

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
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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
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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
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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.