disaster Insurance
Review Inquiry into Flood Insurance and Related Matters July 2011
- 22 Dr Don Driscoll
Priorities in policy and management when existing biodiversity stressors
interact with climate-change
(Related to Submission No. 46)

- 23 Great Barrier Reef Marine Park Authority
Great Barrier Reef Outlook Report 2009
(Related to Submission No. 28)
- 24 Australian Centre for Biodiversity, Monash University
Biodiversity and Climate Change
- 25 Invasive Species Council
Invasive species and climate change
(Related to Submission No. 60)
- 26 Invasive Species Council
Weeds and climate change
(Related to Submission No. 60)
- 27 Department of Environment and Conservation (Western Australia)
Kimberley Science and Conservation Strategy
(Related to Submission No. 74)
- 28 Department of Environment and Conservation (Western Australia)
A Biodiversity and Cultural Conservation Strategy for the Great Western
Woodlands
(Related to Submission No. 74)
- 29 Department of Primary Industries, Parks, Water and Environment
(Tasmania)
Vulnerability of Tasmania's Natural Environment to Climate Change: An
Overview
(Related to Submission No. 78)
- 30 Commonwealth Scientific Industries Research Organisation (CSIRO)
Marine Climate Change in Australia: Impacts and Adaptation Australia
2009 Report Card
(Related to Submission No. 23)

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- 31 Research Centre for Applied Alpine Ecology, La Trobe University
Trends in cover of the main growth forms On the Bogong High Plains,
1979-2010
(Related to Submission No. 72)
- 32 Dr Graeme Worboys
The Decline of Snowpatches in the Snowy Mountains of Australia:
Importance of Climate Warming, Variable Snow, and Wind
(Related to Submission No. 68)
- 33 Australian Museum
Multiple biogeographical barriers identified across the monsoon tropics of
northern Australia: phylogeographic analysis of the rock-wallabies
- 34 Australian Museum
Biogeographic barriers in north-western Australia: an overview and
standardisation of nomenclature
- 35 Australian Museum
Letter: Additive threats from pathogens, climate and land-use change for
global amphibian diversity
- 36 Australian Forests and Climate Alliance
Some Scientific Studies, Reports and Supporting Quotations
(Related to Submission No. 38)
- 37 International Union for Conservation of Nature World Commission on
Protected Areas
Natural Solutions: Protected areas helping people cope with climate change
(Related to Submission No. 30)
- 38 International Union for Conservation of Nature World Commission on
Protected Areas
World Conservation: Last Call - Climate and nature
(Related to Submission No. 30)

- 39 International Union for Conservation of Nature World Commission on Protected Areas
Science Informing Policy Symposium Series - Program and Abstracts: Innovation for 21st Century Conservation
(Related to Submission No. 30)

- 40 International Union for Conservation of Nature World Commission on Protected Areas
Green Carbon: The role of natural forests in carbon storage
(Related to Submission No. 30)

- 41 International Union for Conservation of Nature World Commission on Protected Areas
Draft National Wildlife Corridors Plan - March 2012
(Related to Submission No. 30)

- 42 BirdLife Australia (formerly Birds Australia)
Accounting for Nature: A Model for Building the National Environmental Accounts of Australia
(Related to Submission No. 40)

- 43 Associate Professor Mark Hovenden PhD
Figure submitted to the CCEA Standing Committee
(Related to Submission No. 9)

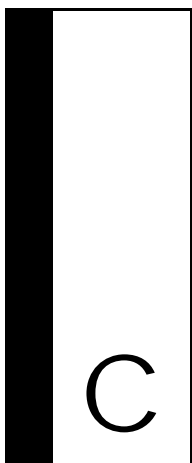
- 44 Associate Professor Mark Hovenden PhD
Soil Nitrogen Availability in the TasFACE experiment
(Related to Submission No. 9)

- 45 Climate and Health Alliance
How Our Health Depends on Biodiversity
(Related to Submission No. 49)

- 46 City of Salisbury
Australia's Biodiversity in a Changing Climate - powerpoint

-
- 47 Department of Environment and Natural Resources (South Australian Government)
3 maps
(Related to Submission No. 80)
- 48 Mr Ed Riley
Fishing in the Collie Area
(Related to Submission No. 81)
- 49 Mr Ed Riley
Relief idle as river weed woes worsen
(Related to Submission No. 81)
- 50 Mr Ed Riley
State dumps desalination
(Related to Submission No. 81)
- 51 Mr Ed Riley
Suggestions on water activities
(Related to Submission No. 81)
- 52 Mr Ed Riley
The Collie Rivers
(Related to Submission No. 81)
- 53 Northern Territory Natural Resource Management
Working Together on Land and Sea Country
(Related to Submission No. 84)
- 54 Northern Territory Natural Resource Management
Territory Conservation Agreements - Landholder Information
(Related to Submission No. 84)
- 55 Northern Territory Natural Resource Management
Territory Natural Resource Management Annual Report 2010-2011
(Related to Submission No. 84)

- 56 Northern Territory Natural Resource Management
Northern Territory Integrated Natural Resource Management Plan 2010-2015
(Related to Submission No. 84)
- 57 Dr Selina Ward
Do It Yourself Kit - Coralwatch Coral Monitoring Kit
- 58 Wet Tropics Management Authority
Wet Tropics Conservation Strategy (2004)
(Related to Submission No. 2)
- 59 Australian Research Council
ARC funding for biodiversity and climate change research
(Related to Submission No. 86)
- 60 Mr Nick Duff and Dr Jessica Weir
Weeds and Native Title: Law and Assumption



Appendix C: List of site inspections and public hearings

Thursday, 13 October 2011 – Canberra (public hearing)

The Australian National University Climate Change Institute

Professor Will Steffen, Executive Director

Monday, 7 November 2011 – Perth (public hearing)

Greening Australia

Mr Hamish Jolly, Advisor and former National Chief Executive Officer

Dr Robert Lambeck, former Chief Executive Officer (WA)

Western Australian State Centre of Excellence for Climate Change, Woodland and Forest Health

Professor Giles Hardy, Director

Professor Bernard Dell, Chief Investigator

Western Australian Local Government Association

Mr Mark Batty, Executive Manager, Environment and Waste

Ms Renata Zelinova, Manager, Perth Biodiversity Project

Western Australian Farmers Federation

Mr Dale Park, Senior Vice President and Spokesman on Climate Change and Land Use

Mr Alan Hill, Director of Policy

Western Australian Department of Environment and Conservation

Mr Keiran McNamara, Director-General

Mr Jim Sharp, Deputy Director-General, Parks and Conservation

Western Australian Museum

Ms Diana Jones, Executive Director, Collections and Research

Dr Jane Fromont, Head of Department of Aquatic Zoology

Professor Richard How, Senior Curator

Monday, 7 November 2011 – Bunbury (site inspection)**South Coast Natural Resource Management**

Mr Justin Bellanger, Operations Manager

South West Catchments Council

Mr David Gardner, Chair

Mr Bernie Masters, Deputy Chair

Mr Damien Postma, Chief Executive Officer

Tuesday, 8 November 2011 – Margaret River (site inspection)**Cape to Cape Catchments Group**

Ms Hayley Rolfe, Co-ordinator

Mr Drew McKenzie, Biodiversity Project Officer

Gondwana Link

Mr Keith Bradby, Program Director

Greening Australia

Mr Craig Anderson, Chief Executive Officer (WA)

Mr Hamish Jolly, Advisor and former National Chief Executive Officer

Monday, 30 January 2012 – Tasmanian Wilderness World Heritage Area (site inspection)**Greening Australia (Tasmania)**

Mr Jamie Bayly-Stark, President

Dr Neil Davidson, Landscape Ecologist (and Senior Lecturer at the University of Tasmania School of Plant Science)

Tasmanian Department of Primary Industries, Parks, Water and Environment

Mr Peter Voller, Branch Manager, Land Conservation Branch

Mr Michael Comfort, Geodiversity Section Leader

Ms Louise Gilfedder, Senior Conservation Scientist

Dr Wendy Potts, Senior Botanist (Threatened Flora)

Tasmanian Land Conservancy

Ms Jane Hutchinson, Chief Executive Officer

Mr Stuart Cowell, Conservation Programs Manager

Tuesday, 31 January 2012 – Hobart (public hearing)**Individuals**

Associate Professor Neil Holbrook, Private capacity

Ms Laura Purcell, Private capacity

Antarctic Climate and Ecosystems Cooperative Research Centre

Dr Tony Press, Chief Executive Officer

Dr Stuart Corney, Climate System Modeller

Australian Marine Sciences Association

Dr Karen Miller, Secretary

Commonwealth Scientific and Industrial Research Organisation (CSIRO) Marine and Atmospheric Research

Dr Nic Bax, Research Scientist

Dr Alistair Hobday, Research Scientist

University of Tasmania (UTAS)

Professor Ted Lefroy, Director, Centre for Environment UTAS and
Director, Landscapes and Policy National Environmental Research
Program Hub

University of Tasmania Institute for Marine and Antarctic Studies (IMAS)

Professor Thomas Trull, Professor, IMAS, and Director, CSIRO-UTAS
Quantitative Marine Science PhD Program

Professor Graham Edgar, Senior Marine Ecologist

Dr Gretta Pecl, Senior Research Fellow

National Climate Change Marine Adaptation Network

Dr Julie Davidson, Senior Research Fellow

Friday, 17 February 2012 – Australian Alps/Gundharwar (site inspection)**Individuals**

Mr Roger Good, Alpine Ecologist

Great Eastern Ranges Initiative

Mr Ian Pulsford, Founding Manager (2007-2010) and private environment, protected area and linking landscapes specialist

Kosciuszko to Coast

Mr Geoff Robertson, President

Ms Lauren van Dyke, Facilitator

NSW Department of Premier and Cabinet, Office of Environment and Heritage National Parks and Wildlife Service

Pam O'Brien, Area Manager

Dr Ken Green, Principal Research Scientist

Mr Gary Saunders, Manager, Planning and Performance Unit

Ms Mel Schroder, Environmental Management Officer

Friday, 2 March 2012 – Canberra (public hearing)**Individuals**

Mr Roger Good, Private capacity

Great Eastern Ranges Initiative

Mr Rob Dunn, Chief Executive Officer

Research Centre for Applied Alpine Ecology

Professor Ary Hoffmann, Australian Research Council Laureate Fellow, Departments of Genetics and Zoology, University of Melbourne

Dr Ewen Silvester, Director, Department of Environmental Management and Ecology, La Trobe University

Dr Carl-Henrik Wahren, Deputy Director, Department of Agricultural Sciences, La Trobe University

National Parks Australia Council

Ms Christine Goonrey, President

Mr Matt Ruchel, Executive Director, Victorian National Parks Association

International Union for the Conservation of Nature, World Commission on Protected Areas

Dr Graeme Worboys, Vice-Chair, Mountains and Connectivity Conservation

Tuesday, 27 March 2012 – Sydney (site inspection)**Australian Botanic Garden**

Dr Catherine Offord, Manager, Horticultural Research, Science and Conservation

Mr Peter Cuneo, Manager, Natural Heritage

Sydney Olympic Park Authority

Ms Kerry Darcovich, Senior Manager, Environment and Ecology

Mr Mike Bartlett, Manager of Education

Dr Marianne Sheumack, Project Manager, Education and Sustainability

Wednesday, 28 March 2012 – Sydney (public hearing)**Australian Forests and Climate Alliance**

Mr Pepe Clarke, Member and Chief Executive Officer of the Nature Conservation Council of NSW

Ms Lorraine Bower, Spokesperson

Australian Museum

Dr Brian Lassig, Assistant Director, Research and Collections Division

Dr Patricia Hutchings, Senior Principal Research Scientist

Ecological Society of Australia

Professor Kristine French, President

International Union for Conservation of Nature, World Commission on Protected Areas

Ms Penelope Figgis, Vice Chair for Oceania

National Parks Association of New South Wales

Mr Kevin Evans, Chief Executive Officer

Thursday, 3 May 2012 – Melbourne (site inspection)**Australasian Wader Studies Group**

Mr Ken Gosbell, Member

BirdLife Australia

Dr Graeme Hamilton, Chief Executive Officer

Dr Jenny Lau, Head of Conservation

Melbourne Museum

Dr Mark Norman, Head of Sciences

Dr Timothy O'Hara, Deputy Head of Sciences - Marine

Dr Robin Hirst, Director, Collections, Research and Exhibitions

Dr Jane Melville, Senior Curator, Terrestrial Vertebrates

Dr Joanna Sumner, Manager, Genetic Resources

Ms Wendy Roberts, Reef Watch Co-ordinator

University of Ballarat

Dr Birgita Hansen, Research Fellow

Friday, 4 May 2012 – Melbourne (public hearing)**Australian Coastal Society**

Dr Eric Woehler, Convenor, Tasmanian Branch

Australian Conservation Foundation

Mr Graham Tupper, National Liaison Manager

Dr Paul Sinclair, Program Manager, Healthy Ecosystems Program

Australian Network of Environmental Defender's Offices

Ms Nicola Rivers, Law Reform Director, Environmental Defender's Office,
Victoria

Ms Elizabeth McKinnon, Lawyer, Environmental Defender's Office,
Victoria

Australian Psychological Society

Dr Susie Burke, Senior Psychologist

BirdLife Australia

Dr Jenifer Lau, Acting Head of Conservation

Mr Charles Sherwin, Conservation Manager

Climate and Health Alliance

Ms Fiona Armstrong, Convenor

Dr John Merory, Member

Monash Sustainability Institute

Dr Marion Carey, Senior Research Fellow

Planet Ark Environmental Foundation

Dr Sean O'Malley, Research and Technical Manager

University of Tasmania

Associate Professor Mark Hovenden PhD, Associate Professor of Plant Ecology, School of Plant Science

Wednesday, 16 May 2012 – South Australia (site inspection)**Department of Environment, Water and Natural Resources (South Australian Government)**

Ms Gemma Cunningham, Community Engagement Manager

Mr Lachlan Sutherland, Ngarrindjeri Partnerships Coordinator, Wyndgate on Hindmarsh Island

Mr Russell Seaman, Environmental Advisor

Mr Tim Hartman, Ngarrindjeri Regional Authority, Wyndgate on Hindmarsh Island

Milang Lakes Hub

Ms Karyn Bradford, Lakes Hub Executive

Ms Carole Richardson, Local Action Planning Coordinator

Thursday, 17 May 2012 – Adelaide (public hearing)**City of Salisbury**

Mr Colin Pitman, General Manager, City Projects

Conservation Council of South Australia

Ms Julia Winefield, Campaign Coordinator

Ms Jill Woodlands, Natural Resources Management Facilitator

Ms Noriko Wynn, Policy and Communications Officer

Fixing Our Country Program

Mr Mark Anderson, Chief Executive Officer, Greening Australia (South Australia)

Mr Leonard Cohen, Executive Director, Canopy

South Australian Department of Environment, Water and Natural Resources

Mr Greg Leaman, Executive Director, Policy

Ms Clare Nicolson, Principal Policy Officer, Policy

Thursday, 17 May 2012 – South Australia (site inspection)**City of Salisbury**

Mr Colin Pitman, General Manager, City Projects

Thursday, 21 June 2012 – Canberra (public hearing)**Commonwealth Scientific and Industrial Research Organisation**

Dr John La Salle, Director, Atlas of Living Australia

Mr Peter Doherty, Program Manager, Atlas of Living Australia

Dr Joanne Daly, Strategic Advisor

Invasive Species Council

Mr Andrew Cox, President

Mr Doug Laing, Member

Tuesday, 3 July 2012 – Kakadu National Park (site inspection)**Kakadu National Park**

Mr Michael Bangalang, Traditional Owner and Member, Kakadu National Park Board of Management

Ms Sarah Kerin, Park Manager

Mr Steve Winderlich, Manager, Natural and Cultural Programs

Wednesday, 4 July 2012 – Darwin (public hearing)**Northern Territory Department of Natural Resources, Environment, the Arts and Sport**

Dr Alaric Fisher, Executive Director, Biodiversity Conservation

North Australian Indigenous Land and Sea Management Alliance

Dr Peter Whitehead, Advisor

Northern Territory Natural Resource Management

Ms Kate Andrews, Chair

Thursday, 5 July 2012 – Townsville (public hearing)**Australian Coral Reef Society**

Dr Selina Ward, Councillor

Australian Institute of Marine Science

Mr John Gunn, Chief Executive Officer

Dr Kenneth Anthony, Research Team Leader

Centre for Tropical Biodiversity and Climate Change

Dr Ben Phillips, Senior Research Fellow

Dr Jeremy VanDerWal, Senior Research Fellow

Wet Tropics Management Authority

Mr Andrew Maclean, Executive Director

Thursday, 5 July 2012 – Townsville (site inspection)**Reef HQ Aquarium**

Mr Fred Nucifora, Director

Friday, 6 July 2012 – Daintree Rainforest Observatory (site inspection)**James Cook University**

Dr Susan Laurance, Senior Lecturer, School of Marine and Tropical Biology

Mr Bradley Smith, Research Strategy and Special Projects Manager, Division of Research and Innovation

Mr Peter Byrnes, Site Manager, Daintree Rainforest Observatory

Mr Andrew Thompson, Research Worker/Canopy Crane Operator

Wet Tropics Management Authority

Mr Andrew Maclean, Executive Director

Dr Steve Goosem, Principal Scientist

Thursday, 16 August 2012 – Canberra (public hearing)**Commonwealth Scientific and Industrial Research Organisation**

Dr Craig James, Research Theme Leader, Managing Species and Natural Ecosystems

Dr Andy Sheppard, Research Theme Leader, Building Resilient Australian Biodiversity Assets

National Climate Change Adaptation Research Facility

Dr David Rissik, Deputy Director

Dr Sarah Boulter, Research Fellow

Thursday, 20 September 2012 – Canberra (public hearing)**Australian Institute of Aboriginal and Torres Strait Islander Studies**

Dr Lisa Strelein, Director of Research, Indigenous Country and Governance

Friday, 12 October 2012 – Canberra (public hearing)**Australian Research Council**

Professor Aidan Byrne, Chief Executive Officer

Department of Industry, Innovation, Science, Research and Tertiary Education

Ms Katharine Campbell, Acting Head of Division, Science and Infrastructure Division

Dr Alexander Cooke, Manager, Science Policy

Department of Sustainability, Environment, Water, Population and Communities

Mr Sean Sullivan, Acting Deputy Secretary

Ms Claire Howlett, Acting First Assistant Secretary, Land and Coasts Division

Department of Sustainability, Environment, Water, Population and Communities National Wildlife Corridors Plan Advisory Group

Hon. Robert John Debus, Chair

Dr Judy Henderson, Co-Chair, Spatial, Climate Change and Biodiversity Analysis Expert Working Group

Great Barrier Reef Marine Park Authority

Dr David Wachenfeld, Director, Ecosystems, Conservation and Sustainable Use

Dr Chloe Schäuble, Acting Director, Climate Change and Science