LEGISLATIVE ASSEMBLY

Standing Committee on Natural Resource Management (Climate Change)

Return of the ark

The adequacy of management strategies to address the impacts of climate change on biodiversity

Report No. 5/54 – December 2009

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Membership and staff

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	Dr Carolyn Littlefair, Senior Committee Officer
	Ms Kylie Rudd, Research Officer (from July 2009)
	Mr Leon Last, Committee Officer (from April 2009 to July 2009) Assistant Committee Officer (until April 2009, from July 2009 to November 2009)
Contact details	Standing Committee on Natural Resource Management (Climate Change) Parliament of New South Wales Macquarie Street Sydney NSW 2000
Telephone	02 9230 3438
Facsimile	02 9230 3052
E-mail	climate.change@parliament.nsw.gov.au
URL	www.parliament.nsw.gov.au/climatechange

Committee terms of reference

The Legislative Assembly Standing Committee on Natural Resource Management (Climate Change) was established on 21 June 2007 to inquire into issues of sustainable natural resource management with particular reference to the impact of climate change and, in particular, to report on the following terms of reference:

(a) The likely consequences of human-induced climate change on land (including salinity), water and other natural resources;

(b) Options for ensuring ecologically sustainable natural resource use, taking into particular account the impacts of climate change;

(c) Approaches to land and water use management practices on farms and other natural resource management practices, having regard in particular to the role of such practices in contributing to climate change or as a tool in helping to tackle climate change;

(d) The effectiveness of management systems for ensuring that sustainability measures for the management of natural resources in New South Wales are achieved, having particular regard to climate change; and

(e) The likely consequences of national and international policies on climate change on natural resource management in New South Wales.

Inquiry terms of reference

On 4 March 2009, the Standing Committee on Natural Resource Management (Climate Change) resolved to conduct an inquiry into management strategies to address the likely impacts of climate change on biodiversity in New South Wales ecosystems with the following terms of reference:

That the Committee inquire into and report on:

- the adequacy of management strategies to address the impacts of climate change on biodiversity in New South Wales ecosystems and
- any options for improving these strategies

in order to ensure that these ecosystems are resilient to the likely impacts of climate change including:

a) increasing invasion of weed and pest species;

b) changes to species' distribution and ecosystem composition including increased risk of extinction;

c) changes to species' life cycle events (such as flowering, egg-laying and migration); and

d) other threats to species or ecosystem health.

Chair's foreword

According to Genesis, Noah ensured that animals survived a cataclysmic flood by constructing an ark to protect them, thereby preserving biodiversity for the future. Today, as we try to address the potentially cataclysmic environmental effects of climate change, it is apt that we investigate the need for a new ark or some way of ensuring that healthy ecosystems and biodiversity continue.

It is for this reason that the Standing Committee on Natural Resource Management (Climate Change) sought to investigate the adequacy of management strategies to address the likely impacts of climate change on biodiversity.

One of the fundamental messages the Committee heard during this inquiry is the need to take a new approach to biodiversity management in light of the impacts of climate change. Existing approaches to biodiversity conservation are unlikely to be successful in maintaining ecosystem health or preventing species extinction in the face of increasing threats.

Embracing a new approach will require government agencies, natural resource managers, community groups and society at large to take a fresh look at biodiversity management and make innovative, unfamiliar and potentially challenging decisions. It is not the intention of the Committee to propose the specific details of this new approach, as the Committee recognises that significant scientific and community consultation is required to articulate new goals, objectives and priorities for biodiversity conservation.

During this inquiry the Committee also heard that there is a need for urgent action. As a society we cannot afford the consequences that inaction and indecision would bring to the future of biodiversity. As such, I encourage all relevant agencies to implement the recommendations of the Committee with urgency to ensure that we are able to protect biodiversity for future generations.

Within this report the Committee has outlined a number of principles that should underpin biodiversity management. In particular, the Committee notes that there is considerable uncertainty surrounding the specific details and magnitude of climate change impacts and how species and ecosystems will respond. This means that natural resource managers will need to ensure their management plans are robust and flexible enough to respond to a range of possible changes.

The Committee recognises the importance of maximising the capacity of natural resource management agencies to better manage biodiversity. This will require better alignment of agency goals and improved coordination of agency programs. The Committee also highlights the importance of regionally-based on-ground staff to work with local landholders to encourage improved biodiversity management.

This report also discusses specific issues relating to the management of biodiversity on public and private land. The Committee notes that the reserve system will continue to play a vital role in protecting ecosystems and that measures should be put in place to minimise impacts on the reserve system.

However, public land alone will not provide protection to all ecosystems under the impacts of climate change and therefore measures to protect biodiversity on private land will be increasingly vital. In particular, the Committee highlights the importance of conservation incentive schemes. A delegation of the Committee had the opportunity to meet with landholders who have participated in various schemes to conserve biodiversity on their properties and saw firsthand the positive environmental outcomes that have resulted. The Committee commends all landholders involved in a conservation incentive scheme for their efforts and contribution to conservation in New South Wales.

The Committee understands that the Department of Environment, Climate Change and Water is currently leading the preparation of the new *Biodiversity Strategy for New South Wales* and the *Climate Change Action Plan*. The Committee considers that the finalisation of these documents provides an ideal opportunity to implement many of the recommendations of the Committee.

I would like to thank all the organisations and individuals who provided submissions to the inquiry or appeared at one of the Committee's hearings. I would also like to thank those involved in hosting or organising the visit of inspection to the Bredbo and Bega regions. The efforts of all those involved are greatly appreciated.

I wish to take this opportunity to offer my sincere thanks to the former Chair of the Committee, Mr David Harris MP, who oversaw the bulk of this inquiry. I know that I speak on behalf of all Committee members in thanking Mr Harris for his contributions to the inquiry and the broader work of the Committee.

I also wish to thank my fellow Committee members for their interest and contributions to this inquiry and for the commitment they have demonstrated in progressing this inquiry.

Finally, I wish to express my gratitude to the secretariat staff for their assistance in this inquiry. In particular, I would like to thank Vicki Buchbach for providing guidance and advice throughout the course of the inquiry and Carolyn Littlefair for researching and preparing the report. I would also like to thank Kylie Rudd and Leon Last for their work during the time they were part of the secretariat.

Noreen Hay, MP
Committee Chair

List of recommendations

Abbreviations

AOS	Assessment of significance
BDAC	Biological Diversity Advisory Committee
CAP	Catchment Action Plan
CAR	Comprehensive, adequate, representative
CEO	Chief Executive Officer
CMA	Catchment Management Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCC	Department of Climate Change (Commonwealth)
DEC	Department of Environment and Conservation (NSW) - former
DECC	Department of Environment and Climate Change (NSW) - former
DECCW	Department of Environment, Climate Change and Water (NSW)
DEST	Department of the Environment, Sport and Territories (Commonwealth) - former
DEWHA	Department of the Environment, Water, Heritage and the Arts (Commonwealth)
DPI	Department of Primary Industries (NSW) - former
EDO	Environmental Defender's Office
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPI	Environmental planning instrument
GER	Great Eastern Ranges
IFOA	Integrated Forestry Operations Approvals
K2C	Kosciuszko to Coast
KTP	Key threatening process
LEP	Local environmental plan
LHPA	Livestock Health and Pest Authorities
LPMA	Land and Property Management Authority
MACROC	Macarthur Regional Organisation of Councils
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	National Parks and Wildlife Service
NRAC	Natural Resources Advisory Council
NRC	Natural Resources Commission
NRS	National Reserve System
NV Act	*Native Vegetation Act 2003*
PAS	NSW Threatened Species Priorities Action Statement
PVP	Property Vegetation Plan
SEPP	State environmental planning policy
SHOROC	Shore Regional Organisation of Councils
SIS	Species impact statement
TAP	Threat abatement plan
TSCA	Taronga Conservation Society Australia
TSC Act	*Threatened Species Conservation Act 1995*
TSR	Travelling stock reserve
UNE	University of New England
WOPR	Whole of Paddock Rehabilitation

Note on agency names

During the course of this inquiry a number of Government departments and agencies changed names or were amalgamated into new departments. The table below lists the previous and current names of departments and agencies referred to within the report.

Former name	Current name
Department of Environment and Climate Change	Department of Environment, Climate Change and Water
Department of Lands	Land and Property Management Authority
Department of Primary Industries	Department of Industry and Investment
Rural Lands Protection Boards	Livestock Health and Pest Authorities

It should also be noted that some specific agencies referred to within this report are part of broader departments. In particular, the National Parks and Wildlife Service is part of the Department of Environment, Climate Change and Water and Forests NSW is part of the Department of Industry and Investment.

Throughout this report, the term 'natural resource management agencies' is used to refer to the collection of government departments, authorities and agencies involved in natural resource management. These include:

- Department of Environment, Climate Change and Water (including the National Parks and Wildlife Service)
- Department of Industry and Investment (including Forests NSW)
- Catchment Management Authorities
- Land and Property Management Authority
- Livestock Health and Pest Authorities
- Local governments.

Chapter One - The inquiry process

1.1 The Standing Committee on Natural Resource Management (Climate Change) was appointed on 21 June 2007 to inquire into issues of sustainable natural resource management with particular reference to the impact of climate change. In early 2009 the Committee became concerned about how the likely impacts of climate change on biodiversity were being managed. On 4 March 2009, the Committee resolved to conduct an inquiry into the adequacy of management strategies to address the impacts of climate change on biodiversity.

Submissions

1.2 On 9 March 2009, the Committee called for submissions on the inquiry's terms of reference. The Committee received 26 submissions from individuals, academics, environmental and conservation groups, research organisations, State government agencies, local government representative bodies, interest groups and natural resource management bodies. A list of these submissions is included in Appendix One and copies of the submissions are available from the Committee's website.

Hearings

1.3 The Committee took evidence from a range of State and local government officials, academics, conservation and environmental groups, research organisations and key interest groups. Public hearings were held in Sydney on 4 May 2009, 22 June 2009 and 20 August 2009. A list of witnesses at the hearings is included in Appendix Two and the transcripts are available from the Committee's website.

Visit of inspection

1.4 On 17 and 18 September 2009, a delegation of the Committee travelled to the Bredbo, Bega and Monaro regions to learn about the incentives, obligations and outcomes of different biodiversity conservation incentive schemes on private property. The Committee met with representatives and landholders involved with: the Kosciuszko to Coast project; the Department of Environment, Climate Change and Water's (DECCW) Conservation Agreements; and the Southern Rivers Catchment Management Authority's Bega Dairy Partnerships program and Monaro Grasslands program. Further information on the visit of inspection is included in Appendix Three.

Departmental name changes

1.5 During the course of this inquiry a number of New South Wales Government departments were restructured and renamed. Within this report the Committee has adopted the convention of referring to the name of the department at the time the submission was received, the witness appeared or the report was published. A table of names changes for relevant departments is included at front of this report.

Information provided by departments

1.6 Overall the Committee was impressed with the information provided by Government agencies and departments and the contributions their representatives and staff made to progressing the inquiry. In particular, the Committee thanks the former Department of Primary Industries, the National Parks and Wildlife Service (now part of DECCW)

and the Department of Planning for their thorough and informative responses to questions taken on notice at the 4 May 2009 and 20 August 2009 hearings.

1.7 However, the Committee did have concerns about the quality of some information provided by some departments. Some departmental submissions did not provide detailed information on relevant programs and projects or contained information that was inaccurate. Additionally, the Committee was disappointed with the lack of detail provided by some departments to a number of questions taken on notice at hearings.

1.8 The Committee cannot serve its purpose unless it obtains appropriate information from departments. The Committee was disappointed by these few cases and considers that departments should be reminded about the importance of ensuring that submissions to parliamentary committees and responses to questions on notice are accurate, relevant and informative.

Structure of the report

1.9 Chapter One of the report details the process undertaken to conduct this inquiry and issues relating to the conduct of the inquiry. Chapter Two outlines the likely impacts of climate change on biodiversity and the implications for industries that are dependent on biodiversity for their economic survival. Chapter Three discusses the agreements, strategies and legislation in place at the international, national and State level to protect biodiversity. Chapter Four outlines the key principles that should be adopted to manage biodiversity under climate change. Chapter Five discusses issues to maximise the capacity of government agencies and departments to manage biodiversity. Chapter Six outlines the management of biodiversity on public land and issues surrounding invasive species management. Chapter Seven discusses the management of biodiversity on private land.

Chapter Two - Impacts of climate change on biodiversity

2.1 This chapter provides a brief description of the threats to biodiversity and the likely impacts of climate change on biodiversity. It then discusses factors that contribute to the vulnerability of species and ecosystems to climate change impacts. This chapter also outlines the implications of climate change impacts for the nature tourism, fishing and aquaculture industries which are dependent on biodiversity and healthy ecosystems.

Biodiversity

2.2 Biodiversity is the variety of all life forms on earth, that is, the different plants, animals and micro-organisms, their genes and the terrestrial, marine and freshwater ecosystems of which they are a part.[1] Biodiversity exists at three levels: genetic diversity, the variety of genetic information contained in all living things and that varies within and between populations; species diversity, the variety of species on earth; and ecosystem diversity, the variety of earth's habitats, ecosystems and ecological processes.[2]

2.3 Australia is home to between 600,000 and 700,000 species and is recognised as being one of the world's 'megadiverse' regions, that is, one of the most biologically diverse countries in the world.[3] Additionally, Australia has a high proportion of species that are endemic to Australia with 82% of mammals, 45% of birds, 85% of flowering plants, 89% of reptiles and 93% of frogs found nowhere else on earth.[4]

Why biodiversity matters

2.4 Biodiversity is essential for human existence and is also valuable in its own right. The conservation of biodiversity is fundamental to healthy ecosystems that provide services to sustain life on earth. These ecosystem services include: plants producing oxygen and removing carbon dioxide from the atmosphere, vegetation cleaning and filtering water and recycling nutrients, and bacteria and fungi breaking down organic matter in the soil.[5]

2.5 Biodiversity is also of enormous economic value. It forms the basis of primary production industries, such as agriculture, forestry and fisheries, as well as providing services to these industries such as pollination and nutrient recycling. Biodiversity is

[1] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 16

[2] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 16

[3] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 17;

[4] DEST, *National Strategy for the Conservation of Australia's Biological Diversity*, Canberra, 1996, p. 6

[5] Submission 11, TSCA, pp. 6-7; Submission 13, UNE – School of Environmental and Rural Science, p. 14; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 17

an important resource for the production of other essential human services such as pharmaceuticals and new or improved food or textile crops.[6]

2.6 Areas that are conserved for biodiversity, such as national parks and other natural areas, provide significant economic and social benefits. National parks provide opportunities for recreational activities such as walking, fishing, boating, swimming and camping. National parks also contribute to the health and wellbeing of the community with research showing that visiting natural areas can lower blood pressure and improve mental wellbeing.[7] There are also significant economic benefits associated with these activities, with Australia's recreational fishing industry estimated to be worth $2.9 billion annually[8] and the nature and outdoor tourism industry estimated to be worth around $20 billion annually in Australia.[9]

2.7 The value of biodiversity for the nature tourism, fishing and aquaculture industries is further discussed later in this chapter.

Threats to biodiversity

2.8 The Committee heard that despite the efforts of governments and the community, biodiversity is still under considerable threat and the condition of biodiversity in New South Wales is continuing to decline.[10]

2.9 Ecosystems and biodiversity face many threats, with the loss of biodiversity often a result of multiple threats operating together. The main threats to ecosystems and biodiversity are listed below:

- Loss, fragmentation and degradation of habitat, which is generally the result of vegetation clearance and other human-related disturbances associated with expanding urban development, particularly along the coastline, and changing land uses for agriculture and dam construction.[11]
- Invasive species, including introduced weeds, feral animals (such as foxes, cats and wild dogs), insects and other invertebrates, marine pests, diseases, fungi and parasites.[12]
- Altered hydrological regimes, which is generally caused by water pollution, compromised water quality and the over-extraction of surface and ground water.[13]

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[6] Submission 11, TSCA, pp. 6-7; DEST, *National Strategy for the Conservation of Australia's Biological Diversity*, Canberra, 1996, p. 6; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[7] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 28; DEC, *Living Parks: A sustainable visitation strategy*, Sydney, 2006, p. 8

[8] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 17

[9] Submission 3, Professor Ralf Buckley, p. 3

[10] Dr John Williams, Transcript of hearing, 22 June 2009, p. 17

[11] Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 3; Submission 24, Friends of Narrabeen Lagoon Catchment, p. 2; Submission 25, SHOROC, p. 2; Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 85

[12] Submission 10, DECC, p. 1; Submission 20, MACROC, p. 3; Submission 25, SHOROC, p. 2; Mr Tm Rogers, Transcript of hearing, 4 May 2009, p. 3; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 83

[13] Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 3; Submission 25, SHOROC, p. 2; Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 89

- Altered fire regimes, such as changes to the intensity and frequency of fires.[14]
- Unsustainable use of natural resources, that is, the consumption of terrestrial and marine natural resources at a rate that leads to long-term decline, generally caused by population growth, urban expansion, pollution, intensive agricultural practices, destructive fishing practices and illegal fishing.[15]
- Climate change, which is a change in climate caused directly or indirectly by human activity that alters the composition of the global atmosphere beyond its natural variability.[16]

Likely impacts of climate change

2.10 Climate change is considered to be a new threat to biodiversity and will also exacerbate existing threats.[17] Climate change is likely to affect species and ecosystems in new ways and at rates they have not previously been affected. However, climate change is also a systematic issue affecting almost all aspects of biodiversity and society and therefore will exacerbate many of the existing threats as ecosystems and communities adapt to climate change impacts.

2.11 While acknowledging there is uncertainty around the specific details and magnitude of projected climate change impacts, there is broad scientific consensus about the types of impacts Australia's environment can expect:

- Increases in temperatures, with annual average temperatures anticipated to increase between 0.2 °C and 2.2 °C by 2030. In central and southern New South Wales annual average temperatures are projected to increase by between 0.6 °C and 1.3 °C by 2030 and in northern New South Wales the increase is projected to be between 0.7 °C and 1.5 °C.[18]
- Changes in rainfall, with totals, averages, seasonality and inter-annual variability all likely to change in different ways in different regions.[19]
- Changes in the frequency, timing and severity of extreme events such as floods, storms, heatwaves, high wind, droughts and fire.[20]

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[14] Submission 20, MACROC, p. 3; Submission 25, SHOROC, p. 2; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 90

[15] Submission 20, MACROC, p. 3; DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, pp. 86-88

[16] *United Nations Framework Convention on Climate Change*, 1992, Article 1.2

[17] Submission 6, CSIRO, p. 7; Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 2; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 7

[18] Submission 6, CSIRO, p. 7; M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 32

[19] Submission 6, CSIRO, p. 7; Intergovernmental Panel on Climate Change, *Climate change 2007: Synthesis report – Summary for Policymakers*, Geneva, 2007, p. 8; M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 32

[20] Submission 6, CSIRO, p. 7; Intergovernmental Panel on Climate Change, *Climate change 2007: Synthesis report – Summary for policymakers*, Geneva, 2007, p. 8; M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 33

- Rising sea levels, increased sea-surface temperatures and ocean acidity. Current predictions anticipate that sea level will rise by up to 40 cm by 2050 and 90 cm by 2100.[21]

2.12 Dr Michael Dunlop, a Research Scientist with the CSIRO, told the Committee that there is evidence in Australia and globally that changes to the environment are already occurring.[22] Some of these observed changes are listed below:

- Global atmospheric concentrations of CO_2 have increased from 280 ppm in 1750 to 379 ppm in 2005.
- The frequency of intensity of cyclones in the Atlantic and Pacific basins has increased.
- Average temperatures in Australia have increased by approximately 0.9 °C since 1910, with minimum temperatures increasing by 1.2 °C and maximum temperatures increasing by 0.7 °C.
- Significant changes in Australia's regional rainfall patterns since around 1950 with rainfall increases of up to 50 mm per decade in northern Western Australia and the Northern Territory and rainfall declines in excess of 20 mm per decade across much of the eastern seaboard.
- Warming of sea-surface temperatures in all three oceans surrounding Australia resulting in a rise in sea level of 1.2 mm per year on average between 1920 and 2000.
- Decline in the mean snow cover from the period in the Australian Alps with maximum winter snow depth at Spencers Creek (in the Snowy Mountains) declining by approximately 40% since 1962.[23]

2.13 The predicted impacts of climate change will significantly affect biodiversity, both directly (through impacts on individuals, populations and ecosystems) and indirectly (through changes to the interactions between species, habitat provision and ecosystem function).[24] The Committee was informed that while it is clear that the impacts of climate change on biodiversity will be numerous and complex, the exact details, particularly for indirect impacts, cannot yet be predicted accurately due to the many complex interactions within ecosystems.[25]

2.14 The Committee heard that the key climate change impacts on biodiversity are likely to be:

- changes in species' distributions
- changes in species' life cycle events
- changes in species' food supply

[21] M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 33; DECC, *Scientific basis of the 2009 sea level rise benchmark: Draft technical note*, Sydney, 2009, p. 1

[22] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, pp. 42-43

[23] M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, pp. 28-30

[24] Submission 6, CSIRO, p. 7; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41; Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 12

[25] Submission 3, Professor Ralf Buckley, p. 5; Submission 6, CSIRO, p. 8

- changes in species' abundance and increased risk of extinction
- increased opportunities for invasive species
- changes in the structure and composition of ecosystems.

Changes in species' distribution

2.15 The Committee heard that a key impact of climate change on biodiversity would be a change in the places where species are found. As climatic conditions change, so too will the suitable habitat for many species, resulting in species moving to areas where they have not previously lived which now provide them with more suitable environmental conditions.[26]

2.16 In Australia this generally means that as temperatures increase species are likely to try to find cooler conditions by moving southward and to higher altitudes.[27] However, Dr Dunlop explained that temperature would not be the only influence on changing species distribution and that species would be likely to move along whichever environmental gradient has the greatest influence on their distribution:

> The idea is of distribution moving either uphill or towards the poles—so southward in Australia—typically southward and uphill, but it is actually along environmental gradients. So in Australia, because we have such strong gradients from the inland to the coast, these movements could be west to east rather than north to south, depending on the gradients—whether it is rainfall or temperature—that things are responding to.[28]

2.17 Species' distribution will also be affected in unpredictable ways as species respond to changes in carbon dioxide concentration in the atmosphere, other interacting species and the availability of suitable habitat.[29]

2.18 The Committee heard that there is already evidence that changes in species distribution are occurring. Mr Tim Rogers, the acting Deputy Director General of the Climate Change, Policy and Programs Group for the then Department of Environment and Climate Change, told the Committee that:

> Examples of observed changes to species as a result of climate change include native and feral animals from lower elevations colonising alpine ecosystems, reductions in the area of salt marsh in response to sea level rise, and the widespread reduction in the populations of freshwater invertebrates in rivers and streams that prefer cooler and fast-flowing water bodies. The strengthening of the East Australia Current pushing warmer water south has resulted in the southern extension of a number of marine species normally found in warmer waters and a southwards retreat in a range of marine macro algae species.[30]

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[26] Submission 2, Associate Professor Michael Mahony, p. 2; Submission 8, Mr Robert Mason, p. 1; Submission 10, DECC, p. 1; Submission 11, TSCA, pp. 10-11; Submission 21, Nature Conservation Council of NSW, p. 1; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[27] Submission 3, Professor Ralf Buckley, pp. 4-5; Submission 6, CSIRO, p. 7; Submission 10, DECC, p. 1; Submission 17, Australasian Wildlife Management Society, pp. 1-2

[28] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 43

[29] Submission 12, Namoi CMA, p. 2; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 6

[30] Mr Tim Rogers, Transcript of hearing, 4 May 2009, p. 1

2.19 A report by Griffith University on adapting to climate change, explained some of the implications of species distribution changes:

> Warmer seas have already brought measurable shifts in the distributions of fish and invertebrate animals. Tropical animals turn up more regularly further south. At first glance this does not sound too troublesome, and some perhaps welcome the idea as an extension of paradise. However, the list of species on the move may include crocodiles, deadly jellyfish and Australia's most venomous fish, the estuarine stonefish. The shifting distributions of marine wildlife will affect coastal recreation, tourism and marine industries.[31]

Changes in species' life cycle events

2.20 Climate change is likely to result in changes to the timing and completion of species' life cycle events such as flowering, seed germination, egg laying, egg hatching and migration.[32] Changes in species' life cycle events are likely to occur as a result of direct impacts on species as well as from altered interactions between species.

2.21 The seasonal timing of life cycle events is likely to change as temperatures increase and seasonal temperature patterns change.[33] For example, events that now happen in spring will occur earlier in the year and events that now happen in autumn will happen later in the year.[34] There is also growing evidence that annual reproductive cycles are determined not only by day length but also by climate-related factors.[35]

2.22 In Australia many species are dependent on fire to complete their life cycles. Changes to fire regimes, that is, the frequency, timing and severity of fires are likely to have major impacts and prevent some plants and animals from completing their life cycles.[36]

2.23 Hydrological changes could also disrupt the timing of spawning events as aquatic organisms are sensitive to the frequency, duration and timing of extreme flow events such as floods and droughts. Additionally, changes in aquatic flows and thermal regimes could become a major disruptor of reproductive processes.[37]

Changes in species' food supply

2.24 Climate change is likely to modify to species' food supplies as the way in which species interact with each other changes. One of the primary changes will be disruptions to predator-prey relationships. Changes to the abundance, distribution,

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[31] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 23

[32] Submission 6, CSIRO, p. 7; Submission 11, TSCA, p. 12; Submission 12, Namoi CMA, p. 2; Submission 13, UNE – School of Environmental and Rural Science, p. 12; Submission 17, Australasian Wildlife Management Society, pp. 1-2; Submission 21, Nature Conservation Council of NSW, p. 1; Intergovernmental Panel on Climate Change, *Climate Change and Biodiversity*, Geneva, 2002, p. 16
R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[33] Submission 3, Professor Ralf Buckley, pp. 4-5

[34] Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 12; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 5

[35] Submission 11, TSCA, p. 11

[36] Submission 13, UNE – School of Environmental and Rural Science, p. 12

[37] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 22

health and behaviour of species will alter the availability, timing and quantity of prey as well as altering competition for prey species by carnivorous animals.[38]

2.25 The foraging behaviour of some animals is likely to change as a result of changes to daily temperatures. For example, some arboreal marsupials will only forage within a specific temperature band to decrease their energy expenditure. If climate change alters diurnal temperature patterns then, likewise, the foraging behaviour of such animals will also be affected.[39]

2.26 Climate change is also expected to change the concentration of nutrients and toxic chemicals in leaves and the growth and water use of plants.[40] The foraging behaviour of some herbivores is therefore likely to be affected as the availability and palatability of particular plant species changes in response to the changing characteristics of vegetation.[41]

Changes in species' abundance and increased risk of extinction

2.27 Climate change impacts are likely to result in significant changes to species' abundance and an increased risk species extinction.[42] As climatic conditions change, the abundance of species will be particularly affected if they are unable to move to a more suitable habitat.[43] For example, remnant areas of littoral rainforest in New South Wales may be severely affected by coastal erosion and salt intrusion and these species have little opportunity to move to more suitable habitat.[44] A Griffith University report explained why this is a particular issue for aquatic systems:

> [M]any river and floodplain systems have lost their natural longitudinal and lateral connectivity and potential migratory corridors, reducing the capacity of aquatic organisms such as fish and invertebrates to make compensatory movements into more favourable aquatic conditions. This may cause species extinctions and loss of riparian and aquatic biodiversity.[45]

2.28 In Australia, one of the species most at risk of extinction from such climate change impacts is the mountain pygmy-possum (*Burramys parvus*). Dr Graeme Worboys, Vice Chair of Mountains and Connectivity for the International Union for the Conservation of Nature's World Commission on Protected Areas, told the Committee:

> [T]he mountain pygmy-possum is one of the few Australian species that hibernates during winter. It relies on the snow cover above it to do that because it insulates. The

[38] Submission 3, Professor Ralf Buckley, pp. 4-5; Submission 6, CSIRO, p. 7; Submission 17, Australasian Wildlife Management Society, pp. 1-2; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[39] Submission 3, Professor Ralf Buckley, pp. 4-5

[40] M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 5

[41] Submission 3, Professor Ralf Buckley, pp. 4-5; Submission 13, UNE – School of Environmental and Rural Science, p. 13

[42] Submission 6, CSIRO, p. 14; Submission 10, DECC, p. 1; Submission 11, TSCA, pp. 10-11; Intergovernmental Panel on Climate Change, *Climate change and biodiversity*, Geneva, 2002, p. 16; Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 12

[43] Submission 3, Professor Ralf Buckley, pp. 4-5; Submission 6, CSIRO, p. 7; Submission 10, DECC, p. 1; Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 12

[44] Submission 3, Professor Ralf Buckley, pp. 4-5

[45] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 21

> snow compacts the vegetation and the possum sleeps in the little air zone below the compacted vegetation. That always stays around zero degrees. If there is no snow, it will not be zero; it will be minus twelve or whatever. The temperatures will be below freezing. That is an endangered animal. The scientists are saying that that animal will lose through climate change.[46]

2.29 Change in species' abundance is also likely to be significant if a species is unable to adapt to the changing conditions, especially if they have very specialised habitat requirements.[47] A Griffith University report on climate change adaptation explained:

> Many rare species are restricted to a very particular combination of climate, habitat type and food supply and will find it difficult or impossible to adjust to any significant change in climate. Such specialists are much less adaptable than generalist species such as humans.[48]

2.30 Species' abundance will also be affected by changes to species' health. For some species, heat stress and other extreme weather events will negatively impact on wildlife health[49] with mass mortalities of flying foxes already being observed during extreme heat events.[50] Wildlife health is also likely to be affected as the distribution of disease vectors, pathogens and parasites changes with changing climatic conditions.[51]

Increased opportunities for invasive species

2.31 The impacts of climate change are likely to create conditions where invasive species will become a greater threat.[52] Invasive species can disrupt existing ecosystems, out-compete existing species for food, water or habitat and be predators to existing species, even if they are low in number.[53]

2.32 As discussed above, the distribution of species is likely to change as a result of climate change. This means that both native and exotic species will spread into new areas and provide invasive species more opportunities to expand their range.[54] For example, warmer temperatures across New South Wales may mean that the cane

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[46] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 18

[47] Submission 6, CSIRO, p. 7; Submission 10, DECC, p. 1; Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 12

[48] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34

[49] Submission 11, TSCA, p. 12; Submission 17, Australasian Wildlife Management Society, pp. 1-2; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[50] Submission 10, DECC, pp. 1-2

[51] Submission 11, TSCA, p. 12

[52] Submission 7, University of Sydney – School of Biological Sciences, p. 3; Submission 11, TSCA, p. 9; Submission 12, Namoi CMA, p. 2; Submission 21, Nature Conservation Council of NSW, p. 1; DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 2

[53] Submission 11, TSCA, pp. 10-11; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 8

[54] Submission 6, CSIRO, p. 7; Submission 10, DECC, p. 1; Submission 11, TSCA, p. 9; Submission 13, UNE – School of Environmental and Rural Science, p. 9; Mr Tim Rogers, Transcript of hearing, 4 May 2009, p. 1; Dr Karrie Rose, Transcript of hearing, 22 June 2009, p. 3; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 47; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 19

toad (*Bufo marinus*) reaches southern New South Wales.[55] Weeds such as prickly acacia (*Acacia nilotica*) and Siam weed (*Chromolaena odorata*) are frost tolerant and are likely to expand their range further south, while fireweed (*Senecio madagascariensis*) which is currently restricted by the cold is likely to move to higher altitudes.[56]

2.33 Changes in the distribution of invasive species have already been observed in some areas. In the alpine area of Australia foxes, hares (*Lepus europaeus*), house mice (*Mus musculus*), feral horses (*Equus caballus*) and weeds have all increased their presence at higher altitudes.[57]

2.34 Invasive species are generally good colonisers following disturbance events and are therefore well placed to take advantage of the likely increased frequency and severity of extreme events such as droughts, floods and fire.[58] A report by the Biological Diversity Advisory Committee on climate change and invasive species stated:

> Extreme events such as cyclones, floods, droughts and fires, predicted to occur more often or with greater severity, will facilitate invasions by introduced species, as they have in the past. Many of Australia's worst weeds do well after floods, cyclones or fires, which create ideal conditions for their establishment.[59]

2.35 As discussed above, it is likely that some species will become extinct as a result of climate change impacts. These extinct species may often be replaced by invasive species.[60]

2.36 There is still considerable uncertainty about the impacts of climate change on invasive species due to the complex and interacting impacts on both species and communities which could result in a wide variety of responses.[61] A CSIRO report on the implications of climate change for the reserve system stated:

> We cannot yet accurately predict which species – native or exotic – will increase and spread, and what the impact of their arrival in new areas might be. Some new species might have little impact on resident species or land use in that area, some might be beneficial, and others will have far-reaching negative impacts.[62]

Changes in the structure and composition of ecosystems

2.37 The likely changes to individual species described above will alter the interactions between species within an ecosystem leading to changes in the structure and composition of terrestrial, marine and aquatic ecosystems.[63] Such changes to the

[55] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 12

[56] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 2

[57] Submission 10, DECC, pp. 1-2; Mr Tim Rogers, Transcript of hearing, 4 May 2009, p. 1; BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 13

[58] Submission 13, UNE – School of Environmental and Rural Science, p. 9; DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 2

[59] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 3

[60] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 3

[61] Submission 13, UNE – School of Environmental and Rural Science, p. 9

[62] M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 8

[63] Submission 2, Associate Professor Michael Mahony, p. 2; Submission 10, DECC, p. 1; Submission 11, TSCA, p. 12; Submission 21, Nature Conservation Council of NSW, p. 1; Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 14; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 22

interactions between species and communities is particularly important but very difficult to predict.[64] The submission from the University of New England's School of Environmental and Rural Science stated:

> We currently have little knowledge about how climate change might be affecting the complex interactions between species in a community, and how such changes might ultimately impact upon ecosystems in terms of biotic composition, and ecosystem function. Because ecosystems are inherently complex, the ecosystem-level impacts of global warming are difficult to predict, and an ecosystem approach is required.[65]

Vulnerability to climate change impacts

2.38 Each species and ecosystem will be affected by climate change differently. The severity of these impacts will depend on a number of factors, including:

- the rate at which a species is able to adapt. The rate of adaptive change for most species is significantly lower than the pace at which climate change is proceeding.[66]
- the speed with which species would have to relocate. Populations would need to migrate faster than has ever been recorded to keep up with climate change impacts on habitats.[67]
- the inherent attributes of a species, that is, its physiology, life history, ecology and genetics.[68]
- the level of other stressors in the ecosystem. Species and ecosystems already suffering from other impacts on biodiversity (described in paragraph 2.9 above) are less able to cope with climate change impacts.[69]
- whether species are at the interface between habitat types. Ecotones (transitional zones between two ecological communities that contain species of each) will be one of the places where changes are likely to be the most dramatic.[70]
- whether species have specialised requirements or restricted distributions. Such species will find it very difficult or impossible to adjust to change and/or are unable to move to more suitable habitat.[71]
- whether species have lost a key resource in their ecosystem. For example, if an animal loses its hollow-bearing tree or nectar tree because these plants have already been affected by climate change, it will be especially difficult for the animals to adapt.[72]

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[64] Submission 21, Nature Conservation Council of NSW, p. 1; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 5

[65] Submission 13, UNE – School of Environmental and Rural Science, p. 11

[66] Submission 2, Associate Professor Michael Mahony, p. 1

[67] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 8

[68] Submission 2, Associate Professor Michael Mahony, p. 2

[69] Submission 6, CSIRO, p. 5; Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 2; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9

[70] Submission 13, UNE – School of Environmental and Rural Science, p. 11

[71] Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 2; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34

[72] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9

2.39 The Committee heard that the most vulnerable ecosystems to climate change in New South Wales are alpine areas, coastal areas, inland riverine floodplains and wetlands and rainforests, especially littoral rainforests.[73]

2.40 Dr Dunlop told the Committee that in determining climate change vulnerability most analyses have been based on which ecosystems are likely to have the highest number of individual species that are vulnerable. An alternative assessment undertaken by the CSIRO was to assess patterns of ecosystem growth by considering the season of growth and the climatic limits to growth of different ecosystems. By examining the modelling of which areas are expected to get hotter, colder, drier or wetter, the analysis identified which agro-climatic zones would experience the greatest number of ecosystem related changes.[74] These zones are the temperate cool season wet zone (the southern and northern New South Wales tablelands, Tasmanian lowlands and southern, central and eastern Victoria) and the temperate subhumid zone (western slopes of New South Wales).[75]

2.41 While this approach identified which ecosystems are likely to experience the greatest number of ecosystem changes, Dr Dunlop told the Committee that this does not necessarily correlate with ecosystem vulnerability:

> I hesitate to say that is vulnerability or threat, because there is no guarantee that that will lead to more extinctions because there are more changes. Species may be able to cope but there is more likely, I think, in those regions for there to be changes in land use or changes in fire regimes, new species turning up, than possibly elsewhere in the country. So depending on how you look at the issues and the changes, you might identify different regions as those that are most important.[76]

Industries dependent on biodiversity

2.42 As discussed above, biodiversity supports a number of industries. As climate change impacts biodiversity it also follows that industries dependent on biodiversity are likely to be affected.

2.43 While information on the implications of climate change on biodiversity dependent industries is often not well developed, industries will need to adapt to increasing unpredictability[77] and they will need to increasingly ensure that the natural resources on which they depend are sustainably managed and properly protected so that the industries may prosper into the future.[78]

Nature tourism

2.44 As stated in paragraph 2.6 above, the outdoor and nature tourism industry in Australia is estimated to be worth $20 billion annually. In New South Wales nature

[73] Submission 2, Associate Professor Michael Mahony, p. 2; Submission 3, Professor Ralf Buckley, pp. 4-5; Submission 10, DECC, p. 1; Submission 12, Namoi CMA, p. 2; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 19; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 9; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 19

[74] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 46

[75] M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, pp. 18, 154 & 156

[76] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 46

[77] Submission 6, CSIRO, p. 5

[78] Submission 12, Namoi CMA, p. 4

and outdoor tourism is estimated to be worth between $5 and $7 billion.[79] The Committee heard that the nature tourism industry is likely to be affected in many regions by climate change impacts on biodiversity as the industry is highly dependent on particular species or ecosystems as key tourism attractions.[80]

2.45 The nature tourism industry will be affected by the movement or loss of species, particularly if these species are a significant tourism attraction.[81] For example, if a particular bird species becomes rare or extinct or moves location due to climate change impacts, then the tourism businesses dependent on birdwatching in that area are likely to suffer.

2.46 In New South Wales, there are particular concerns about the future of the ski industry. The alpine areas are economically important for the tourism industry and are one of the areas identified as being most vulnerable to climate change. Therefore, as changing climatic conditions reduce snow cover, the ski tourism industry is also likely to suffer.[82]

2.47 As discussed in paragraph 2.19 above, changes in the distribution of marine species are likely as a result of climate change. This could include species such as jellyfish, crocodiles and venomous fish. Should environmental conditions change so that these species move further south, there would be significant implications for the tourism industry.[83]

2.48 The nature tourism industry will also be particularly affected by the change in the frequency and intensity of extreme events, such as floods, droughts and fires. Such events can destroy visitor infrastructure and facilities and force managers of natural areas to close those areas while they recover, effectively closing down tourism attractions.[84]

2.49 To ensure the economic viability of the nature tourism industry in New South Wales, maintaining the attractiveness and health of New South Wales's natural assets, particularly its national parks, is critical.[85] Further discussion of issues relating to the management of tourism in national parks is in paragraph 6.31 below.

Fishing and aquaculture

2.50 Fisheries and aquaculture are estimated to be worth over $2.1 billion to Australia[86] and the recreational fishing industry is estimated to be worth $2.9 billion annually in Australia.[87] The Committee heard that the fishing and aquaculture industries are likely to be affected by climate change impacts on biodiversity.[88]

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[79] Submission 3, Professor Ralf Buckley, p. 11

[80] Submission 3, Professor Ralf Buckley, p. 11; Submission 9, Northern Rivers CMA, p. 1

[81] Submission 3, Professor Ralf Buckley, p. 11

[82] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 19

[83] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 23

[84] Submission 3, Professor Ralf Buckley, pp. 11-12

[85] Submission 3, Professor Ralf Buckley, p. 12

[86] A J Hobday, E S Poloczanska & R J Matear (eds), *Implications of climate change for Australian fisheries and aquaculture: A preliminary assessment*. CSIRO report to DCC, Canberra, 2008, p. 1

[87] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 17

[88] Submission 9, Northern Rivers CMA, p. 1; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 23

2.51 A number of climate change impacts will influence marine and estuarine biodiversity. Dr Philip Gibbs, Principal Fisheries Scientist, for the then Department of Primary Industries (DPI), explained:

> [T]he major impacts that are likely to occur under variations in climate as they affect our marine biodiversity, for example, the East Australian Current which is moving south and bringing heat to the south; the increasing severity and frequency of storm surges which connect with the east coast lows—that is also the major supplier of water into our agricultural systems—and the shift in the seasonality of that. Freshwater flows in our estuaries impact on estuarine fauna. One issue that is well documented under water quality is the increasing acidity of the ocean and what impact that will have on a lot of our marine fauna that have calcium carbonate shells. Oysters are a good example of that in our aquaculture industry.[89]

2.52 There are several implications for marine and estuarine ecosystems including:

- The distribution of species will change as the East Australian Current changes.[90]
- Productivity of marine ecosystems will be reduced as a result of changes in ocean circulation or wind patterns which affect the up-welling of nutrient rich waters.[91]
- Productivity of estuarine ecosystems will be reduced as a result of decreased freshwater input from rivers and changing water salinity.[92]

2.53 Adaptation to new conditions will be essential for the ongoing future of the fishing and aquaculture industries. The submission from the CSIRO stated:

> [A]daptation options should focus largely on improving knowledge of the requirements of relevant species and ecosystems. For example, regional studies on the relationship between climate variables and species of interest are one way to improve understanding of the potential impacts of climate change on the fisheries and aquaculture industries.[93]

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[89] Dr Philip Gibbs, Transcript of hearing, 4 May 2009, p. 21

[90] Submission 6, CSIRO, p. 10; Dr Philip Gibbs, Transcript of hearing, 4 May 2009, p. 21 & p. 23; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 23

[91] Submission 11, TSCA, p. 12

[92] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 22

[93] Submission 6, CSIRO, p. 5

2.54 Other stakeholders concurred with this sentiment noting that marine and estuarine condition monitoring and research was essential to understand and mitigate the impacts of climate change on fishing and aquaculture.[94]

2.55 In a response to questions taken on notice at a hearing the then DPI informed the Committee that there was a need for fisheries and aquaculture management policies to better integrate the effects of climate variability and climate change in establishing harvest levels and developing future strategies.[95] A report by Griffith University on climate change adaptation reinforces this need for new strategies:

> Fisheries managers in Australia have successfully protected critical habitats, and have recently dealt with the issue of overharvesting. They have not yet come to terms with the far-reaching effects of climate change, however, and new management strategies are required…Fishing practices and the broader effects of human activities on the health of marine ecosystems will need new ideas, and quickly.[96]

[94] Submission 9, Northern Rivers CMA, p. 2; Submission 11, TSCA, p. 12

[95] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 16

[96] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 23

Chapter Three - Protection of biodiversity

3.1 Biodiversity is protected through a range of legal mechanisms at different levels of government. This chapter provides an overview of the main international and national agreements and plans that guide the protection of biodiversity in Australia. It also describes the key legislation, strategies and plans in New South Wales for biodiversity conservation and management.

International agreements

Convention on Biological Diversity

3.2 The United Nations *Convention on Biological Diversity* is a global agreement that was adopted at the Earth Summit in Rio De Janeiro in 1992 and entered into force on 29 December 1993. The Convention has 192 parties out of a possible 196. Australia signed the Convention in June 1992 and ratified it in June 1993.[97]

3.3 The Convention recognises the importance of all aspects of biodiversity – ecosystems, species and genes. The Convention has three objectives:

- to conserve biological diversity
- the use of biological diversity in a sustainable fashion
- to share the benefits of biological diversity fairly and equitably.[98]

3.4 Article 6 of the Convention commits parties to develop national strategies, plans or programs for the conservation and sustainable use of biodiversity. It also commits parties to integrate, as far as possible, biodiversity conservation into broader policies and programs.[99]

3.5 In 2002, parties to the Convention made an additional commitment:

> to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on earth.[100]

3.6 The Committee understands that international negotiations will take place next year in an effort to develop a new international agreement.

National strategies

National Strategy for the Conservation of Australia's Biological Diversity

3.7 In 1996 Australia released its first national biodiversity strategy, *The National Strategy for the Conservation of Australia's Biological Diversity*, which fulfilled its obligations under the *Convention on Biological Diversity*. The Strategy was prepared by the Australian and New Zealand Environment and Conservation Council and endorsed by the Council of Australian Governments.

3.8 The Strategy covered six themes:

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[97] *Convention on Biological Diversity,* 1992, List of Parties

[98] *Convention on Biological Diversity,* 1992, Article 1

[99] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 55

[100] *Conference of Parties to the Convention on Biological Diversity*, Strategic Plan for the Convention on Biological Diversity, COP 6 Decision VI/26, 11

- conservation of biological diversity across Australia
- integrating biological diversity conservation and natural resource management
- managing threatening processes
- improving our knowledge
- involving the community
- Australia's international role.[101]

3.9 Within each of these themes are a series of objectives and actions. The Strategy also highlights a number of priority actions for completion by 2000 and 2005.[102]

National Biodiversity and Climate Change Action Plan

3.10 The *National Biodiversity and Climate Change Action Plan* was released in 2004 to provide a broad framework that coordinated and supported adaptation to climate change across Australia.[103] The Action Plan was developed by the Natural Resource Management Ministerial Council and adopted by all jurisdictions.

3.11 The Action Plan identified a series of adaptation strategies and accompanying actions to minimise the negative impacts of climate change on biodiversity and maximise the capacity of species and ecosystems to adapt to future climate change. The Action Plan had seven objectives:

1. To improve our understanding of the impacts of climate change on biodiversity.
2. To increase awareness of climate change impacts and our capacity to respond.
3. To minimise the impacts of climate change on inland aquatic and semi-aquatic ecosystems.
4. To minimise the impacts of climate change on marine, estuarine and coastal ecosystems.
5. To minimise the impacts of climate change on native terrestrial species, communities and ecosystems.
6. To minimise the impact of invasive organisms on biodiversity in future climates.
7. To factor the impacts of climate change on biodiversity into natural resource management and land-use planning.[104]

Australia's Biodiversity Conservation Strategy

3.12 A review of *The National Strategy for the Conservation of Australia's Biological Diversity* is currently being conducted by the Natural Resource Management Ministerial Council. A consultation draft of the new strategy, *Australia's Biodiversity Conservation Strategy 2010-2020*, was released earlier this year.

3.13 The draft Strategy identified six 'priorities for change':

1. Building ecosystem resilience—ensuring that our natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressure, including from climate change.

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[101] DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 51

[102] DEST, *National Strategy for the Conservation of Australia's Biological Diversity*, Canberra, 1996, pp. 55-57

[103] Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, p. 8

[104] Natural Resource Management Ministerial Council, *National Biodiversity and Climate Change Action Plan*, Canberra, 2004, pp. 18-30

2. Mainstreaming biodiversity—ensuring that all Australians understand how their lives and actions affect biodiversity, and how biodiversity supports them.
3. Knowledge for all—improving, sharing and using our knowledge of biodiversity.
4. Getting results—improving delivery of conservation initiatives.
5. Involving Indigenous peoples—recognising the special relationship of Indigenous peoples with Australia's natural environments, the cultural significance of that relationship and its ongoing importance to the conservation of Australia's biodiversity.
6. Measuring success—measuring and reporting the strategy's implementation and effectiveness and being accountable for meeting the targets we set.[105]

3.14 The Committee understands that the final Strategy is expected to be released in December 2009.

New South Wales legislation

National Parks and Wildlife Act 1974

3.15 The *National Parks and Wildlife Act 1974* (NPW Act) provides provisions for the establishment, preservation and management of national parks, nature reserves and historic sites and the protection and care of native fauna, native flora and Aboriginal objects. The objects of the Act are:

(a) the conservation of nature, including, but not limited to, the conservation of:
  (i) habitat, ecosystems and ecosystem processes, and
  (ii) biological diversity at the community, species and genetic levels, and
  (iii) landforms of significance, including geological features and processes, and
  (iv) landscapes and natural features of significance including wilderness and wild rivers,

(b) the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to:
  (i) places, objects and features of significance to Aboriginal people, and
  (ii) places of social value to the people of New South Wales, and
  (iii) places of historic, architectural or scientific significance,

(c) fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation,

(d) providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.[106]

3.16 The NPW Act allows for the creation of Conservation Agreements,[107] which are voluntary commitments by landholders to protect and conserve a particular areas of their land that have significant conservation values. They are 'in perpetuity' commitments which are binding on current and successive landholders, as well as on the New South Wales Government.[108]

3.17 The NPW Act also allows for the creation of Wildlife Refuges,[109] which are voluntary commitments by landholders to protect and conserve native wildlife and its habitat.

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105 DEWHA, *Australia's Biodiversity Conservation Strategy,* Consultation draft, Canberra, 2009, p. 12

106 *National Parks and Wildlife Act*, s 2A

107 *National Parks and Wildlife Act*, ss 69A to 69KA

108 DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 9

109 *National Parks and Wildlife Act*, s 68

Proclamations of Wildlife Refuges are noted on the land title and remain in place for current and future owners unless landholders formally request that the Wildlife Refuge status be amended or revoked.[110]

3.18 The use of Conservation Agreements and Wildlife Refuges are discussed further in paragraphs 7.18 and 7.26 below.

Environmental Planning and Assessment Act 1979

3.19 The *Environmental Planning and Assessment Act 1979* controls planning and development within New South Wales. It includes an object of encouraging, through responsible planning:

> (vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats[.][111]

3.20 Biodiversity conservation within the planning context is primarily managed through environmental planning instruments (EPIs) which include State environmental planning policies, regional environmental policies and local environmental plans (LEPs). EPIs may make provision for a number of matters, including:

- protecting, improving or utilising the environment
- protecting or preserving trees and vegetation
- protecting and conserving native animals and plants, including threatened species, populations and ecological communities, and their habitats.[112]

3.21 An LEP establishes the rules regulating land use and development at the local level.[113] Ms Donna Rygate, Executive Director of Corporate Governance and Policy within the Department of Planning, told the Committee:

> A bit over three years ago the Department of Planning created a common structure and language for local environmental plans. That is commonly known as the standard instrument or the LEP template and all councils have to use it in preparing new principal LEPs. The standard instrument contains standard definitions. It also has mandatory and optional clauses and a range of zones for councils to use as best fit their local government area, and specific areas within those local government areas. Councils can add their own provisions to address particular local planning issues and the instrument is flexible enough to accommodate a range of environmental issues, including climate change and biodiversity.[114]

3.22 The Committee also heard that the LEP template:

> includes several land use zones with a primary focus on the protection of the environment and retention of native vegetation. They are predominantly in the form of environmental protection E zones. There are other zones like the W1 natural waterway zone that afford a high degree of protection and also the RU2 rural landscape zone, which could provide adequate protection for vegetation whilst allowing other land uses to occur[.][115]

[110] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 24
[111] *Environmental Planning and Assessment Act 1979*, s 5
[112] *Environmental Planning and Assessment Act 1979*, s 26
[113] Ms Donna Rygate, Transcript of hearing, 20 August 2009, p. 9
[114] Ms Donna Rygate, Transcript of hearing, 20 August 2009, p. 10
[115] Ms Donna Rygate, Transcript of hearing, 20 August 2009, p. 10

Threatened Species Conservation Act 1995

3.23 The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and maintain biodiversity, in particular threatened species, in New South Wales. The objects of the TSC Act are:

(a) to conserve biodiversity and promote ecologically sustainable development, and

(b) to prevent the extinction and promote the recovery of threatened species, populations and ecological communities, and

(c) to protect the critical habitat of those threatened species, populations and ecological communities that are endangered, and

(d) to eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities, and

(e) to ensure that the impact of any action affecting threatened species, populations and ecological communities is properly assessed, and

(f) to encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.[116]

3.24 The TSC Act establishes the process for the listing of species, populations or ecological communities as either vulnerable, endangered or critically endangered.[117] There are currently 942 species, 42 populations and 90 ecological communities listed under the TSC Act.[118] The TSC Act also identifies key threatening processes (KTPs).[119] In November 2000, anthropogenic climate change was listed as a KTP.

3.25 The TSC Act requires the Department of Environment, Climate Change and Water (DECCW) to prepare and adopt a NSW Threatened Species Priorities Action Statement (PAS) that:

- sets out the recovery and threat abatement strategies to be adopted for each threatened species
- establishes relative priorities and actions to implement the above strategies
- establishes performance indicators to report achievements in implementing recovery and threat abatement strategies in their effectiveness
- contains a status report on each threatened species (where information is available)
- set outs clear timetables for recovery and threat abatement planning and achievement.[120]

3.26 The PAS outlines thirty-four broad recovery and threat abatement strategies as well as detailed actions for these strategies. Each strategy and action has been prioritised according to its relative importance for achieving recovery or threat abatement for each species and KTP.[121]

3.27 The PAS identifies for which threatened species, populations or ecological communities a recovery plan should be prepared. Recovery plans are likely to be developed for iconic species, where there are complex conservation issues involving

[116] *Threatened Species Conservation Act 1995*, s 3
[117] *Threatened Species Conservation Act 1995*, ss 10, 11, 12
[118] *Threatened Species Conservation Act 1995*, Schedules 1, 2, 3
[119] *Threatened Species Conservation Act 1995*, s 74
[120] DECC, *Introducing the NSW Threatened Species Priorities Action Statement*, Sydney, p. 1
[121] DECC, *Introducing the NSW Threatened Species Priorities Action Statement*, Sydney, p. 5

a suite of management actions and where the input and agreement of multiple stakeholders (including Aboriginal communities) is required.[122]

3.28 The PAS also identifies which KTPs will require the a threat abatement plan (TAP). There are a number of circumstances in which a TAP is likely to be prepared:

- The KTP significantly affects biodiversity or is the main threat to many species.
- The severity of impact from the KTP varies across different locations and requires and planned and coordinated approach.
- Existing threat abatement strategies in other conservation planning documents and policy instruments need to be combined into one document.
- Management of the KTP requires coordination and commitment from several public authorities and stakeholders.[123]

3.29 Additionally, DECCW prepares statements of intent for each KTP listed under the TSC Act which outline DECCW's response to the KTP. Mr Tim Rogers, the Acting Deputy Director General of the Climate Change, Policy and Programs Group for the then Department of Environment and Climate Change (DECC), told the Committee:

> A statement of intent in response to the listing of climate change as a key threatening process under the Threatened Species Conservation Act is being prepared. That will be a summary of specific actions that DECC will undertake to improve the resilience of biodiversity over the next five years.[124]

3.30 The TSC Act also establishes the Biodiversity Banking and Offsets Scheme, referred to as the BioBanking Scheme.[125] The Scheme provides a mechanism for conservation actions to be funded through development actions. The Scheme is market based and self-funding.[126]

Native Vegetation Act 2003

3.31 The *Native Vegetation Act 2003* (NV Act) provides for the sustainable management and conservation of native vegetation and in particular controls the clearing of native vegetation in rural areas. The objects of the NV Act are:

> (a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State, and
>
> (b) to prevent broadscale clearing unless it improves or maintains environmental outcomes, and
>
> (c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation, and
>
> (d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and
>
> (e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation,
>
> in accordance with the principles of ecologically sustainable development.[127]

[122] DECC, *Introducing the NSW Threatened Species Priorities Action Statement*, Sydney, p. 10
[123] DECC, *Introducing the NSW Threatened Species Priorities Action Statement*, Sydney, p. 10
[124] Mr Tim Rogers, Transcript of hearing, 4 May 2009, p. 2
[125] *Threatened Species Conservation Act 1995*, Part 7A
[126] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3
[127] *Native Vegetation Act*, s 3

3.32 Under the NV Act, clearing of native vegetation is only allowed if it will 'improve or maintain environmental outcomes.'[128] The NV Act allows for the development of Property Vegetation Plans.[129] They are voluntary agreements administered by the Catchment Management Authorities (CMAs) that may:

- allow clearing on certain areas of a property
- identify certain areas of a property as offsets
- provide for continuing uses in certain areas
- facilitate financial assistance for conservation management.[130]

3.33 The Committee understands that in August 2009 DECCW commenced a review of the NV Act which should be completed in 2010.

New South Wales strategies and plans

State Plan: A new direction for NSW

3.34 In 2006 the New South Wales Government released the *State Plan: A new direction for NSW* which set out a number of goals, priorities and targets for New South Wales Government action. The thirteen natural resource management targets set by the Natural Resources Commission (NRC) were adopted as the targets in the State Plan. Four of these targets relate to biodiversity:

1. By 2015 there is an increase in native vegetation extent and an improvement in native vegetation condition.
2. By 2015 there is an increase in the number of sustainable populations of a range of native fauna species.
3. By 2015 there is an increase in the recovery of threatened species, populations and ecological communities.
4. By 2015 there is a reduction in the impact of invasive species.[131]

3.35 The 2008 Annual Report on the State Plan identified that the resource condition of all four aspects of biodiversity identified in the targets was poor. The Annual Report noted that there was no change in the condition trend for the extent of native vegetation (target one). It further identified that the trends for sustainable populations of native fauna species (target two), threatened species, populations and ecological communities (target three) and invasive species' impacts (target four) indicated they were deteriorating in condition. The Annual Report noted:

> On the basis of current data, the biodiversity targets are among the most challenging of the Natural Resource Management (NRM) goals.[132]

3.36 The Committee understands that a revised version, *NSW State Plan: Investing in a better future*, has recently been released. The new version retains the same targets for natural resource management, including the biodiversity targets.[133]

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[128] *Native Vegetation Act*, ss 14, 29

[129] *Native Vegetation Act*, Part 4

[130] Submission 14, EDO, p. 74

[131] Department of Premier, *State Plan: A new direction for NSW*, Sydney, 2006, p. 120

[132] Department of Premier and Cabinet, *2008 Annual Report - State Plan: A new direction for NSW*, Sydney, 2009, p. 57

[133] Department of Premier and Cabinet, *NSW State Plan: Investing in a better future*, Sydney, 2009, p. 37

NSW Biodiversity and Climate Change Adaptation Framework

3.37 The *NSW Biodiversity and Climate Change Adaptation Framework* was developed in 2007 in response to the *National Biodiversity and Climate Change Action Plan*.[134] It outlined how the New South Wales Government would address the impacts of climate change on biodiversity.

3.38 The Framework identified six key action areas:

1. Share knowledge about biodiversity and climate change, and raise awareness of adaptation actions.
2. Research and monitor impacts of, and adaptation to, climate change.
3. Incorporate adaptation strategies that deal with the impacts of climate change on biodiversity into policy and operations.
4. Provide adaptation planning methods and tools to deal with climate change impacts on biodiversity.
5. Minimise the impacts of climate change on key ecosystems and species.
6. Minimise the increased threat of invasive species on native species that comes with climate change.[135]

Department of Environment and Climate Change NSW Adaptation Strategy for Climate Change Impacts on Biodiversity

3.39 The *Department of Environment and Climate Change NSW Adaptation Strategy for Climate Change Impacts on Biodiversity* was released in 2007 and identifies DECC actions to implement the *National Biodiversity and Climate Change Action Plan* and the *NSW Biodiversity and Climate Change Adaptation Framework*.

3.40 The Strategy outlined a number of priority focus areas and a detailed list of priority actions that were to be undertaken by DECC during 2007 and 2008. This was to form the basis of a practical approach to climate change adaptation planning for DECC.[136]

3.41 The priority focus areas identified were:

- building the reserve system
- managing the reserve system
- cross-tenure connectivity conservation planning
- wildlife management
- climate change adaptation science, research and modelling
- natural resource management and environmental planning
- communication, awareness raising and capacity building.[137]

New South Wales Invasive Species Plan

3.42 The *New South Wales Invasive Species Plan* was released in 2008 as a means of prioritising and directing invasive species management programs, funding and resources within New South Wales.[138] The Plan identified four goals:

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[134] Mr Tim Rogers, Transcript of hearing, 4 May 2009, p. 2

[135] NSW Inter-agency Biodiversity and Climate Change Impacts and Adaptation Working Group, *NSW Biodiversity and Climate Change Adaptation Framework*, Sydney, 2007, p. 1

[136] Submission 10, DECC, p. 3

[137] DECC, *Department of Environment and Climate Change NSW Adaptation Strategy for Climate Change Impacts on Biodiversity*, Sydney, 2007, p. 2

[138] DPI, *NSW Invasive Species Plan*, Orange, 2008, p. 10

1. Exclude – prevent the establishment of new invasive species
2. Eradicate or contain – eliminate, or prevent the spread of new invasive species
3. Effectively manage – reduce the impacts of widespread invasive species
4. Capacity building – ensure NSW has the ability and commitment to manage invasive species.[139]

3.43 The Plan also identified a number of objectives, actions and outcomes/outputs that linked the broader goals with on ground actions.[140] The Plan also acknowledged that there is a range of stakeholders involved in invasive species management. It identified the key government agencies, community groups, interest groups and industry groups and outlined the roles and responsibilities of each.[141]

Climate Change Action Plan

3.44 A *Climate Change Action Plan* is currently being developed which aims to establish priorities for the New South Wales Government to reduce greenhouse gas emissions, assist communities and businesses to adapt to impacts of climate change, and ensure the prosperity of New South Wales in a low carbon economy.[142] DECCW has advised the Committee that the Plan should be completed by the end of 2009.[143]

Biodiversity Strategy for New South Wales

3.45 A new *Biodiversity Strategy for New South Wales* is currently being developed. The Strategy will cover terrestrial, aquatic and marine biodiversity and will provide a framework for improved decision making and investment in biodiversity conservation, including adaptation to climate change.[144] A discussion paper was released in October 2008 with opportunities for interested parties to provide feedback and submissions until February 2009. DECCW has advised the Committee that the draft Strategy is due to be released in December 2009.[145]

3.46 The discussion paper outlined four major approaches underpinning the successful conservation of biodiversity:

- improved decision making
- targeted investment in biodiversity
- ongoing commitment to traditional conservation programs
- conservation across the landscape.[146]

3.47 To address the impacts of climate change on biodiversity, the discussion paper recognised the need for the new Strategy to include approaches that both adapt to the impacts of climate on biodiversity and mitigate its effects. The proposed objective of the new Strategy is to identify and manage the impacts of climate change on biodiversity in order to minimise species loss and build ecosystem resilience.[147]

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[139] DPI, *NSW Invasive Species Plan*, Orange, 2008, p. 1
[140] DPI, *NSW Invasive Species Plan*, Orange, 2008, p. 11
[141] DPI, *NSW Invasive Species Plan*, Orange, 2008, pp. 8-9
[142] Submission 10, DECC, p. 4
[143] Mr Simon Smith, Transcript of hearing, 20 August 2009, p. 36
[144] Submission 10, DECC, p. 5
[145] Mr Simon Smith, Transcript of hearing, 20 August 2009, p. 37
[146] DECC, *A new Biodiversity Strategy for New South Wales,* Discussion paper, Sydney, 2008, p. viii
[147] DECC, *A new Biodiversity Strategy for New South Wales*, Discussion paper, Sydney, 2008, p. xi

3.48 DECCW has indicated that climate change impacts on biodiversity are likely to be addressed in both the new *Biodiversity Strategy for New South Wales* and the *Climate Change Action Plan*. As both documents are still being developed, it is unclear the extent to which each will include specific goals, objectives, mechanisms and actions to conserve biodiversity in the light of climate change impacts.

Catchment Action Plans

3.49 Each of the thirteen CMAs in New South Wales have the responsibility for developing Catchment Action Plans (CAPs) in partnership with their communities and relevant government agencies. The CAPs are regional plans intended to drive and integrate community and government investment and action in natural resource management and are a primary mechanism for delivering on the State Plan's biodiversity targets.[148]

3.50 Under the *Natural Resources Commission Act 2003* the NRC is required to audit the effectiveness of the implementation of CAPs in achieving compliance with state-wide standards and targets.[149] The NRC submission stated:

> One of the NRC's responsibilities is to audit the effective implementation of Catchment Action Plans in terms of progress in achieving compliance with the state's Standard for Quality Natural Resource Management (the Standard) and meeting the state-wide targets. Our audits so far have indicated that CMAs are effectively implementing these plans. Whilst CMAs can improve their planning (for instance through expressing their targets spatially on maps of desired landscape changes), there are up-stream policy and planning issues that impede the achievement of lasting outcomes that respond to climate change impacts on biodiversity.[150]

[148] Submission 26, NRC, p. 2

[149] *Natural Resources Commission Act 2003*, s 15

[150] Submission 26, NRC, p. 2

Chapter Four - Principles for biodiversity management

4.1 This chapter discusses the principles for biodiversity management that will be needed to ensure the preservation of biodiversity under the impacts of climate change. Some of these principles are established conservation principles that should continue to be implemented, or implemented more effectively or quickly.[151] Other principles will be new, some of them potentially controversial, and will require a redirection of effort, the development of dynamic and responsive tools and to look at biodiversity conservation with a fresh perspective.[152]

A new approach

4.2 One of the key messages conveyed to the Committee during this inquiry was that a new approach is needed if we are to conserve biodiversity under the impacts of climate change, and that this new approach is needed urgently.[153] The Committee heard that the traditional methods of conserving biodiversity have delivered some incredibly successful results, however, they have not prevented the continued degradation of biodiversity under current conditions and are even less likely to prevent further loss of biodiversity under climate change.[154] Dr John Williams, the New South Wales Natural Resources Commissioner, told the Committee:

> In New South Wales our biodiversity is in a degrading state and continues to decline—that is established—and climate change is going to be a major driver to accelerate this as our natural systems have a limited capacity to respond to that change. What we really do need is urgent, integrated, adaptive action by our communities, our government and industry to improve our biodiversity—at least maintain it—in order to remain healthy landscapes and resilient communities.[155]

4.3 Embracing a new approach to biodiversity management will require government agencies, natural resource managers, community groups and society at large to change and make innovative, challenging and unfamiliar decisions.[156] Mr Jeff Smith, Director of the Environmental Defender's Office (EDO), told the Committee:

> The starting point for this work here is that the issues are so fundamental that we want to recognise the importance and the profoundness of the changes that are needed.[157]

4.4 It will also require considerable leadership from governments to adopt a new approach. The submission from the Namoi Catchment Management Authority (CMA) stated:

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[151] Submission 14, EDO, p. 10; Mr Tom Holden, Transcript of hearing, 4 May 2009, pp. 26-27

[152] Submission 14, EDO, p. 11; Mr Tom Holden, Transcript of hearing, 4 May 2009, pp. 26-27; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 11

[153] Submission 14, EDO, p. 1; Submission 21, Nature Conservation Council of NSW, p. 1; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 11

[154] Submission 12, Namoi CMA, p. 4; Submission 14, EDO, p. 24; Submission 19, NRAC, p. 3

[155] Dr John Williams, Transcript of hearing, 22 June 2009, p. 17

[156] Submission 14, EDO, p. 1; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

[157] Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 26

> [W]e simply need the political will to make the decisions that are in the best interest of the environment and biodiversity (and thus our communities in the longer term).[158]

4.5 The Committee recognises the urgency of the need for change. It is not the intention of the Committee to propose the specific details of a new approach, as this should be the outcome of significant scientific and community participation which is beyond the scope and role of this Committee. However, the Committee understands that the Department of Environment, Climate Change and Water (DECCW) is currently preparing two important documents which would provide ideal opportunities to facilitate such debate: the new *Biodiversity Strategy for New South Wales* and the *Climate Change Action Plan*.

Develop new goals and objectives

4.6 Currently, our biodiversity goals and objectives are to prevent any change to biodiversity and to protect all species from extinction. There is increasing recognition that this will be impossible to achieve under climate change.[159] Dr Michael Dunlop, a Research Scientist with the CSIRO, told the Committee:

> Traditionally, biodiversity conservation is essentially about preventing any sort of change happening, or trying to revert to some ideal, maybe pre-European, state. But we are faced with inevitable continuing changes, so we need to come up with some sort of objective for biodiversity conservation that accommodates those changes.[160]

4.7 Worse still, the EDO warned that efforts to continue with our current goals and objectives may actually have detrimental outcomes for biodiversity because the focus of conservation efforts may be in the wrong areas and result in greater extinctions.[161]

4.8 The Committee sees a clear need to develop new goals and objectives if biodiversity is to be conserved into the future. A CSIRO report on the implications of climate change for the reserve system suggested that the new focus of conservation should be 'managing the change to minimise the loss.'[162]

4.9 Deciding on appropriate new goals and objectives will require a well informed scientific and community debate. It will not be an easy task.[163] This debate will need to discuss the realities of climate change impacts on biodiversity and how society achieves its aspirational objectives under these new realities.[164] The debate will also need to identify what changes to the environment are acceptable and what changes should be avoided.[165] The submission from the EDO advised that this will be a fundamental change to the current approach:

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[158] Submission 12, Namoi CMA, p. 4

[159] Submission 14, EDO, p. 25; Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 28; Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 25;

[160] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

[161] Submission 14, EDO, p. 26

[162] M Dunlop & P Brown, *Implications of climate change for Australia's National Reserve System: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 10

[163] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

[164] Submission 14, EDO, pp 26-27

[165] M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 2

> The recognition of the inherent right of species to exist, and for people to do everything they can to ensure this, has been institutionally recognised not only in NSW, but both internationally and nationally.[166]

Determine conservation priorities

4.10 As described in paragraph 4.6 above, it will not be possible to save every species from the impacts of climate change and so society will need to determine the priorities for conservation.[167] Additionally, as climate change adds additional pressures to biodiversity it will further exacerbate the problem of limited conservation budgets, creating a much greater need to prioritise conservation actions.[168]

4.11 In determining conservation priorities, society will need to make ethical decisions about what species and ecosystems to keep, what changes to the environment are acceptable, why specific species and ecosystems should be kept and the priorities amongst those species and ecosystems to be kept.[169] A CSIRO report on the implications of climate change for the reserve system provided an example of a choice that may need to be made in New South Wales:

> It will become increasingly difficult to provide enough water at the right time to maintain wetlands and floodplains such as the Macquarie Marshes in New South Wales and river red gum forests in the Murray Darling Basin. 'Environmental flow' water allocations are generally much less than natural flow regimes, and additional allocations are expensive to purchase. We might need to choose which wetland ecosystems we wish to maintain and which we will sacrifice.[170]

4.12 As with the process of developing new goals and objectives, determining conservation priorities will require a broad national and state-wide debate involving the broader community rather than just governments and scientists.[171] Mr Smith explained why this is important:

> [W]e need to think about this as a community; think about the values. You would not want to do it blind to science, but you do not want to do it blind to what people are beholden to, or to cultural values, or to the efficacy of what you are doing as well. All those things are part of the mix. At the moment we do not talk about that at all, we just have this general idea that we will save everything and then it all goes into an administrative bin, if you like, where decisions are made. We need to be more transparent, honest and upfront about exactly what we are trying to do and how we go about doing it, and bring the community along in that process.[172]

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166 Submission 14, EDO, p. 25

167 Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 37

168 Submission 14, EDO, p. 21

169 Submission 14, EDO, p. 26; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 18; Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 25; Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 28; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

170 M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 7

171 Submission 6, CSIRO, p. 9; Submission 14, EDO, p. 26; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 12

172 Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 29

Current prioritisation of conservation efforts

4.13 The Committee heard that prioritisation currently occurs largely on the basis of conservation status, that is, more funding is allocated to those species or ecological communities with the highest risk of extinction.[173] However, there are concerns within the scientific community about this approach:

> Scientists have argued that spending the most money on the species with the highest extinction risk is not the most efficient way of minimising species extinctions, because often these species will require significant resources with only a small chance of success.[174]

4.14 Mr Tom Holden, Scientific Director of the EDO, raised concerns about the current approach under the *Threatened Species Conservation Act 1995*, regarding the listing of priority actions in the NSW Threatened Species Priorities Action Statement:

> There were just so many priority actions listed against each species. Every species had priority actions listed against it. I forget the figures, but there were thousands of high priority actions. Obviously the Government is not going to have the resources to implement each one.[175]

4.15 Mr Holden then went on to suggest how the current approach could be improved:

> Firstly we need some criteria to prioritise between the species. So instead of having high priority actions against each of the thousand species, we have high priority actions against only two hundred of those species. That decision-making criteria for deciding what species we give funding towards is obviously really important.[176]

Deciding what to conserve

4.16 The Committee heard that there are several approaches to determining biodiversity conservation priorities.

4.17 Dr Dunlop told the Committee that what society conserves is based on what we value the most. He explained that there are four reasons why we value biodiversity: for individual species, functioning of ecosystems, the whole landscape and biological diversity. For each of these values there are likely impacts of climate change and different aspects that should therefore be conserved, as outlined in Table 1.[177] For example, if society values individual species most highly, then conservation efforts should be focussed on ensuring the existence of species. However, if society values ecosystems most highly, then the priority for conservation efforts should be protecting ecosystem health. Thus, what society chooses to conserve should be in line with what society values the most.

[173] Submission 14, EDO, p. 20
[174] Submission 14, EDO, p. 20
[175] Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 30
[176] Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 30
[177] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 48

Table 1 – Targets of conservation

Value	Likely change	What should be conserved
Individual species (genes)	Abundance, distribution and co-occurrence of species	*Existence* of species
Ecosystem (point on the ground)	Composition, structure and function of ecosystem	Ecosystem *health*
Land/sea-scapes (social-ecological system; ecosystem services)	Types of human uses and native biodiversity	The *balance* of uses
Biological diversity (α,β,γ)	Changes in species and ecosystems identity	*Patterns* of diversity

Source: Modified from *Implications of climate change for biodiversity management*, tabled by Dr Michael Dunlop at hearing, 22 June 2009, p. 1

4.18 A number of stakeholders suggested that climate refugia will be priority areas to identify and protect under climate change.[178] A CSIRO report on the implications of climate change for the reserve system explained:

> Some parts of the landscape - for example mountain tops, or places with permanent water or a variety of landforms - are likely to be particularly important for maintaining biodiversity during droughts, fires and times of ongoing environmental change. These places may act as refuges for biodiversity. Where they can be identified, protecting them will help ensure species survive as the climate changes.[179]

4.19 Protecting climate refugia, such as estuaries, rainforests and wetlands, provides better opportunities for the survival, reproduction and recolonisation of species.[180]

4.20 Another approach to determining priority ecosystems for protection is to identify which ecosystems are currently underrepresented in the reserve system. While this is an important element of prioritisation, Dr Dunlop advised the Committee that underrepresentation does not necessarily correlate with those ecosystems that are under the greatest threat. In some circumstances there is a strong link but in other cases ecosystems that are not well represented in the reserve system are not under any more threat than those well represented.[181]

4.21 The Committee also heard from stakeholders suggesting that 'functional species' should be prioritised in conservation efforts.[182] Functional species are species that play an important role in the ecosystem resilience and maintain the ecosystem of which they are a part but are not necessarily threatened.

[178] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 14, EDO, p. 17; Submission 19, NRAC, p. 3; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14

[179] M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 14

[180] Submission 14, EDO, p. 17; Submission 19, NRAC, p. 3

[181] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 46

[182] Submission 11, TSCA, p. 6; Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 29; Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 29

4.22 It has also been suggested that conservation efforts should be focussed on marginal ecosystems, that is, ecosystems that are not currently in healthy conditions. It was suggested that prioritising efforts to restore ecosystems would enable ecosystems to survive in the long term as resilient healthy ecosystems which were better able to cope with the impacts of climate change.[183]

4.23 The submission from the EDO outlined four factors that should be considered when determining conservation priorities:

- species value. This is defined by conservation status, evolutionary distinctiveness, social value, economic value, ecological function.
- cost of management. Generally, all else being equal, a cheaper action should be prioritised over a more expensive action.
- benefit of management. This is the difference in outcomes with management taking place versus without management taking place.
- likelihood of success of management. Generally, all else being equal, an action likely to succeed should be prioritised over an action likely to fail.[184]

Conclusion

4.24 The Committee finds that it is necessary to review the current goals and objectives for biodiversity management in order to develop a new approach under climate change. Additionally, it will be necessary to review the current biodiversity conservation priorities to align with the new goals and objectives. The Committee notes that doing this will require a well informed scientific and community debate.

RECOMMENDATION 1: The Department of Environment, Climate Change and Water reviews the current goals, objectives and priorities for biodiversity conservation and facilitates the community and scientific debate necessary to identify a new approach to biodiversity management.

Manage for uncertainty and change

4.25 As discussed in Chapter Two, there is significant uncertainty associated with the impacts of climate change on biodiversity. There is uncertainty about the specific details and magnitude of climate change impacts on the environment and about exactly how species and ecosystems will respond to climate change impacts.

4.26 The many types of change anticipated and the considerable uncertainty about the details of these change presents a management challenge to decide which are the best management strategies. Dr Dunlop explained to the Committee the possible choices in management strategies:

> Do you want to have a proactive strategy, predicting what is going to happen and to react? Do you want to be reactive—when you see something happen, you respond? Do you design specific strategies that may or may not work, so you risk-spread by having a whole range of different strategies, on the off-chance that some will work in some places? Or do you develop what might be regarded as robust strategies which work against a number of different types of changes and levels of uncertainty?[185]

[183] Submission 13, UNE – School of Environmental and Rural Science, p. 27

[184] Submission 14, EDO, pp. 20-21

[185] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

4.27 The Committee noted the strong support for choosing management strategies that are robust and flexible enough to respond to a range of possible changes that may occur in the future.[186] In fact, the Committee was told that if management strategies did not cope with many sorts of change and uncertainty then they are likely to not address all significant impacts of climate change on biodiversity.[187]

Adaptive management

4.28 The framework of adaptive management was recommended by a number of stakeholders as an appropriate strategy for managing biodiversity under the impacts of climate change.[188] Adaptive management is an iterative process that seeks to improve management decisions by establishing and testing hypotheses, learning from the results and then incorporating these lessons into future management actions.[189] The EDO submission explained that adaptive management generally consisted of five steps:

1. Identify alternative strategies to meet the objectives.
2. Predict the outcome of the alternatives based on what is currently known.
3. Implement one or more alternatives.
4. Monitor each alternative to determine the one that best meets the objectives.
5. Update knowledge and adjust management actions according to results.[190]

4.29 The Committee heard that the benefit of adaptive management is that it allows managers to evaluate whether their management actions are producing the desired outcome by assessing actions against a set of targets. It also allows managers to respond to new and emerging threats as climate change advances.[191]

4.30 Many stakeholders highlighted how critical it was that the outcomes of management choices were monitored to assess their effectiveness in meeting biodiversity outcomes and to incorporate this information into the adaptive management cycle.[192] The importance of monitoring is discussed further from paragraph 4.69 below.

4.31 The Committee also heard about the importance of ensuring that research is integrated into the adaptive management cycle.[193] This ensures that management decisions are based on the most up to date and accurate information. The issue of research is discussed further from paragraph 4.88 below.

4.32 The Committee heard that adaptive management is not well implemented across any area of natural resource management.[194] Stakeholders suggested that there were a

[186] Submission 6, CSIRO, p. 5; Submission 13, UNE – School of Environmental and Rural Science, p. 23; Submission 21, Nature Conservation Council of NSW, p. 1; Dr John Williams, Transcript of hearing, 22 June 2009, p. 17; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 42

[187] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

[188] Submission 11, TSCA, p. 7; Submission 14, EDO, p. 21; Dr David Slip, Transcript of hearing, 22 June 2009, p. 1

[189] Submission 14, EDO, p. 21

[190] Submission 14, EDO, pp. 21-22

[191] Submission 11, TSCA, p. 7

[192] Submission 6, CSIRO, p. 5; Submission 14, EDO, p. 60; Submission 13, UNE – School of Environmental and Rural Science, p. 26; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, pp. 41-42

[193] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 11, TSCA, p. 8

[194] Submission 13, UNE – School of Environmental and Rural Science, p. 26; Submission 14, EDO, p. 36; Dr David Slip, Transcript of hearing, 22 June 2009, p. 1

number of barriers preventing the effective implementation of adaptive management:

- There is a lack of institutional support for changing current management planning practices.
- Adaptive management generally has higher costs than other management approaches.
- Some stakeholders express concerns about adopting an approach where there is uncertainty about the outcomes and the risk of failure.
- There are usually a number of implications associated with adopting adaptive management for legislatively required management plans, such as national park Plans of Management.
- Adaptive natural resource management experiments tend to require long time frames in order to assess their effectiveness.
- Staff and managers involved in preparing biodiversity management plans often lack a good understanding and training in adaptive management.[195]

4.33 The Committee believes that adaptive management provides a sound basis for developing plans to ensure the effective management of biodiversity under climate change. Additionally, there is a need to identify and overcome barriers to the effective implementation of adaptive management. In particular, it is important that all staff and managers involved in preparing and implementing biodiversity management plans are provided with training and support in adaptive management.

RECOMMENDATION 2: All natural resource management agencies adopt adaptive management frameworks for plans dealing with biodiversity management.

RECOMMENDATION 3: All natural resource management agencies identify and overcome barriers (such as through the provision of relevant training) to the effective implementation of adaptive management.

Protect ecosystems

4.34 As noted above, the Committee has heard that current conservation efforts are often focussed on threatened species management. This approach has been criticised as it often fails to protect biodiversity in general and draws resources away from broader strategies that protect biodiversity.[196] Additionally, there is often a mismatch between what needs to be done to protect a threatened species and what needs to be done to protect biodiversity under climate change.[197]

4.35 The Committee heard that the most effective strategy to protect biodiversity in the face of climate change is to have a greater focus on ecosystem health by increasing ecosystem resilience and protecting ecosystem function.[198] Dr Dunlop explained that

[195] Submission 11, TSCA, p. 9; Submission 14, EDO, p. 36

[196] Submission 14, EDO, p. 40; Submission 25, SHOROC, p. 4

[197] Submission 14, EDO, p. 39

[198] Submission 12, Namoi CMA, p. 4; Submission 14, EDO, pp. 17-18; Dr David Slip, Transcript of hearing, 22 June 2009, p. 2; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 48

such an approach would actually assist in preventing species from becoming threatened:

> I would suggest that it is worth moving away from focusing on the most threatened species towards focusing on how we stop species from becoming threatened. In doing that, if there is a finite pot of money, we might need to put less effort into dealing with those threatened species and more towards stopping things becoming threatened.[199]

4.36 A number of stakeholders told the Committee about the importance of focussing conservation on 'functional groups' within ecosystems.[200] These are the groups of species that play the most important role in maintaining the ecological functions and processes of an ecosystem.[201] The submission from the EDO explained the benefit of such an approach:

> [S]ome scientists argue that conservation efforts should be targeted towards maintaining the diversity amongst functional groups. By better ensuring that ecological functions are maintained, this approach will maximise the number of species protected, including the many we have not yet identified.[202]

4.37 The Committee finds that to protect biodiversity in the face of climate change it will be critical for biodiversity management strategies to focus on protecting ecosystems rather than just threatened species.

RECOMMENDATION 4: The Department of Environment, Climate Change and Water ensures that strategies regarding biodiversity and climate change focus on ecosystems rather than just on threatened species.

Protect diversity and large areas

4.38 The Committee heard about the importance of protecting remaining intact ecosystems[203] and ensuring that this is legal environmental protection.[204]

4.39 It is critical to protect a diversity of ecosystems as different ecosystems provide habitat for different species.[205] Therefore the best way to protect as many species as possible is to protect as many different types of ecosystems as possible. The submission from the CSIRO explained:

> Climate change impacts will vary considerably between species and will be very difficult to predict. Therefore probably the best approach to minimise loss will be to make sure many different types of habitat are protected. This way even if the ecosystems and habitats change, a wide range of environmental conditions will be available to help native species survive as they respond in many different ways over time.[206]

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199 Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 48

200 Submission 11, TSCA, p. 6

201 Submission 14, EDO, p. 18

202 Submission 14, EDO, p. 40

203 Submission 12, Namoi CMA, p. 2; Submission 24, Friends of Narrabeen Lagoon Catchment, p. 2; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10

204 Submission 24, Friends of Narrabeen Lagoon Catchment, p. 2

205 Submission 6, CSIRO, pp. 5, 8 & 9; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 3

206 Submission 6, CSIRO, p. 8

4.40 The Committee also heard about the importance of protecting large areas of ecosystems.[207] Species will have a greater chance of surviving the impacts of climate change if their areas of habitat are larger. For example, larger areas provide more opportunities for wildlife to relocate following extreme events such as fire, floods or coastal inundation.[208] The submission from the EDO explained the value of protecting large areas:

> There are well established relationships between the size of a patch and the size and viability of populations, species richness (large patches generally support more species than small patches, all other things being equal), and many other important ecological factors such as dispersal and vegetation diversity.[209]

4.41 The Committee notes that efforts to protect large areas and diverse ecosystems will involve both the reservation of public land (such as national parks or council reserves)[210] and voluntary action on private land.[211] Dr Graeme Worboys, Vice Chair of Mountains and Connectivity for the International Union for the Conservation of Nature's World Commission on Protected Areas, told the Committee:

> The organisation that I am involved in has a strategic target of basically saying, "Okay, let us encourage nations to really keep these large natural areas intact", recognising that a lot of it will be voluntary with a lot of different landowners and so on.[212]

4.42 The management of biodiversity on public land is discussed further in Chapter Six and measures to manage biodiversity on private land are discussed further in Chapter Seven.

Improve the resilience of ecosystems

4.43 The Committee heard that one of the most critical principles for protecting biodiversity under climate change was to improve the resilience of ecosystems.[213] This is based on the premise that healthy ecosystems are better able either to remain unaffected by change or to recover after change.[214] The Shore Regional Organisation of Councils (SHOROC) submission stated:

> Key to any discussion about how climate change will impact on biodiversity is the need to recognise the importance of maintaining and monitoring resilience of ecosystems and

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[207] Submission 6, CSIRO, pp. 5, 8 & 9; Submission 14, EDO, pp 13-14; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 3

[208] Submission 24, Friends of Narrabeen Lagoon Catchment, p. 3

[209] Submission 14, EDO, p. 13

[210] Submission 25, SHOROC, p. 6; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 13

[211] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 41

[212] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15

[213] Submission 3, Professor Ralf Buckley, pp. 5 & 6; Submission 6, CSIRO, p. 5; Submission 11, TSCA, p. 7; Submission 12, Namoi CMA, p. 2; Submission 19, NRAC, p. 3; Submission 23, Southern Rivers CMA, p. 2; Submission 25, SHOROC, p. 3; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

[214] Submission 14, EDO, p. 11; Submission 25, SHOROC, p. 3; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

> ecosystem health. There is a need to build resilience of existing ecosystems and manage the ecosystems so that they can respond and adapt more readily to the threats from climate change.[215]

4.44 As discussed in paragraph 2.9 above, there are a number of threats to biodiversity apart from climate change. The Committee heard that one of the key ways to improve ecosystem resilience is to reduce other impacts on ecosystems.[216] Professor Ralf Buckley, Director and Chair of the International Centre for Ecotourism Research at Griffith University, told the Committee:

> With regard to resilience, the idea is that if an ecosystem has to be able to adapt to a new impact from climate change, one way to give it that opportunity is to reduce the impact it is suffering from other kinds of effects, such as invasive species, fires and so on.[217]

4.45 Some of the key impacts on ecosystems that need to be reduced include weeds, feral animals, pollution, inappropriate fire regimes, water flow regulation and recreation and tourism use.[218]

4.46 The Committee finds that improving the resilience of all ecosystems is a critical strategy to protect biodiversity under the impacts of climate change. This will involve reducing or removing current impacts on ecosystems to increase overall ecosystem health.

RECOMMENDATION 5: All natural resource management agencies identify specific measures to increase the health of all ecosystems and reduce impacts on ecosystems as an effective means of protecting biodiversity under the impacts of climate change.

Connectivity conservation

4.47 One of the most recommended strategies to address the impacts of climate change on biodiversity was 'connectivity conservation'.[219] Under this approach, areas of remnant habitat are connected by creating or maintaining corridors of native vegetation.[220] Connectivity can occur at a different scales: localised corridors that connect nearby patches of habitat, effectively making the home range of species

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215 Submission 25, SHOROC, p. 3

216 Submission 3, Professor Ralf Buckley, p. 5; Submission 20, MACROC, p. 4; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 48

217 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24

218 Submission 2, Associate Professor Michael Mahony, p. 3; Submission 3, Professor Ralf Buckley, p. 5; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24; M Dunlop & P Brown, *Overview of the report: Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 4

219 Submission 3, Professor Ralf Buckley, pp. 5 & 6; Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 12, Namoi CMA, p. 2; Submission 13, UNE – School of Environmental and Rural Science, p. 26; Submission 14, EDO, p. 15; Submission 16, Mr Jason Smith, p. 2; Submission 23, Southern Rivers CMA, p. 2; Submission 25, SHOROC, pp. 3 & 5; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24

220 R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007; p. 16; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 14

larger; and large scale landscape corridors that connect a number of ecosystems across hundreds or thousands of kilometres.[221]

4.48 As discussed in paragraph 2.15 above, one of the likely impacts of climate change is a change in the range and distribution of species as they move to more favourable conditions. For this to happen, species must physically be able to get to a new location through corridors of suitable habitat.[222] Connectivity conservation creates conditions that maximise the chances for species to move should they need to.[223]

4.49 The Committee also heard that corridors created through connectivity conservation can provide important habitat for wildlife during or after extreme events such as fires, floods or coastal inundation.[224]

4.50 Creating connectivity across the landscape will include both public land (such as national parks, state forests, council reserves) and private land (such as agricultural production land).[225] Dr Worboys told the Committee:

> [U]sually connectivity conservation is a potpourri of different tenures and people committed to trying to do something; they may be private landowners, governments, whoever.[226]

4.51 Additionally, the Committee heard that it would not be possible for governments to purchase all the necessary land to create corridors, particularly as much of the land is on high value private agricultural properties[227] and, therefore, efforts to establish conservation corridors will be reliant on private conservation efforts.[228]

Risks associated with connectivity conservation

4.52 The Committee heard that there are a number of risks associated with connectivity conservation:

- There is an increased potential for the movement of invasive species.[229]
- Some species may be dependent on isolation for their survival, such as species at the top of mountains.[230]

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[221] Submission 16, Mr Jason Smith, p. 2; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 45

[222] Submission 3, Professor Ralf Buckley, p. 5; Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 25, SHOROC, p. 3; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34

[223] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14

[224] Submission 24, Friends of Narrabeen Lagoon Catchment, p. 3

[225] Submission 12, Namoi CMA, pp. 5-6; Submission 13, UNE – School of Environmental and Rural Science, p. 26; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17; R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, 2008, p. 1

[226] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14

[227] Submission 3, Professor Ralf Buckley, p. 6

[228] Submission 12, Namoi CMA, pp. 5-6; Submission 13, UNE – School of Environmental and Rural Science, p. 26; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17

[229] Submission 3, Professor Ralf Buckley, p. 5; Submission 14, EDO, p. 15; Submission 21, Nature Conservation Council of NSW, p. 2; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 46

[230] M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 14

- It is currently unclear the extent to which connectivity will be the limiting factor in species extinction.[231]
- It is currently unclear which species would benefit from connectivity, and if these are the species we would want to benefit.[232]
- It will not protect species that are unable to move, such as species at the top of mountains.[233]
- Not all species will be able to use the corridors to move to new locations.[234]

4.53 Despite these risks most experts, agencies and stakeholders agree that the benefits of connectivity conservation outweigh the risks.[235] In particular, there was wide spread support for creating local corridors to link patches of habitat.[236]

A New South Wales framework for connectivity conservation

4.54 The Committee heard that there is a clear need to develop an overarching framework for the analysis and planning of landscape scale corridors across all tenures. The submission from the Southern Rivers CMA noted:

> We need a framework for undertaking landscape scale analysis of corridors to assist with vegetation and fauna adaptation and genetic diversity, in addition to an agreed science-driven policy on the critical thresholds for landscape connectivity. This framework should encompass broad concepts such as the protection of vegetation types across their geographic extent as a strategy for maximising capacity to adapt to climate change. This framework will allow a focussed debate on what needs to happen and where in NSW.[237]

4.55 The identification of appropriate corridors will require research and existing data to be gathered from a range of government agencies, private land owners and non-government organisations in order to identify the best geographic locations for corridors. In particular, identifying appropriate corridors will require the consideration of different environmental gradients, such as temperature and rainfall, across the New South Wales environment.[238]

4.56 Developing and implementing connectivity conservation will require a coordinated effort between a range of State government departments, local governments, CMAs and private land owners.[239]

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231 Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 45

232 Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 46

233 Dr Michael Dunlop, Transcript of hearing, 22 June 2009, pp. 47-48; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

234 R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

235 Submission 3, Professor Ralf Buckley, p. 5; Submission 14, EDO, p. 15

236 Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 45

237 Submission 23, Southern Rivers CMA, pp. 4-5

238 Submission 13, UNE – School of Environmental and Rural Science, p. 25; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34

239 Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 16

4.57 The implementation of connectivity conservation will also require significant funding, political support, appropriately skilled natural resource managers and a strong and effective legal basis to underpin the creation and conservation of corridors.[240]

Connectivity on private land

4.58 Once corridors have been identified there is a need to have a coordinated program that encourages the involvement of private land owners. The submission from Professor Buckley stated:

> To establish an effective set of conservation corridors, therefore, these particular areas and properties need to be approached in a focussed manner, and appropriate agreements and incentives for conservation and restoration negotiated.[241]

4.59 The creation of corridors across private land is likely to involve significant restoration efforts, as well as the conservation of existing remnant habitat, as much of the private land surrounding public land has been cleared.[242]

4.60 The development of legal and financial incentives will be of particular importance in changing land management practices on private land to protect and/or restore biodiversity.[243] This issue is discussed further in Chapter Seven.

Connectivity on public land

4.61 Implementing corridors will also require a reassessment of the use of some public land. The most fruitful opportunities for connectivity may occur where existing national parks are separated by production forests.[244] Professor Buckley explained to the Committee:

> [I]f we are talking about improving connectivity for conservation and biodiversity under climate change, the most obvious lands to use for corridors are large areas of state forests, which intervene between the existing parks. I would be strongly in favour of reducing the level of logging in those areas and looking towards moving them towards a conservation and tourism recreation land use in future.[245]

4.62 Professor Buckley gave an example of where this already occurs in New South Wales:

> In Nightcap National Park, for example, there is an enclave of land owned by New South Wales state forests which is operated entirely for tourism; there is no logging there. Rummery Park, I think, is the name of the camp, and you can book to go and stay there. That is only a small area, but that model could easily be applied across the entire State. Some of the most beautiful landscapes, as our forestry industry will tell you—some of the most beautiful waterfalls, some of the most beautiful camping spots—

[240] Submission 25, SHOROC, p. 5; R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, 2008, p. 2

[241] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17

[242] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, pp. 16 & 17

[243] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34; R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, 2007, p. 1

[244] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17

[245] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 30

are inside state forests, and there are certainly very good opportunities for tourism in those areas.[246]

4.63 Further issues relating to the use of public land for tourism are discussed in Chapter Six.

Conclusion

4.64 The Committee finds that it would be of significant benefit for New South Wales to have an overarching conservation connectivity framework. The Committee commends efforts thus far on the Great Eastern Ranges initiative (discussed from paragraph 7.43 below) and notes that other corridors may be necessary to protect biodiversity in the face of climate change. The development of a state-wide framework should identify key corridors across the State on both public and private land and appropriate mechanisms for their protection and/or restoration.

RECOMMENDATION 6: The Minister for Climate Change and the Environment nominate an agency or establish a taskforce to develop an overarching New South Wales framework for connectivity conservation, including the identification of key corridors across New South Wales and mechanisms for their protection and/or restoration.

Other options

4.65 As the impacts of climate change take effect on biodiversity, it may be necessary to consider other options in addition to those already outlined in this chapter, to save certain species from extinction. These include:

- ex-situ conservation in zoos and botanic gardens[247]
- deliberate translocation of species or populations, that is, moving individuals from their current location to a more suitable habitat[248]
- cryogenic preservation of the germplasm, that is, the genetic material of organisms.[249]

4.66 Ex-situ conservation is problematic as it is expensive and unlikely to be feasible for a majority of species.[250] It would also require significantly increased resourcing to enable zoos and botanic gardens to take on a greater number of species for conservation and captive breeding.[251]

4.67 Translocation of species is also an expensive option which has no guarantee of success. It is also likely that it would be difficult to find a new suitable habitat to move

[246] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 30

[247] Submission 3, Professor Ralf Buckley, p. 6; Submission 11, TSCA, p. 15; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, pp. 16 & 34

[248] Submission 3, Professor Ralf Buckley, pp. 5-6; Submission 14, EDO, p. 19

[249] Submission 3, Professor Ralf Buckley, p. 6

[250] Submission 3, Professor Ralf Buckley, p. 6; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 35

[251] Submission 3, Professor Ralf Buckley, p. 6; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 34

species to.[252] In addition, translocation could have unknown and potentially adverse impacts as a result of introducing new species into existing ecosystems.[253]

4.68 The Committee heard that cryogenic preservation remains largely untested and it is likely to be a highly expensive approach.[254]

Monitoring

4.69 The Committee heard overwhelming support for the need to monitor and the value of monitoring for understanding the impacts of climate change on biodiversity. Monitoring is also critical in ensuring that natural resource management funding is being allocated to the most effective management options.

Current monitoring

4.70 The Committee heard that, apart from a few outstanding examples, monitoring across the State is insufficient, particularly at the regional level.[255] As Dr Francesca Andreoni, Senior Project Officer, Biodiversity and Threatened Species for the Namoi CMA, explained:

> Any first-year natural resource management student will know step one is to know your resource. So there are a couple of ongoing knots to unravel at that level.[256]

4.71 The Committee heard a number of good examples of monitoring of the impacts of climate change on biodiversity and overall biodiversity health across national parks. In the alpine areas of New South Wales the National Parks and Wildlife Service (NPWS) is monitoring a number of climate change impacts including:

- snow and ice cover. For example, weekly measurement of the Whites River, Lake Cootapatamba and Club Lake Creek snowcourses, the date of ice breakup on Blue Lake, the date of thaw of Main Rain snowpatches and monthly sampling of the chemistry and algae of five glacial lakes.
- animal migration. For example, the arrival date of migrating birds (Flame Robin and Richard's Pipit), the arrival date of bogong moths and weekly monitoring of the arrival of woodland birds during their migration period.
- plant phenology. For example, the flowering time of alpine and subalpine plants.[257]

4.72 In other national parks across New South Wales the NPWS is monitoring a range of biodiversity and ecosystem health issues such as:

- fire. For example, how the responses of individual plants to fire vary with fire intensity and ecosystem structural changes following the 2003 fires in southern New South Wales, species' responses to prescribed burning in western New South Wales, the effects of fire management on the endangered plant *Zieria*

[252] Submission 3, Professor Ralf Buckley, pp. 5-6; Submission 14, EDO, p. 19

[253] Submission 14, EDO, p. 19

[254] Submission 3, Professor Ralf Buckley, p. 6

[255] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 12, Namoi CMA, p. 7; Submission 14, EDO, p. 59; Submission 15, Hunter Councils, p. 3; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10

[256] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10

[257] DECCW, Response to questions taken on notice at hearing, 20 August 2009, pp. 9-10

involucrate in central-eastern New South Wales and the impact of fires on small ground mammals.

- weeds and pest animals. For example, wild dog monitoring involving the trapping and tracking of wild dogs throughout south-eastern Australia and the response of the little penguin colony on Montague Island to the control of kikuyu grass.
- establishing baseline data. For example, the distribution and abundance of ground-dwelling mammals and their primary food resource in south-eastern New South Wales and small mammal monitoring to track populations in central-eastern and north-eastern New South Wales.[258]

What should be monitored?

4.73 There is a range of environmental attributes and issues that need to be monitored including:

- species and ecosystems most vulnerable to climate change impacts[259]
- rare and threatened species, populations and ecosystems[260]
- other known threats to biodiversity[261]
- ecological processes and functions[262]
- ecosystem resilience and health.[263]

4.74 As discussed in Chapter Two, the specific details and magnitude of climate change impacts and its effects on biodiversity are uncertain. The Committee heard that this uncertainty reinforces the importance of monitoring the impacts of climate change on biodiversity[264] and how species and ecosystems respond to these impacts.[265]

4.75 In addition, it is vital that monitoring occurs across all land tenures, not just public land.[266]

The importance of baseline data

4.76 The need for thorough baseline information was stressed to the Committee by a number of agencies and stakeholders.[267] The Namoi CMA submission explained:

> The lack of access to baseline data and credible environmental accounting is an issue, and renders almost impossible the evaluation of any initiatives to protect biodiversity from climate change – or to separate it out from the deleterious effects due to contradictory policy settings. Without access to credible baseline data and credible

[258] DECCW, Response to questions taken on notice at hearing, 20 August 2009, pp. 10-12

[259] Submission 2, Associate Professor Michael Mahony, p. 3; Submission 20, MACROC, p. 4; Submission 25, SHOROC, p. 7

[260] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 18

[261] Submission 2, Associate Professor Michael Mahony, p. 3; Submission 9, Northern Rivers CMA, p. 2; Submission 19, NRAC, p. 3; Submission 20, MACROC, p. 4

[262] Submission 7, University of Sydney – School of Biological Sciences, p. 2

[263] Submission 25, SHOROC, p. 3

[264] Submission 9, Northern Rivers CMA, p. 2; Submission 11, TSCA, p. 7

[265] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 10, DECC, p. 5; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 18

[266] Submission 19, NRAC, p. 2

[267] Submission 25, SHOROC, p. 7; Submission 26, NRC, pp. 3-4

> environmental accounting it is impossible to measure progress on key strategies such as the State Plan and the NSW Biodiversity Strategy or the climate change Action Plan.[268]

4.77 The Namoi CMA has recognised the importance of having accurate information to inform natural resource management and planning and has therefore investing significant funding into developing baseline data.[269] Dr Andreoni told the Committee:

> Namoi Catchment Management Authority, for example, has invested something like $5 million of State and Federal money in developing a set of really good baseline catchment data. It is looking at things like soils, salinity, pollution, wetlands, riverine condition, aquatic biodiversity, groundwater, surface water, threatened species, native vegetation, weeds, invasive animals, the socioeconomics of the community, and future scenario planning and what it means for various industries. That investment has been made out of a sense that it is such an important priority and also that we cannot wait always for State-based and Federal programs to get up and get going, to finish their work or what have you. This CMA—like many, I suspect—has just bitten the bullet got on with developing some baseline data.[270]

4.78 The Committee commends the Namoi CMA for the progressive work and significant investment it has made gathering baseline data.

4.79 The Committee also heard about the efforts of the University of New England's (UNE's) School of Environmental and Rural Science to gather baseline information about critical physiological, behavioural and morphological characteristics of a number of agriculturally important and native insect species. The School believes that the continuation of such a program will enable land managers to develop appropriate mechanisms to mitigate any adverse impacts of climate change.[271]

Monitoring and adaptive management

4.80 Monitoring is an essential part of an adaptive management framework in two key ways. Firstly, monitoring changes in biodiversity and the environment under climate change will identify trends and issues. When fed into an adaptive management framework such information will enable better management decisions and prioritisation of investments to be made.[272]

4.81 Secondly, it is critical that the effectiveness of chosen management strategies and actions are monitored to assess their success in achieving desired outcomes. This ensures that funding is being put into the most effective management strategies.[273]

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[268] Submission 12, Namoi CMA, p. 7

[269] Submission 12, Namoi CMA, p. 7

[270] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10

[271] Submission 13, UNE – School of Environmental and Rural Science, p. 13

[272] Submission 6, CSIRO, pp. 5&9; Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 9, Northern Rivers CMA, p. 2; Submission 12, Namoi CMA, p. 7; Submission 13, UNE – School of Environmental and Rural Science, p. 13; Submission 14, EDO, p. 60; Submission 19, NRAC, p. 2; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, pp. 41-42

[273] Submission 10, DECC, p. 5; Submission 11, TSCA, p. 7; Submission 12, Namoi CMA, p. 7; Submission 14, EDO, p. 60; Submission 19, NRAC, p. 2; Dr John Williams, Transcript of hearing, 22 June 2009, p. 18; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, pp. 41-42; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 18

The need for coordinated, formal, long term monitoring

4.82 The Committee was informed that it is critical that monitoring is a long term activity.[274] Dr David Slip, a Research Biologist at the Taronga Conservation Society Australia, explained to the Committee:

> One of the points we have made in our submission is that long-term monitoring is a pretty important thing in order to understand what is going on with biodiversity. I do not think we have terribly many long-term data sets in the world—purely because of the fact that funding is usually done on a three-year cycle. Occasionally you might get a longer bit; sometimes it involves cycles of less than that. It is very difficult for researchers to set up a long-term monitoring program. There are a few examples of them that have gone on, and some of those have given brilliant data.[275]

4.83 To be useful in improving management of biodiversity, monitoring must be coordinated, properly resourced and formally and professionally conducted.[276]

4.84 The University of Sydney's School of Biological Sciences raised concerns about the use of volunteer schemes for biodiversity monitoring. They urged caution when considering the use of volunteers because volunteers may not necessarily have the level of knowledge or skill required to undertake robust and accurate monitoring.[277]

Monitoring systems

4.85 The Committee heard that systems for monitoring should be practical and publicly accessible.[278] The SHOROC submission suggested that consistent, clear and scientifically based indicators should be developed for use across all councils to enable uniform monitoring of ecosystem health, biodiversity impacts and trends. The submission further to recommend that the methodologies developed to measure these indicators should be rigorous and easy to follow.[279]

4.86 Dr Mark Dangerfield, a representative of the Natural Resources Advisory Council, told that Committee that it was important for monitoring systems to be developed from the ground up rather than defining what should be measured from the top down.[280]

Conclusion

4.87 The Committee finds that professional and coordinated collection of baseline data is critical to understanding the current state of biodiversity across New South Wales and identifying the impacts of climate change as they occur. Additionally, the Committee notes the importance of all natural resource management agencies monitoring the outcomes of their management actions to determine their

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[274] Submission 11, TSCA, p. 9; Submission 19, NRAC, p. 2; Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 35; Dr David Slip, Transcript of hearing, 22 June 2009, p. 1

[275] Dr David Slip, Transcript of hearing, 22 June 2009, p. 7

[276] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 12, Namoi CMA, p. 7; Submission 26, NRC, pp. 3-4; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 13

[277] Submission 7, University of Sydney – School of Biological Sciences, p. 2

[278] Submission 19, NRAC, p. 3

[279] Submission 25, SHOROC, p. 7

[280] Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 35

effectiveness in protecting biodiversity and that these results need to be incorporated into adaptive management frameworks.

RECOMMENDATION 7: All natural resource management agencies prioritise the collection of baseline data.

RECOMMENDATION 8: All natural resource management agencies monitor management actions and feed the results into their adaptive management frameworks.

Research

4.88 The Committee heard that given the considerable uncertainty surrounding the details of climate change impacts on biodiversity and the fundamental information gaps, conducting further research is absolutely critical to inform management and enable community understanding and adaptation.[281] It was also recommended that governments provide significantly more direct funding for research.[282] According to the submission from the University of Sydney's School of Biological Sciences New South Wales invests less than other states in environmental research.[283]

DECCW research

4.89 DECCW advised the Committee that it had established the Climate Change Science Research Network to provide independent technical advice on the strategic priorities for climate change impacts and adaptation research.[284] The Network comprises academic researchers from a range of disciplines and works towards filling priority knowledge gaps.[285]

4.90 DECCW has also developed the Climate Change Impacts and Adaptation Research Program which had undertaken research to address key climate change impacts and vulnerabilities across New South Wales.[286] Dr Peter Smith, Manager of Climate Change Science within the then Department of Environment and Climate Change (DECC), told the Committee:

> In terms of climate change research and DECC, there are about fifty projects that currently are underway. They cover ecosystems from the alpine zone, the north-east rainforest, the desert regions, freshwater systems, estuarine systems and marine systems. They range in detail from field-based studies—long-term historical analysis of how ecosystems respond to climate variability and therefore predicting how they may respond in the future; palaeoecological studies where we are trying to look at how our ecosystems have responded in the past to climate change so that we can get a much

[281] Submission 10, DECC, p. 2; Submission 13, UNE – School of Environmental and Rural Science, p. 26; Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 33; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 13

[282] Submission 13, UNE – School of Environmental and Rural Science, p. 27; Submission 18, Local Government and Shires Associations of NSW, p. 1

[283] Submission 7, University of Sydney – School of Biological Sciences, p. 3

[284] Submission 10, DECC, p. 2; DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 4

[285] Mr Tim Rogers, Transcript of hearing, 4 May 2009, pp. 1-2; DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 4

[286] Submission 10, DECC, p. 3

> better handle on how resilient they are to climate change in the future; laboratory-based studies that examine, for example, the effect of rising CO_2 on freshwater algal species—and field-based studies looking at the effect of temperature and water flow on freshwater ecosystems, in particular freshwater macro invertebrates.[287]

4.91 UNE's School of Environmental and Rural Science submission recommended that the New South Wales Government's research program should:

> include a review of what research has been conducted in the past, what work is currently being undertaken and by whom, and what needs to be done in the future. There is an urgent need for coordination of this work to avoid duplication and also for appropriate feedback and data sharing mechanisms and the prioritisation of what needs to be done.[288]

4.92 The Committee has been unable to obtain enough detailed information on the actual research topics and specific scope of the Climate Change Impacts and Adaptation Research Program to determine whether it will fulfil such a purpose.

Research needs

4.93 The Committee heard a large number of suggested research priorities, including:

- how climate change is affecting populations[289]
- distribution shifts by species as a result of climate change, including information on where species are currently found and ecological tolerances of species and communities[290]
- how species distributions may change in relation to the location of protected areas[291]
- how ecosystem services, such as nutrient cycling, carbon dioxide exchange, water balance and soil retention are affected by climate change[292]
- a better understanding of ecological processes within the marine system, including near-shore and oceanographic environments[293]
- the importance of species specific characteristics in determining adaptive ability to climate change impacts[294]
- triggers of reproductive seasonality, puberty, senescence, loss of reproductive function and interaction with adrenal parameters for significant species[295]
- how the sustainability of harvesting marine resources will be impacted by climate change[296]
- the implications of climate change for disease prevalence and transmission amongst wildlife[297]

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[287] Dr Peter Smith, Transcript of hearing, 4 May 2009, p. 7
[288] Submission 13, UNE – School of Environmental and Rural Science, p. 27
[289] Submission 10, DECC, p. 5
[290] Submission 7, University of Sydney – School of Biological Sciences, p. 3
[291] Submission 8, Mr Robert Mason, p. 1
[292] Submission 7, University of Sydney – School of Biological Sciences, pp. 3-4
[293] Submission 7, University of Sydney – School of Biological Sciences, p. 4; Submission 11, TSCA, p. 12
[294] Submission 11, TSCA, p. 8
[295] Submission 11, TSCA, pp. 11-12
[296] Submission 11, TSCA, p. 12; Dr David Slip, Transcript of hearing, 22 June 2009, p. 7
[297] Submission 11, TSCA, p. 13

- how climate change may affect the complex interactions between species and how such changes may impact upon ecosystem function[298]
- the physiology, behaviour and morphological traits of little known native species (such as sap sucking insects) and the potential impacts that climate change will have on their distribution, life history and food source preferences[299]
- empirical knowledge of species distribution, abundance and function and how species respond to change[300]
- identifying appropriate and effective adaptation strategies and the role of community and government in implementing these strategies[301]
- the effects of climate change on native and introduced wildlife[302]
- predictive ecosystem change modelling to identify the redistribution of fire regimes, species and communities at a local level[303]
- the interactions between climate change and invasive species[304]
- the response of biodiversity to impacts of climate change on fire regimes.[305]

Using research in management

4.94 One of the recurring issues raised by stakeholders was the need for research to be informed by the needs of natural resource managers.[306] The submission from the Hunter Councils called on governments to provide guidance to:

> identify and prioritise the focus of research being undertaken by a range of stakeholders to ensure that its value and outputs is compatible with the needs of land managers responsible for developing and implementing adaptation strategies at regional and local levels. In this regard it is recommended that the State Government consult with local government and other key stakeholders to identify particular information and research needs and priorities.[307]

4.95 As with the need for monitoring to be incorporated into an adaptive management framework, stakeholders reinforced the need for research findings to be fed into adaptive management frameworks to inform decision making and prioritisation by natural resource managers.[308]

Disseminating research findings

4.96 The Committee notes that, as with information from monitoring, research findings are of little value if they are not disseminated to those who need them to make decisions. A number of stakeholders highlighted the importance of providing better community

[298] Submission 13, UNE – School of Environmental and Rural Science, p. 11; Submission 17, Australasian Wildlife Management Society, p. 3
[299] Submission 13, UNE – School of Environmental and Rural Science, p. 13
[300] Submission 13, UNE – School of Environmental and Rural Science, pp. 25-26
[301] Submission 13, UNE – School of Environmental and Rural Science, p. 27
[302] Submission 17, Australasian Wildlife Management Society, p. 3
[303] Submission 23, Southern Rivers CMA, p. 4
[304] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 38
[305] Submission 10, DECC, p. 5
[306] Submission 25, SHOROC, pp. 4-5; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15; Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 36
[307] Submission 15, Hunter Councils, p. 3
[308] Submission 11, TSCA, p. 8; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15

access to natural resource management information systems, maps, datasets and research findings.[309] In particular, the Hunter Councils submission suggested:

> that an information / knowledge hub (preferably web based) be established to provide direct access by councils and other stakeholders to the considerable amount of research and data that is being conducted and collated at various levels by governments, academics, conservation organisations (e.g. International Union for Conservation of Nature) and other stakeholders.[310]

4.97 The Committee understands that current pressures on academics to publish in technical or scientific journals may discourage them from publishing the findings of their results more widely or through non-scientific avenues. The Committee was provided with a copy of a publication by Griffith University entitled *Climate response: Issues, costs and liability in adapting to climate change in Australia*. This report was developed as a contribution to public debate on policies for Australia to adapt to unavoidable climate change with minimal social, environmental and economic costs. The Committee found the efforts of these academics to compile such an easily understandable report highly beneficial. The Committee commends Griffith University and all academics involved for undertaking such a task.

Conclusion

4.98 The Committee finds that it is important that the DECCW research agenda on climate change incorporates the needs of natural resource managers to ensure that the research undertaken is relevant and useful for on-ground management. The Committee also finds that it is critical that research findings are quickly and clearly disseminated to relevant natural resource managers so they can be incorporated into management decisions.

RECOMMENDATION 9: The Department of Environment, Climate Change and Water consult with a range of natural resource managers to identify on-ground research needs with respect to climate change impacts on biodiversity, and incorporate these needs into the Department's research agenda.

RECOMMENDATION 10: The Department of Environment, Climate Change and Water clearly identifies the specific climate change and biodiversity research it is undertaking and ensures that the findings of all research are disseminated to relevant natural resource managers in a format that identifies the key management implications of the research.

[309] Submission 19, NRAC, p. 2; Submission 25, SHOROC, pp. 4-5

[310] Submission 15, Hunter Councils, p. 3

Chapter Five - Maximising agency capacity to manage biodiversity

5.1 The chapter outlines a number of measures to improve the capacity of natural resource management agencies to manage biodiversity. While many of these measures are not new, they have been identified by stakeholders as critically underpinning the ability of agencies to manage biodiversity effectively under the impacts of climate change and highlight that there is still scope for agencies to improve in these areas.

Agency goals and strategies

5.2 Throughout this inquiry, stakeholders expressed concern that goals and strategies were not aligned across New South Wales Government departments and agencies and across different levels of government.

5.3 The Committee heard that current New South Wales Government strategies, policies and programs are not consistent in their approach or commitment to biodiversity management.[311] A number of stakeholders told the Committee that to ensure their effectiveness, all relevant strategies, policies and programs across different New South Wales Government agencies will need to be better aligned towards common goals.[312] The submission from the Hunter Councils stated:

> [I]t is absolutely paramount that that the NSW Government and its agencies demonstrate clearly and consistently that the Government's climate change objectives in relation to biodiversity are being translated across all levels and areas of Government policy, planning, strategy, research and on ground action.[313]

5.4 In particular, the Committee was told about the importance of aligning Catchment Actions Plans (CAPs) with local environmental plans (LEPs).[314] The New South Wales Natural Resources Commissioner, Dr John Williams, explained to the Committee that there is no legislative requirement for LEPs to interact with CAPs.[315] Given that both are responsible for regional planning and conservation issues, it is important that efforts are made to align their goals and actions as a failure to do so will undermine the ability of agencies to make progress towards natural resource management goals.[316] Dr Williams further explained:

> To me, unless we get alignment between Catchment Action Plans and local environmental plans, and the data that sits around that at the scale, we have no way of knowing if we are making progress or whether we are investing in the best places.[317]

[311] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 25, SHOROC, p. 3

[312] Submission 15, Hunter Councils, p. 4; Submission 19, NRAC, p. 2; Submission 20, MACROC, p. 4; Submission 26, NRC, p. 3

[313] Submission 15, Hunter Councils, pp. 1-2

[314] Submission 14, EDO, p. 65

[315] Dr John Williams, Transcript of hearing, 22 June 2009, p. 22

[316] Submission 14, EDO, p. 60; Submission 15, Hunter Councils, p. 4; Dr John Williams, Transcript of hearing, 22 June 2009, p. 19

[317] Dr John Williams, Transcript of hearing, 22 June 2009, p. 18

5.5 The Committee also heard about the importance of aligning State and Federal Government policies and programs.[318] The submission from the Natural Resources Commission stated:

> Currently, NSW and Federal Government policies and programs are not aligned and their objectives can conflict with each other. This leads to inefficiencies, duplication and tension between NRM agencies and sends mixed messages to the community.[319]

5.6 The Committee finds that it is critical for all New South Wales Government plans and strategies to be aligned to the new goals, objectives and priorities necessary to manage biodiversity under the impacts of climate change. In particular, the Committee finds that it is vital for CAPs and LEPs to be aligned, recognising that there is a range of legislative, policy and agency barriers to this.

RECOMMENDATION 11: The revised goals, objectives and priorities for biodiversity management are reflected in all relevant New South Wales Government agency plans and strategies.

RECOMMENDATION 12: The Minister for Climate Change and the Environment and Minister for Planning nominate an agency or establish a taskforce to identify mechanisms to align Catchment Action Plans and local environmental plans.

Coordination of agencies

5.7 In addition to the alignment of agency goals and objectives, the Committee heard how critical it was that there was improved coordination between agencies, particularly with respect to program delivery and information sharing.

Better coordination of programs

5.8 One of the key strategies widely recommended to better manage biodiversity under climate change was increased coordination of biodiversity conservation programs.[320] The Namoi Catchment Management Authority (CMA) stated in its submission;

> The NSW Government could achieve significant improvements to biodiversity conservation by clarifying, co-ordinating and aligning agency activities more effectively. To achieve a whole of Government response, better cross agency co-ordination and information exchange is required.[321]

5.9 Stakeholders acknowledged that improving coordination in biodiversity conservation requires the involvement of a number of natural resource management players. Dr Williams told the Committee:

> Addressing the impacts of climate change on biodiversity requires an integrated approach across catchment planning, water sharing and water management, land use

[318] Submission 26, NRC, p. 3

[319] Submission 26, NRC, p. 3

[320] Submission 6, CSIRO, p. 5; Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 12, Namoi CMA, p. 6; Submission 14, EDO, p. 60; Submission 19, NRAC, p. 2; Submission 20, MACROC, p. 5; Submission 23, Southern Rivers CMA, p. 2; Dr David Slip, Transcript of hearing, 22 June 2009, p. 2

[321] Submission 12, Namoi CMA, p. 6

> planning and urban development, environmental regulation and conservation, primary industries and services to regional communities.[322]

5.10 Additionally, as many of the threats to biodiversity occur at the regional or landscape level, a cross-agency coordinated approach to managing biodiversity allows landscape wide threats to be managed better. The CSIRO submission explained:

> Many ecosystem processes and many of the changes that occur to biodiversity and threats will do so at large scales. Increased coordination of different conservation and NRM programs would enable improved management at landscape and regional scales.[323]

Better information sharing

5.11 The Committee heard that better information sharing between agencies and different levels of government would improve biodiversity management decision making.[324] The Committee was encouraged to hear examples of where agencies or programs were making particular efforts to work across agencies for the best biodiversity management outcomes.

5.12 In particular, the Committee heard about the efforts of the Namoi CMA to coordinate with local governments and share information about weeds. Dr Francesca Andreoni, Senior Project Officer, Biodiversity and Threatened Species for the Namoi CMA, explained:

> We have a weed tracer program that links up with all the local government areas across our catchment. It is no extra work for anybody but every individual council is going out and weeds officers are recording data in the field or doing up maps, et cetera. We also get them to send it to the weeds officer at the CMA. He manages a centralised database so we can work as an early alert system. I can say, "This local government area over here as a new thing that has come in so I can let you guys know, the neighbouring local government areas, that it has come in." Again, it is not adding to the workload but just trying to coordinate a little better and get us on the front foot as new innovations come through.[325]

5.13 On its trip to the Bredbo region a delegation of the Committee heard about the Kosciuszko to Coast project, part of the Great Eastern Ranges initiative. The program has a facilitator who works with local landholders and speaks with them about different programs from different natural resource management agencies and non-government agencies. Working across a number of agencies enabled the facilitator to identify which program from the different organisations was most suitable to the needs of the specific landholder.

Better agency cooperation at all levels

5.14 The Committee noted the importance of better agency coordination occurring at all levels of agencies, from the Chief Executive Officer (CEO) level to regional and field staff. The Department of Environment, Climate Change and Water (DECCW) explained that the New South Wales Government has established CEO committees

[322] Dr John Williams, Transcript of hearing, 22 June 2009, p. 17

[323] Submission 6, CSIRO, pp. 9-10

[324] Submission 11, TSCA, p. 8; Submission 25, SHOROC, pp. 4-5; Dr John Williams, Transcript of hearing, 22 June 2009, p. 20

[325] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 11

to allows the CEOs and senior officials from different department to meet and exchange information about what each agency is doing.[326]

5.15 While such efforts are encouraging and commendable, the Committee notes the importance of coordination also occurring on the ground where biodiversity management projects are delivered.

RECOMMENDATION 13: All natural resource management agencies identify mechanisms and procedures to increase on-ground officer level coordination of biodiversity management across different agencies and levels of government.

Regional delivery

5.16 The Committee understands that achieving effective outcomes in natural resource management necessitates the effective delivery of programs at the localised or regional level. Managing biodiversity under climate change is no exception. The Committee heard how important it would be for any response to climate change impacts on biodiversity to be delivered regionally.[327] The submission from the then Department of Environment and Climate Change stated:

> Climate change impacts will be experienced at regional and local levels. In many cases local organisations will have a better understanding of community needs and will be better placed to respond and adapt to climate change pressures. Partnerships with regional and local bodies will continue to be vital in ensuring we can capitalise on local knowledge and ensure that adaptation responses for biodiversity are appropriate.[328]

5.17 Throughout the course of the inquiry, the Committee heard about the importance of programs being delivered by local government, CMAs and regional staff within State Government departments.

Local government

5.18 The Committee heard from a number of councils about the range of projects they were involved in to protect biodiversity within their local areas. The submission from the Macarthur Regional Organisation of Councils stated:

> For the success of any strategy it is important to define specific actions that can be targeted at Local Government level.[329]

Regional staff within State Government departments

5.19 During the visit of inspection to the Bredbo region, a delegation of the Committee heard about the importance of having regional staff to deliver State Government programs. The delegation heard that the Southern Branch of the National Parks and Wildlife Service has a dedicated position to work with local landholders to develop conservation agreements, with the overall program being managed through the head office of the Climate Change, Policy and Programs Group of DECCW. The delegation heard that having this regionally-based officer contributed significantly to the higher number of Conservation Agreements within Southern Branch compared to the three Branches that did not have a dedicated regional officer.

[326] Mr Simon Smith, Transcript of hearing, 20 August 2009, p. 38

[327] Dr John Williams, Transcript of hearing, 22 June 2009, p. 17

[328] Submission 10, DECC, p. 3

[329] Submission 20, MACROC, p. 2

Catchment Management Authorities

5.20 The Committee noted the strong support for CMAs as effective regional delivery agencies.[330] The Southern Rivers CMA told the Committee that it believes the CMA model is very good as each CMA provides a focussed and target-orientated approach to biodiversity protection. They are effective because they are locally focussed.[331]

5.21 Dr Williams told the Committee:

> CMAs are well positioned within their communities to build community capacity and facilitate behaviour change to minimise climate change impacts. The impacts of climate change on our ecology, industry and communities will be most felt at the local and regional level.[332]

5.22 The Committee finds that the CMAs are a good model for the delivery of natural resource management projects that should continue to be supported. As discussed in paragraph 5.6 above, there is scope for CMAs to improve their coordination with other regional natural resource management agencies, particularly local governments. The Committee finds that all CMAs should work to improve relationships and links with other agencies and organisations involved in the delivery of natural resource management within their region such as local governments and Landcare groups.

RECOMMENDATION 14: The Catchment Management Authority model should continue to be supported for the delivery of natural resource management projects and all Catchment Management Authorities should work to improve relationships and links with other regional natural resource management agencies and organisations such as local governments and Landcare groups.

Resourcing agencies

5.23 The Committee understands that funding for natural resource management has always been limited and heard claims that this has led to problems of implementation.[333] The Environmental Defender's Office stated in its submission:

> It has long been the case that resources for biodiversity protection are limited, which has meant that government agencies often fail to provide adequate funding to manage the biodiversity that they are responsible for protecting.[334]

5.24 Stakeholders acknowledged both the importance of adequately resourcing plans and programs to achieve biodiversity conservation goals and objectives,[335] and the considerable challenge that will be required to do this.[336] The submission from the Natural Resources Advisory Council stated:

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[330] Submission 23, Southern Rivers CMA, p.3; Dr John Williams, Transcript of hearing, 22 June 2009, p. 18; Mr Michael Muston, Transcript of hearing, 22 June 2009, pp. 56-57

[331] Submission 23, Southern Rivers CMA, p.3; Mr Michael Muston, Transcript of hearing, 22 June 2009, pp. 56-57

[332] Submission 26, NRC, p. 2

[333] Submission 14, EDO, p. 79

[334] Submission 14, EDO, p. 20

[335] Submission 12, Namoi CMA, p. 4; Submission 19, NRAC, p. 3; Submission 23, Southern Rivers CMA, p.2

[336] Submission 26, NRC, p. 2

> New revenue and investment strategies are needed for ongoing programs to restore ecosystem health, build resilience and minimise biodiversity loss.[337]

More threats to ecosystems

5.25 The Committee heard that as the impacts of climate change on biodiversity intensify there will be a need to put more funds into actively managing remaining ecosystems to improve their resilience and reduce threats to biodiversity.[338]

5.26 In particular, the Committee heard about the need to improve funding for public protected areas, such as national parks, given the significant role they play in protecting biodiversity and the increasing threats they are likely to experience under climate change.[339] Additionally, Professor Ralf Buckley, Director and Chair of the International Centre for Ecotourism Research at Griffith University, told the Committee that a current concern for national parks was that political and financial pressures were requiring national parks agencies to increase recreation and commercial tourism within parks, which would actually decrease the resilience of national parks rather than increase it.[340] The issue of tourism in national parks is further discussed from paragraph 6.31 below.

Need for long term funding

5.27 Currently many natural resource management agencies receive funding through either three year project budgets or annual allocations which they are required to spend in a single year. Such funding regimes increase the risk of failure of projects (for example being forced to undertake projects such as tree plantings while there are bad climatic conditions such as drought) or do not allow projects to reach their full potential.[341]

5.28 During the visit of inspection to the Bega and Cooma regions a delegation of the Committee heard that many natural resource management projects, including biodiversity management, require long term funding certainty (at least ten to fifteen years) in order to be successful. The Southern Rivers CMA explained that many projects that involve working with private landholders can take two to five years to initially build relationships with landholders before they receive significant landholder support to more broadly implement the projects.

5.29 It was therefore suggested to the Committee that funding arrangements for natural resource management agencies and projects should be reviewed to provide longer term and/or ongoing funding which allows for greater certainty and effectiveness in the implementation of biodiversity management projects.[342]

5.30 The Committee notes the importance of funding certainty for natural resource management projects and encourages all natural resource management agencies to identify priority projects that require long term funding and incorporate these into their budget requests.

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[337] Submission 19, NRAC, p. 3

[338] Submission 19, NRAC, p. 3; Submission 25, SHOROC, p. 7

[339] Submission 14, EDO, p. 80; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 36

[340] Submission 3, Professor Ralf Buckley, p. 5

[341] Submission 14, EDO, p. 60; Dr John Williams, Transcript of hearing, 22 June 2009, p. 20

[342] Submission 20, MACROC, p. 5; Submission 23, Southern Rivers CMA, p.2; Dr John Williams, Transcript of hearing, 22 June 2009, p. 20

RECOMMENDATION 15: All natural resource management agencies identify priority projects that require long term and ongoing funding and incorporate these into their budget requests.

Information dissemination

Community education

5.31 The Committee notes the importance of clear and effective communication channels between agencies and the community. The Committee heard that, while there may be a high level of awareness within the community of climate change and the importance of biodiversity management, there is a low level of practical knowledge about addressing these issues.[343] The submission from the Shore Regional Organisation of Councils stated:

> There is a need to devise and expand programs for widescale community education and engagement so that the public is aware of the issues, understand the benefits of biodiversity, develop a positive attitude to supporting biodiversity conservation and skills in planning and maintaining their properties in a way that is conducive to enhancing biodiversity.[344]

5.32 The Southern Rivers CMA told the Committee that providing basic environmental messages to the community would actually assist natural resource managers to do their duties.[345] Additionally they suggested that promoting success stories (such as successful models for feral animal exclusion) would improve implementation of programs by assuring landholders that the programs were effective encouraging their participation in the programs.[346]

Extension

5.33 The University of New England's School of Environmental and Rural Science submission stated that over the last decade there has been a decline in the number of staff actively involved in natural resource management extension.[347] To effectively address the impacts of climate change on biodiversity they suggested that:

> an effective network of extension, education and facilitation officers must be put in place to build the human and social capital required to enable appropriate adaptive mechanisms to be extended and adopted.[348]

5.34 On the visit of inspection to the Bredbo, Bega and Cooma regions, a delegation of the Committee witnessed first hand the value of extension officers. The Committee saw that programs with extension and regional on-ground officers were better able to work with and support local landholders and were fundamental to the success of biodiversity conservation programs.

[343] Submission 25, SHOROC, p. 6; Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, pp. 34-35
[344] Submission 25, SHOROC, p. 6
[345] Submission 23, Southern Rivers CMA, p.3
[346] Submission 23, Southern Rivers CMA, p.4
[347] Submission 13, UNE – School of Environmental and Rural Science, p. 26
[348] Submission 13, UNE – School of Environmental and Rural Science, p. 26

Conclusion

5.35 The Committee notes the importance of natural resource management agencies communicating with the community and that there is scope for improvement in agency communication and extension programs.

RECOMMENDATION 16: All natural resource management agencies review their communication and community education programs and identify opportunities for improving communication to enable more effective implementation of biodiversity management programs.

RECOMMENDATION 17: All natural resource management agencies increase their extension efforts and staffing to maximise implementation of biodiversity conservation programs.

Chapter Six - Managing biodiversity on public land

6.1 This chapter discusses biodiversity management within the reserve system with particular reference to the extent of the reserve system and the management of impacts on the reserve system. This chapter also discusses biodiversity management with respect to the review of travelling stock reserves (TSRs) and current native forestry operations.

6.2 For convenience of structure, the Committee has included the discussion of invasive species management within this chapter, noting that it is a significant issue for both public and private land and that both public land managers and private landholders need to address it.

The reserve system

6.3 The National Parks and Wildlife Service (NPWS) manages almost 6.7 million hectares of protected areas, which represents 8.3% of the land area of New South Wales.[349] These protected areas include national parks, nature reserves, regional parks, state conservation areas, karst conservation areas, community conservation areas, Aboriginal areas and historic sites. Collectively they are known as the 'reserve system'.

6.4 The reserve system in New South Wales is part of the National Reserve System (NRS) which covers more than 11% of Australia and contains areas vital to the survival of Australia's plants and animals. In particular, it includes core habitats for many native species of high conservation value.[350]

6.5 The Committee heard that as climate change takes effect, the NRS will be vital to Australia's conservation efforts. Additionally, the continued preservation of the NRS will be a more cost effective management response than restoring degraded or modified ecosystems.[351]

6.6 To ensure the protection of biodiversity under climate change, the Committee heard that there were two key strategies for the reserve system: expanding the extent of the reserve system, and better managing the reserve system by reducing impacts and threats and increasing resilience. These strategies are explained further below.

Extent of the reserve system

Goals and targets for the National Reserve System

6.7 In line with other Australian states and territories, New South Wales is seeking to build a comprehensive, adequate and representative system of public protected areas, known as a CAR reserve system.[352] Associated with the CAR objective are a number of targets:

- comprehensiveness – at least 80% of the number of extant regional ecosystem in each bioregion are represented in the reserve system

[349] DECC, *New South Wales National Parks Establishment Plan 2008*, Sydney, 2008, p. 1

[350] Submission 6, CSIRO, p. 8

[351] Submission 12, Namoi CMA, p. 5; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17

[352] DECC, *New South Wales National Parks Establishment Plan 2008*, Sydney, 2008, p. 3

- adequacy – the need to secure an 'adequate' size and configuration of protected areas to provide long term protection and security for the natural and cultural values they protect (no quantified target set)
- representativeness – at least 80% of extant regional ecosystems in each subregion are represented in the reserve system.[353]

6.8 Mr Bob Conroy, Executive Director of Park Management for the NPWS, explained to the Committee that in New South Wales the comprehensiveness target involved:

> ensuring that within each of those eighteen bioregions, all of the extant ecosystems that exist within each of the bioregions are sampled within the reserve system.[354]

6.9 Mr Conroy further explained about the representativeness target:

> [W]ithin each of the 18 bioregions there are also subregions—that is, each of the eighteen bioregions are broken down. An example would be the Sydney Basin bioregion and the Cumberland Plains area is a subregion within the Sydney Basin bioregion. The representativeness target is about ensuring that within each of the subregions, for example the Cumberland Plains subregion, each of the extant ecosystems is sampled within the reserve system.

6.10 As discussed in paragraph 4.39 above, protecting a diversity of habitats is a critical strategy for ensuring that biodiversity is conserved in the face of climate change. The CAR objective and targets are an effective framework for identifying and protecting habitat diversity.[355]

New South Wales National Parks Establishment Plan

6.11 The *New South Wales National Parks Establishment Plan* was adopted by the New South Wales Government in 2008 and outlines the priorities for additions to the reserve system over the next ten years. The aim of the Establishment Plan is to achieve the CAR objective and targets.[356] To do this, three priority areas have been identified:

- New reserves will be established in many parts of the State's far west and central west where reserves currently protect less than 5% of the landscape.
- Existing reserves on the western slopes and tablelands will be built-up.
- Existing reserve boundaries along the coast and coastal ranges will be fine-tuned where poor configurations currently complicate and impair management effectiveness.[357]

6.12 Mr Conroy explained the reasoning behind adopting the first priority:

> [T]he priorities, as identified in the establishment plan, are clearly in the central west and the far west and they are priorities because there is a great under-representation of the ecosystems that exist out there within the bioregion. So in order to achieve our comprehensiveness and representativeness targets we are clearly focusing on priorities in the central west and the far west and the Booligool property and the Toorale property are far west properties that clearly meet the strategies as identified and the priorities as identified in the establishment plan.[358]

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[353] Submission 14, EDO, pp. 28-29

[354] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 31

[355] Submission 6, CSIRO, p. 9

[356] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 31

[357] DECC, *New South Wales National Parks Establishment Plan 2008*, Sydney, 2008, pp. 1-2

[358] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 34

6.13 The Committee notes that the Establishment Plan acknowledges that the reserve system is only one part of biodiversity conservation and that the expansion of the reserve system alone:

> cannot ensure the achievement of healthy and sustainable landscapes, and that this can only occur through a broad range of conservation activities across the whole landscape on both public and private land.[359]

Meeting the CAR targets

6.14 The Committee heard that while significant progress has occurred to date, many ecosystems are still not represented in the reserve system.[360] Dr Graeme Worboys, Vice Chair of Mountains and Connectivity for the International Union for the Conservation of Nature's World Commission on Protected Areas, told the Committee:

> Internationally, New South Wales should be proud of is protected area system. It is really a leading system throughout the world, but my main point is that it is unfinished business.[361]

6.15 Dr Francesca Andreoni, Senior Project Officer, Biodiversity and Threatened Species for the Namoi Catchment Management Authority (CMA), told the Committee that generally the unrepresented ecosystems were:

> anything that occurs on flat fertile soil. Our whole reserve system for predictable reasons we have developed our agriculture on flatter fertile soils and we have reserved all the beautiful but poor fertility, scrubby stuff up on the hills.[362]

6.16 The submission from the Environmental Defender's Office (EDO) explained that progress towards meeting the CAR targets in New South Wales varied across bioregions and in general was more advanced in the east of the State than the west. Of the 18 bioregions, 11 have less than 50% of their regional ecosystems within the reserve system. Of the 129 subregions, 79% have less than 50% of their regional ecosystems within the reserve system.[363]

Expansion of the reserve system

6.17 The Committee also heard that the current extent of the reserve system is not adequate to protect biodiversity from the impacts of climate change and that the reserve system needs to be expanded.[364] The submission from the University of New England's School of Environmental and Rural Science stated:

> The current fragmented and disconnected reserve system alone will be markedly inadequate to cope with the biological forces of change wrought by climatic variations. It is likely that the current conservation values of the reserve system itself will be under threat.[365]

6.18 In particular, the reserve system will be affected by changes in species' distributions which could reduce the capacity of the reserve system to protect species. The

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[359] DECC, *New South Wales National Parks Establishment Plan 2008*, Sydney, 2008, p. 1

[360] Submission 4, South East Forest Rescue, p. 3; Submission 6, CSIRO, p. 8; Submission 12, Namoi CMA, p. 5; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 16

[361] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15

[362] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p 16

[363] Submission 14, EDO, p. 31

[364] Submission 8, Mr Robert Mason, p. 1; Submission 14, EDO, pp 13-14

[365] Submission 13, UNE – School of Environmental and Rural Science, p. 26

submission from Mr Robert Mason explained that if changes in species' distributions occurred:

> existing protected areas may decrease in their effectiveness, as the species that are found within protected areas currently may be unable to live within those areas in the future.[366]

6.19 The Committee heard that the New South Wales reserve system will require further investment if it is to meet the CAR targets.[367] Stakeholders also noted the need to build the reserve system urgently while remaining ecosystems are still intact and before the impacts of climate change take hold.[368]

6.20 The Committee notes the strong support for the expansion of the reserve system in line with the CAR objective and targets as an essential strategy in the protection of biodiversity from the impacts of climate change.[369]

Marine parks

6.21 Some stakeholders expressed doubt about whether the current system of marine parks provided a comprehensive and connected network of marine protected areas.[370] It was suggested that further management effort be directed towards creating marine corridors and reserves.[371] The submission from the Shore Regional Organisation of Councils argued that:

> A higher degree of protection must be afforded to marine ecosystems in order to conserve biodiversity. To this end, a system of inter-connected national parks, marine parks, aquatic reserves and inter-tidal protection areas should be developed along the NSW coast to conserve marine flora and fauna as well as reefs, rock platforms and other inter-tidal habitat, spawning grounds and estuarine fish nurseries.[372]

6.22 The Committee notes that in 2007 the National Parks Association of NSW published a report on the state of marine conservation in New South Wales entitled *The torn blue fringe: Marine conservation in NSW.* The report identified 'significant shortfalls' in commitments to the marine protected areas network in New South Wales[373] and called on the New South Wales Government to establish a CAR reserve system for marine ecosystems.[374] The National Parks Association of NSW has been advocating the establishment of a network of marine protection from Tweed Heads to Cape Howe covering over 200,000 hectares of New South Wales's oceans.[375]

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366 Submission 8, Mr Robert Mason, p. 1

367 Submission 6, CSIRO, p. 8; Submission 12, Namoi CMA, p. 5; Submission 14, EDO, pp. 32 & 37

368 Submission 6, CSIRO, p. 8; Submission 12, Namoi CMA, p. 5; Submission 14, EDO, p. 37; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15

369 Submission 6, CSIRO, p. 8; Submission 12, Namoi CMA, p. 5; Submission 14, EDO, p. 32; Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 14; M Dunlop & P Brown, *Overview of the report - Implications of climate change for Australia's national reserve system: A preliminary assessment*, CSIRO report to DCC & DEWHA, Canberra, 2008, p. 4

370 Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 25, SHOROC, p. 6

371 Submission 7, University of Sydney – School of Biological Sciences, p. 2

372 Submission 25, SHOROC, p. 6

373 National Parks Association of NSW, *The torn blue fringe: Marine conservation in NSW*, Part I – Building resilience, Sydney, 2007, p. 8

374 National Parks Association of NSW, *The torn blue fringe: Marine conservation in NSW*, Part I – Building resilience, Sydney, 2007, p. 19

375 National Parks Association of NSW, *Sydney marine park proposal launched*, media release, Sydney, 4 December 2008

6.23 In a response to questions taken on notice at a hearing, the then Department of Environment and Climate Change advised the Committee that significant progress had already been made towards establishing marine protected areas in New South Wales through the declaration and zoning of six marine parks comprising 345,000 hectares.[376] The Department further explained:

> The Government has not proposed declaration of any new marine parks but remains committed to marine biodiversity conservation, and to building a comprehensive marine protected area system under its national and international obligations. The current focus of efforts is on managing and monitoring existing marine parks and on reviewing the zoning plans for its two oldest parks, Solitary Islands and Jervis Bay.[377]

6.24 The Committee notes the Government's commitment to establishing marine protected areas and notes that there are no plans to expand the number or extent of marine parks at this time.

Conclusion

6.25 The Committee agrees with stakeholders that there is a need to continue to expand the reserve system in line with the CAR objective and targets.

RECOMMENDATION 18: The New South Wales Government continues to invest in the expansion of the reserve system in line with the established CAR objective and targets as a key strategy to protect biodiversity under the impacts of climate change.

Management of the reserve system

6.26 As discussed in 4.43, a key strategy for managing the impacts of climate change on biodiversity is to increase the resilience of ecosystems. This is especially true for the reserve system. The Committee heard that national parks management agencies would face a challenge to more effectively manage key impacts and threats including:

- changing fire regimes[378]
- invasive species[379]
- pollution[380]
- altered water flows[381]

[376] DECC, Response to questions taken on notice at hearing, 4 May 2009, p. 2

[377] DECC, Response to questions taken on notice at hearing, 4 May 2009, p. 2

[378] Submission 2, Associate Professor Michael Mahony, p. 3; Submission 3, Professor Ralf Buckley, p. 10; Submission 6, CSIRO, p. 8; Submission 11, TSCA, p. 13; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 35

[379] Submission 2, Associate Professor Michael Mahony, p. 3; Submission 3, Professor Ralf Buckley, p. 10; Submission 6, CSIRO, p. 8; Submission 11, TSCA, p. 13; Submission 12, Namoi CMA, p. 5; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24; DECCW, Response to questions taken on notice at hearing, 20 August 2009, pp. 8-9

[380] Submission 11, TSCA, p. 13; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 35

[381] DECCW, Response to questions taken on notice at hearing, 20 August 2009, pp. 8-9; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 35

- pathogens[382]
- recreation and tourism[383]
- adjoining land uses[384]
- fragmentation.[385]

6.27 The management of tourism and recreation within the reserve system is discussed further in paragraph 6.31 below and the management of invasive species is discussed further in paragraph 6.63 below.

6.28 The Committee heard that the impacts of climate change on biodiversity will put increasing pressure on national parks agencies in two main ways. Firstly, additional management effort will be required to reduce increasing threats to biodiversity and to improve the resilience of ecosystems. Secondly, additional expenditure will be needed to recover from the increasing frequency and intensity of extreme events such as cyclones, floods and fires. The submission from the EDO stated:

> [C]limate change will require more active management of protected areas with concomitant resource implications. Many of these costs will draw from park budgets but will be unrelated to biodiversity conservation, such as maintenance costs associated with fire frequency, cyclonic activity and extreme weather events[.][386]

6.29 The submission from Professor Ralf Buckley, Director and Chair of the International Centre for Ecotourism Research at Griffith University, stated that national parks management agencies are being required to fund more of their management costs by increasing revenue from tourism and recreational use of the reserve system. He warned that doing so would actually decrease the resilience of the reserve system rather than contribute to increasing resilience because of the impacts associated with tourism and recreation.[387]

6.30 In light of the increasing management costs for the reserve system under climate change, a number of stakeholders argued for the budgets of national parks management agencies to be increased.[388]

Managing tourism and recreation in the reserve system

6.31 As discussed in paragraph 2.44 above, nature tourism is an important economic activity within New South Wales worth between $5 and $7 billion annually.[389] The

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382 Submission 11, TSCA, p. 13; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

383 Submission 2, Associate Professor Michael Mahony, p. 3; Submission 3, Professor Ralf Buckley, p. 10; Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 29; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 16

384 Submission 11, TSCA, p. 13; DECCW, Response to questions taken on notice at hearing, 20 August 2009, pp. 8-9

385 Submission 11, TSCA, p. 13

386 Submission 14, EDO, p. 80

387 Submission 3, Professor Ralf Buckley, p. 5

388 Submission 3, Professor Ralf Buckley, pp. 5, 10 &12; Submission 12, Namoi CMA, p. 5; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 35

389 Submission 3, Professor Ralf Buckley, p. 11

New South Wales reserve system attracts over 38 million domestic visits annually[390] and 1.3 million international tourists to New South Wales visit a national park as part of their trip.[391]

6.32 However, it is has long been acknowledged that tourism and recreation can have significant impacts on the reserve system and potentially pose a significant threat to conservation.[392] The Committee heard a number of suggestions for reducing the impacts of tourism and recreation in the reserve system, thereby maintaining the resilience of the reserve system. Professor Buckley explained to the Committee the importance of doing this:

> If we are looking particularly at conserving biodiversity under climate change, I think we have to give our parks the best shot they can have, and that means reducing the impacts from tourism rather than increasing them.[393]

6.33 It has been recommended that the fundamental purpose of the reserve system should remain conservation, not tourism and recreation. Some stakeholders have expressed concerns about recent proposals to amend the *National Parks and Wildlife Act 1974* to include tourism in the objects of the Act.[394] Professor Buckley explained these concerns to the Committee:

> I think that there is considerable concern about proposals that in New South Wales the opposite might occur, where suggestions have been made that legislation for the New South Wales parks service should specifically include tourism. Suggestions have been made that this would not change anything but, of course, that is not true, because if it were not going to change anything, why would you do it? If legislation specifically says that commercial tourism is one of the approved uses of national parks, then I think we can be very sure that commercial tourism in parks would grow very extensively.[395]

6.34 Professor Buckley's submission recommended that it was important to:

> [r]eaffirm, if necessary through legislative changes, that the primary role of parks is conservation and the primary function of NSW NPWS is to manage parks for conservation.[396]

6.35 The Committee also heard that it may be necessary to restrict some high impact tourism and recreation activities within the reserve system or relocate them to areas of lower conservation value. The submission from the Friends of Narrabeen Lagoon Catchment stated:

> National Parks are intended to provide a natural haven. Some forms of recreational use are a threat to biodiversity, species and ecosystems. Mountain biking and trail biking for example, can cause serious soil erosion and degrade habitat. [Four]-wheel drive

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390 Roy Morgan Research, *Annual visits to PWG managed parks in New South Wales – Final report*, Report prepared for the DECC, Sydney, 2009, p. 4

391 Tourism New South Wales, *International travel to NSW: Year ended June 2009*, Sydney, 2009, p. 3

392 Submission 3, Professor Ralf Buckley, pp. 10-11; Submission 24, Friends of Narrabeen Lagoon Catchment, pp. 5-6; A Mathieson & G Wall, *Tourism: economic, physical and social impacts*, Longman Scientific and Technical, London, 1980; S Wearing & J Neil, *Ecotourism: Impacts, pitfalls and possibilities*, Butterworth-Heinemann, Oxford, 1999; R Buckley (Ed), *Environmental impacts of ecotourism*, CAB International, Oxford, 2004

393 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 29

394 National Parks Association of NSW, Colong Foundation for Wilderness & Blue Mountains Conservation Society, *Rees hands national parks to tourism industry*, media release, Sydney, 3 December 2008

395 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, pp. 28-29

396 Submission 3, Professor Ralf Buckley, p. 12

> vehicles are even more damaging. Consequently, sporting or recreational uses, which damage the environment, may need to be restricted.[397]

6.36 It was also suggested to the Committee that tourism developments should always be located outside of the reserve system. Professor Buckley explained to the Committee:

> The key issue here is that the role for the tourism industry is outside the national parks, not inside. There are very good opportunities and good examples around the world of where the private tourism sector has successfully improved conservation on private land outside parks, and on other public lands such as state forests. However, all the examples worldwide where parks agencies have tried to enter into partnerships with commercial tourism providers inside parks have ended up bad for conservation and often also bad for tourism.[398]

6.37 The Committee heard that tourism developments located outside the reserve system provide greater conservation benefits than those located inside. When nature tourism developments are located on private land there is more incentive for tourism operators to manage their land sustainably to ensure its attractiveness as a tourism destination, rather than relying on public money to maintain the reserve system that they are benefiting from.[399] Additionally, areas used for nature tourism adjacent to the reserve system effectively extend the area of land used for conservation purposes and can create buffers and corridors around the reserve system.[400]

6.38 Professor Buckley explained that all the evidence indicates that encouraging tourism developments within the reserve system would not help national parks agencies to improve resilience or protect biodiversity under climate change.[401] He told the Committee:

> I am aware that there is a degree of political interest in New South Wales at the moment in expanding the role of commercial tourism development inside national parks. I simply point out that wherever that has been tried in the rest of the world it has not worked. I do not think that it is a good idea.[402]

6.39 The NPWS advised the Committee that tourism and recreation in the reserve system was guided by *Living Parks*, the state-wide strategic plan for visitation.[403] While no details of the specific processes or systems were provided to the Committee, the NPWS stated that all activities within the reserve system considered the potential impacts to:

> conservation values (biodiversity, Aboriginal and historic heritage); physical elements (soil, water, hazards, wastes, and pollution); community (services, infrastructure, cultural significance, recreational value, safety, visual, and economic); and natural resource use.[404]

[397] Submission 24, Friends of Narrabeen Lagoon Catchment, pp. 5-6
[398] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24
[399] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 25
[400] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 28
[401] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 26
[402] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 25
[403] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 8
[404] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 8

6.40 The Committee understands that one of the priority actions within *Living Parks* is to:

> Develop a program to monitor and research visitation impacts and develop management strategies.[405]

6.41 While the Committee was not provided with any specific details on the implementation of *Living Parks* actions, the Committee notes that the implementation of such an action would allay concerns from stakeholders about the impacts of tourism and recreation on the reserve system.

Adaptive management in the reserve system

6.42 As discussed in paragraph 4.25 above, there is a need for management plans to acknowledge the considerable degree of uncertainty associated with the impacts of climate change on biodiversity. Stakeholders strongly recommended the adoption of an adaptive management framework. This is particularly necessary for the reserve system. The EDO submission stated:

> Increasing uncertainty in relation to the management of protected areas under climate change strongly suggests the need to apply decision-theory frameworks to decision-making process in management and adaptive management frameworks to the implementation of management strategies, both of which deal explicitly with uncertainty.[406]

6.43 The EDO made a number of suggestions:

- Adaptive management should be used as a management framework of all protected areas.
- Barriers to the effective implementation of adaptive management frameworks across the reserve system should be identified.
- Funding for national parks agencies should be increased to allow for the adoption of an adaptive management framework.[407]

Conclusion

6.44 The Committee finds that management efforts to minimise impacts on the reserve system will need to be enhanced, particularly with respect to tourism and recreation impacts.

RECOMMENDATION 19: The National Parks and Wildlife Service seeks additional funding for increasing the resilience of the reserve system in light of the increasing impacts and management costs that will be experienced under climate change.

RECOMMENDATION 20: The National Parks and Wildlife Service ensures that systems are in place to identify, minimise and manage the impacts of tourism and recreation on the reserve system by fully implementing the endorsed actions within *Living parks* to monitor visitation impacts and develop management strategies to address these impacts.

[405] DEC, *Living Parks: A sustainable visitation strategy*, Sydney, 2006, p. 14

[406] Submission 14, EDO, p. 36

[407] Submission 14, EDO, p. 37

RECOMMENDATION 21: The New South Wales Government encourages nature tourism outside the reserve system on areas such as private land, state forests or Crown land and identifies and addresses any barriers to the development of nature tourism outside the reserve system.

Travelling stock reserves

6.45 TSRs are parcels of Crown land reserved for the purpose of moving stock across the landscape. The Committee heard that many TSRs contain important biodiversity values and provide corridors of native vegetation.[408] The Namoi CMA submission stated:

> In the Namoi TSRs contain significant conservation values. In some overcleared regions of NSW they are the only significant stands of remnant vegetation. TSRs should be maintained and managed for their conservation values to assist in maintaining environmental resilience. They provide a vital network that can be the basis of further essential landscape scale linkages in combination with remnant vegetation on private land.[409]

6.46 In 2008 the New South Wales Government announced that as part of broader changes to the then Rural Lands Protection Boards, a review would be undertaken to identify TSRs that should be ceded back to the then Department of Lands.[410] Mr Tim Seears, Pest and Travelling Stock Reserves Manager for the State Management Council of the Livestock Health and Pest Authorities (LHPA), explained to the Committee that those TSRs that are still likely to be used to facilitate the movement of stock would likely be retained by the LHPA and those that have no or very little movement of stock would be likely to be transferred to the Land and Property Management Authority (LPMA).[411]

6.47 The Committee heard from a number of stakeholders concerned about the fate of TSRs and that this process may result in the sale of TSRs and a loss of their biodiversity and conservation values.[412]

6.48 Mr Adrian Harte, Director of Land Management with the LPMA, told the Committee that there were no plans to sell TSRs that had any environmental values or that contributed to the social, cultural or economic needs of the community.[413] Mr Harte also told the Committee about the approach being taken to ensure that the values of TSRs are maintained:

> [W]e have been in the process of developing assessment methodology to assess the various values of that TSR network; values ranging from the social, the commercial and the environmental, which happened to underpin the basis of our own enabling legislation: the Crown Lands Act, it is a triple bottom-line approach. So we need to take

[408] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 8

[409] Submission 12, Namoi CMA, p. 5

[410] Department of Lands, *The future of travelling stock reserves*, fact sheet, Sydney, 2008, p. 1

[411] Mr Tim Seears, Transcript of hearing, 20 August 2009, p. 26

[412] Submission 7, University of Sydney – School of Biological Sciences, p. 2; Submission 12, Namoi CMA, p. 5; Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, p. 10

[413] Transcript of hearing, 20 August 2009, pp. 27-28

> account of all of those issues from conservation and environment, right through to the social needs and social good.[414]

6.49 Mr Seears told the Committee that during the assessment process of TSRs the LHPA was aware of the need to maintain TSRs for their original purpose:

> From the perspective of Livestock Health and Pest Authorities, our core issue with travelling stock reserves is with regard to the management of travelling stock. That is what they were intended for and that is our key function; to ensure that stock can move throughout the State on these key routes especially, as it is required.[415]

6.50 Mr Harte also explained:

> [T]he maintenance of the travelling stock reserve reservation will prevail, so the reserve for travelling stock now, even the ones that come back to us, will still have that generic reservation on the Crown land that comes back to us, but we will also be looking at other reservations on top of that for multipurpose-type use, whatever is considered most appropriate for the parcel.[416]

6.51 The Committee also heard that there were ongoing discussions to identify any TSRs that may be suitable for incorporation into the reserve system. Mr Conroy told the Committee:

> We are certainly interested in travelling stock reserves that are either within or directly adjoining—I am talking in the order of one hundred metres or a couple of hundred metres of our park boundaries. So, where the travelling stock reserve either directly adjoins or is within or within the vicinity of our parks and reserves, if those TSRs have high biodiversity values we are certainly interested in seeing those reserves added to the reserve system.[417]

6.52 The Committee also heard that the addition of land and management responsibilities to either the LPMA or NPWS would require addition resources to ensure that the current values of the TSRs were maintained.[418]

6.53 The Committee notes that it is important that any agency that is given additional lands for ongoing management as part of the review of TSRs is also given additional resources to manage and maintain the values the reserves.

RECOMMENDATION 22: Those agencies (such as the Land and Property Management Authority or the National Parks and Wildlife Service) that are given additional lands for ongoing management as a result of the review of travelling stock reserves be given commensurate additional resources to adequately manage and maintain the values of the reserves.

Native forestry

6.54 New South Wales is a major timber producer with extensive native forests and plantations throughout the State on both public and private land. Native forests on

[414] Mr Adrian Harte, Transcript of hearing, 20 August 2009, p. 24
[415] Mr Tim Seears, Transcript of hearing, 20 August 2009, p. 25
[416] Mr Adrian Harte, Transcript of hearing, 20 August 2009, p. 28
[417] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 32
[418] Mr Adrian Harte, Transcript of hearing, 20 August 2009, p. 27

public land cover 2.4 million hectares and are managed by Forests NSW (which is part of the Department of Industry and Investment).[419]

6.55 In a response to questions taken on notice at a hearing, the then Department of Primary Industries advised that:

> Forestry operations are regulated by Integrated Forestry Operations Approvals (IFOAs) that contain conditions of licences' issued under the NSW Threatened Species Conservation Act 1995. They prescribe minimum measures to protect threatened species and the habitat of threatened species, including the protection of general features such as rainforest, old growth forest, habitat trees and riparian habitat. IFOAs also include species specific and site-specific conditions. An integral part of the licences is the requirement to conduct pre-operational surveys to assess the presence of threatened species that may require species-specific and site-specific measures.[420]

6.56 Some stakeholders expressed concern that logging operations within native forests in the State's south east were unsustainable and were a significant threat to biodiversity.[421] Stakeholders claimed that current logging operations are degrading biodiversity through:

- removal of coarse woody debris from the forest ecosystem
- post-harvest burning causing changes in species composition
- removal of older trees resulting in the loss of tree hollows, which provide critical habitat for birds and mammals
- runoff from logging operations that is not controlled by erosion control measures during storms.[422]

6.57 Concerns were also raised that the forestry operations were breaching their licence conditions under the Integrated Forestry Operations Approvals and that these breaches had not been prosecuted by the Department of Environment, Climate Change and Water (DECCW).[423] Suggestions were also made that licence conditions were not enforced due to a shortage of staff within the relevant area within DECCW.[424]

6.58 As a result of these concerns, and the likelihood that climate change will increase impacts on biodiversity, some stakeholders recommended the cessation of logging of native forests and that these lands be added to the reserve system.[425]

6.59 Forests NSW told the Committee that all state forests in New South Wales are adaptively managed based on sustainability principles to ensure that they provide environmental, social and economic benefits in perpetuity.[426] The Committee was advised that:

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[419] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 9

[420] DPI, Response to questions taken on notice at hearing, 4 May 2009, pp. 9-10

[421] Submission 4, South East Forest Rescue, p. 3; Submission 5, Australian Labor Party – Murrah Day Branch, p. 1

[422] Submission 5, Australian Labor Party – Murrah Day Branch, p. 1

[423] Submission 4, South East Forest Rescue, p. 4

[424] Submission 4, South East Forest Rescue, p. 4

[425] Submission 4, South East Forest Rescue, p. 8; Submission 5, Australian Labor Party – Murrah Day Branch, p. 1

[426] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 9

> Forests NSW believes its harvesting operations are demonstrably sustainable with regard to social and environmental values as well as ongoing wood supply.[427]

6.60 The Committee heard about a number of measures that Forests NSW has in place to monitor and protect biodiversity. Forests NSW explained that they are currently developing a broadscale biodiversity monitoring program which will provide information on ecosystem health, species distribution and changing trends in biodiversity across state forests.[428] Forests NSW further explained that as part of the program they would be:

> developing targets or thresholds so that significant changes in species composition or occurrence will trigger the requirement for the review and revision of management prescriptions and further monitoring or research. Monitoring results will aim to build on the substantial existing data for individual study areas and will be supplemented by research data where relevant.[429]

6.61 Forests NSW explained that within state forests there are flora reserves which are dedicated as formal conservation reserves under the *Forestry Act 1916*. Across New South Wales there are 32,654 hectares of flora reserves, with 23,103 hectares of these located within native forests. Flora reserves can include:

- high conservation value old growth forest
- representative examples of forest ecosystems
- areas of unique biological values and high biodiversity
- rainforest
- areas of particular beauty, grandeur or attraction
- habitat of key threatened flora or fauna
- sites of historical, Aboriginal or non-Aboriginal cultural heritage.[430]

6.62 The Committee notes that there is insufficient evidence to determine the accuracy of the claims of breach of licence by Forests NSW and trusts that agencies are aware of their legislative responsibilities for compliance and enforcement of licence conditions.

Invasive species management

6.63 Invasive species are animals, plants or other organisms that threaten biodiversity by acting as predators, competitors, parasites or pathogens when they establish in a new ecosystem.[431] Invasive species currently cause significant economic and environmental problems including agricultural losses, extinction of native flora and fauna, impacts on human health and changes to ecosystem function.[432] As discussed in paragraph 2.31 above, the likely impacts of climate change add more urgency to the need to prevent and control invasive species.

[427] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 9

[428] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 10

[429] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 10

[430] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 13

[431] BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 5

[432] Submission 11, TSCA, p. 9; R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 19; BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, pp. 5-6

6.64 As discussed in paragraph 3.42 above, the *New South Wales Invasive Species Plan* provides a framework for the coordinated management of invasive species and aims to prevent new incursions, contain existing populations and adaptively manage already widespread species. The then Department of Primary Industries (DPI) advised the Committee that actions within the *New South Wales Invasive Species Plan* are consistent with key objectives in the *NSW Biodiversity and Climate Change Adaptation Framework* relating to invasive species:

- To understand the interaction between climate change, invasive species and biodiversity.
- To identify changes in the distribution, abundance and impact of invasive species to ensure management practices are adapted to minimise future impacts on NSW's biodiversity.[433]

6.65 In response to questions taken on notice at a hearing, DECCW explained that invasive species management priorities for biodiversity conservation are identified in NSW Threatened Species Priorities Action Statement (PAS) and threat abatement plans (TAPs) for each invasive species key threatening process listed under *Threatened Species Conservation Act 1995*. The Department advised that these documents establish the key priorities for invasive species management for biodiversity conservation across all tenures with a focus on threatened species.[434]

Invasive species management on the reserve system

6.66 The Committee heard from the NSW Farmers' Association that pest animals were not being adequately managed on public land. Mr Rod Young, Chair of the Conservation and Resource Management Committee within the NSW Farmers' Association, told the Committee:

> In my opinion more emphasis should be placed on pest animal control on our public land. I have observed and I have gained a lot of experience from the landowners adjoining public land along the escarpment country. It is obvious that invasive species such as wild dogs, cats and foxes in particular, need to be reduced.[435]

6.67 The Committee was advised that each region within NPWS has a Regional Pest Management Strategy, available publicly on the DECCW website, which details the priorities for invasive species management within that region.[436] The Strategies aim to apply best practice, cost effective and human invasive species management programs which have minimal impact on the environment. The programs are developed and often carried out in collaboration with neighbours, other government agencies, LHPA, local councils, regional pest committees, universities and local community groups.[437] These Strategies include actions listed in the PAS and TAPs as well as other actions such as weed, wild dog and feral pig control to protect neighbouring properties.[438]

[433] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 3
[434] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 7
[435] Mr Rod Young, Transcript of hearing, 20 August 2009, p. 1
[436] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 7
[437] DECCW, *Regional pest management strategies*, viewed 14 November 2009, <http://www.environment.nsw.gov.au/pestsweeds/RegionPestManagement.htm>
[438] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 7

6.68 At its hearing on 20 August 2009, Mr Conroy gave an example of the NPWS working with the LHPA in invasive species management efforts:

> Each year we use the Livestock Health and Pest Authority rangers to assist us with programs on park. In fact for the deer control program in the Royal National Park we use the local Livestock Health and Pest Authority ranger to assist us with the control of deer by way of ground shooting within the park and we also use Livestock Health and Pest Authority rangers on the South Coast and far South Coast for various programs.[439]

Conservation hunting

6.69 The submission from the Australian Deer Association advocated the use of conservation hunting (where recreational hunters are used to control pest species) as an effective strategy to control vertebrate pests across the New South Wales reserve system.[440] Their submission stated:

> Section 15 of the [Game and Feral Animal Control] Act does not authorise hunting in national parks and as a result the benefits of sustained and effective pest animal control by voluntary conservation hunters are currently not possible.[441]

6.70 The Australian Deer Association has suggested the following changes to vertebrate pest management:

- Firstly, we believe there needs to be a fundamental change in attitude within DECC so that alternative strategies, not only from us but from other authoritative groups, can be genuinely considered.
- Secondly, the relevant legislative changes to enable conservation hunting to take place within national parks should be adopted.[442]

6.71 The Committee notes that the issue of conservation hunting has recently received attention as a result of a private member's bill, the *Game and Feral Animal Control Amendment Bill 2009*, introduced into the New South Wales Legislative Council on 3 June 2009. The Bill proposed to allow the hunting of game and pest species, including native animals, across the reserve system by licensed game hunters.

6.72 Professor Ralf Buckley explained to the Committee:

> There are significant problems with feral animals in many parks throughout Australia, and it has been an ongoing issue whether feral animal control should be carried out by parks staff, which is a cost to the public purse, or whether it should be subcontracted to private hunting groups, which does happen, for example, in some areas in New Zealand.[443]

6.73 Professor Buckley further explained that the specific details of how conservation hunting operates often determines whether it is a successful strategy for biodiversity management or not:

> The details of whether or not it is good—it is one of these the devil is in the detail things. If large-scale private hunting lodges were constructed in New South Wales national parks ostensibly to control feral animals, that would be used as an excuse for tourism infrastructure in the way that I have just been describing which has not tended to work. If the parks agency decided to run a particular program of feral animal control in which it

[439] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 33
[440] Submission 22, Australian Deer Association, p. 2
[441] Submission 22, Australian Deer Association, p. 1
[442] Submission 22, Australian Deer Association, p. 4
[443] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, pp. 26-27

> invited appropriately pre-qualified private hunters to join it, I do not see that that would be a problem.[444]

6.74 At its hearing on 20 August 2009 the Committee questioned the NPWS about whether hunting within the reserve system is being considered. Mr Conroy explained that the:

> Government's position is that it has currently reached the right balance between recreational hunting within public lands within New South Wales. Currently there are 450 state forests—that is about 2 million hectares—that are currently available for recreational hunting in New South Wales. Extending that to the national park system, the Department does not support that and, as I understand it, the Government does not support that position either.[445]

6.75 Mr Conroy further explained the concerns of the NPWS regarding conservation hunting within the reserve system:

> We would have concerns from a department point of view about the safety of our park visitors, particularly in those parks that obviously have high visitor use at the moment. We would also have concerns about the use of hunting dogs within our park system and the possibility of those dogs escaping from their owners…We would also have problems with the potential for national park areas to be seeded with game animals, that is, seeded with deer, as an example, or feral pigs or piglets in order to provide the capacity for hunters to use those areas. We would also have concerns about the proper disposal of carcasses as a general concern because if the carcasses are left on park, then it further encourages other vermin to remain on park, such as feral pigs, foxes and wild dogs, for example. There may well be a place for the use of licensed hunters in our pest management program, but not as recreational hunters.[446]

Strategies for invasive species management

The importance of cooperation

6.76 The Committee notes that preventing and managing invasive species will require a actions by both public land managers and private land holders. Dr Andreoni told the Committee that effective control regimes would require:

> the coordination of all levels of government and across all land tenure and across the range of activities, whether it is education, on-ground action, enforcement of existing laws or what have you. But the whole element of better coordinating our responses is critical in invasive species.[447]

6.77 Effective invasive species management will also require better cooperation between government agencies and different levels of government. As discussed in paragraph 5.12 above, the Committee heard about how cooperation between the Namoi CMA and local councils on the Weed Tracer Program is leading to more effective weed management within the region.

6.78 The Committee notes that further efforts in agency cooperation and public-private land manager cooperation will be necessary to fight the increasing impacts of invasive species under climate change.

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[444] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, pp. 26-27

[445] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 33

[446] Mr Bob Conroy, Transcript of hearing, 20 August 2009, p. 33

[447] Dr Francesca Andreoni, Transcript of hearing, 22 June 2009, pp. 9-10

Building ecosystem resilience

6.79 As discussed in paragraph 4.43 above, improving the resilience of ecosystems is one of the most critical strategies for protecting biodiversity under the impacts of climate change. The Committee heard that building ecosystem resilience and removing other threats should be a priority strategy to minimise the impacts of invasive species on biodiversity.[448] The Taronga Conservation Society Australia (TSCA) submission stated:

> [M]aintaining species balance and ecosystem health will reduce susceptibility to invasion. For example, maintaining favourable conditions for native species to compete against invasive species may deter invasive species or prevent establishment.[449]

6.80 Mr Noel Kesby, General Manager of the Southern Rivers CMA, further explained the importance of increasing ecosystem resilience:

> Just throwing chemical at weeds is not going to be the answer. It is not the answer now, and it will not be the answer under our climate change regime, but maintaining ground cover, soil moisture and soil health is. So we are now doing a package where we are saying we want to maintain soil health and ground cover, and particularly the harmonisation of native grasses with production species. Actually, that is the best way to be resilient against weeds.[450]

Reintroduction of native animals

6.81 The Committee was particularly interested to hear about innovative invasive management species programs to suppress exotic pest species through the reintroduction of native species.

6.82 The TSCA told the Committee that they are involved with a number of other partners in a project to reintroduce native bush rats to the Sydney Harbour Foreshore as a means of controlling the introduced black rat species. Dr David Slip, a Research Biologist at the TSCA, told the Committee:

> [I]f you have a healthy population of native rats, then the black rat actually has great difficulty in establishing itself… If you have bush remnants and you have a strong population of native rats, the evidence suggests that they can keep the black rats at bay.[451]

6.83 The TSCA submission described what was involved in the project:

> Black rats will be eliminated from large experimental areas which have undergone bush regeneration by our horticultural staff. Bush rats will be introduced and allowed to establish. With the removal of black rats and reintroducing bush rats we hope to establish a ecologically stable habitat; prolong the beneficial effects of habitat restoration efforts and improve the ability of these habitats to repel invasive species. Ongoing vegetative and fauna surveys will determine the effect of restoring a locally native species to an urban area.[452]

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[448] Dr Mark Dangerfield, Transcript of hearing, 4 May 2009, p. 35; BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, pp. 4, 38

[449] Submission 11, TSCA, p. 9

[450] Mr Noel Kesby, Transcript of hearing, 22 June 2009, p. 53

[451] Dr David Slip, Transcript of hearing, 22 June 2009, p. 5

[452] Submission 11, TSCA, p. 9

6.84 The Committee was told that it was vital to the success of reintroduction programs for existing threats to be addressed adequately before native species are reintroduced.[453]

6.85 The Committee looks forward to seeing the result of this program and hopes that it proves to be an effective pest management strategy.

6.86 The Committee finds that reintroduction programs may prove to be a viable and positive invasive species management option. The Committee encourages all natural resource management agencies to consider whether this model can be applied to managing pest species within their areas of responsibility.

RECOMMENDATION 23: All natural resource management agencies consider the use of reintroduction programs in the control of pest species.

Better quarantine measures

6.87 In their response to questions taken on notice at a hearing the then DPI explained:

> The most effective way to manage invasive species is to prevent their initial incursion. Once widely established, the eradication of invasive species across large areas is extremely difficult, if not impossible, to achieve.[454]

6.88 The Committee heard from a number of stakeholders about the importance of preventing new invasive species from entering Australia through enhancing quarantine and biosecurity measures.[455]

6.89 Dr Michael Dunlop, a Research Scientist with the CSIRO, told the Committee:

> A natural response to that might be to try to limit them at the source; that is, let fewer things into the country. It is a concomitant sort of thing. If the risk goes up, presumably it is reasonable to impose a greater barrier to people wishing to bring stuff in, particularly if there is any chance that it may pose a threat.[456]

6.90 The Committee supports the need for robust biosecurity and quarantine measures but notes that these matters lie largely within the responsibility of the Federal Government.

Better taxonomic capacity

6.91 The Committee heard that Australia's taxonomic capacity will be a significant influence on its ability to manage emerging invasive species threats. A Griffith University report on climate change adaptation stated:

> Over recent decades Australia has run down its capability in taxonomy, the identification and classification of organisms. As a result, when a species shows up unexpectedly it can take a long time before it is identified as a new invasive. The longer this period, the smaller the chance that the species can be eradicated and the greater the cost of control.[457]

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[453] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 7

[454] DPI, Response to questions taken on notice at hearing, 4 May 2009, p. 5

[455] Submission 3, Professor Ralf Buckley, p.10; Submission 21, Nature Conservation Council of NSW, p. 2; BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 35

[456] Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 47

[457] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 20

6.92 In light of this current shortfall there have been recommendations for taxonomy to be given increased funding to enhance Australia's capacity to identify new invasive species threats.[458]

6.93 The Committee supports the need for better taxonomy capacity but notes that this issue lies largely within the responsibility of the Federal Government.

[458] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 20; BDAC, *Climate change and invasive species – A review of interactions*, Canberra, 2008, p. 36

Chapter Seven - Managing biodiversity on private land

7.1 The Committee heard that public land alone is not able to provide protection to all ecosystems under the impacts of climate change and that conservation of biodiversity on private land is critical.[459] Dr John Williams, the New South Wales Natural Resources Commissioner, told the Committee:

> When we have something like 89% of land that is managed by private individuals…I think we have to really look at all mechanisms we possibly can, to value that asset, which has a private benefit but it also has a significant public benefit. I think stewardship programs that are coordinated towards delivering a public benefit, that are actually sitting on private land, and are the ecosystem service idea, must have increasing importance in the way we invest in the future.[460]

7.2 Protection of biodiversity on private land involves both voluntary incentive mechanisms landholders can choose to participate in, as well as land-use planning and development restrictions. Both are examined in this chapter.

Conservation incentive schemes

7.3 Incentive schemes for private landholders to conserve biodiversity will be vital for implementing many of the principles outlined in Chapter Four, such as connectivity conservation, improving ecosystem resilience and protecting a diversity of ecosystems. Conservation incentive schemes are used for a variety of conservation activities including:

- retaining undisturbed native vegetation
- fencing livestock out of watercourses and wetlands
- maintaining mature trees as seed sources or as breeding sites for native bird or mammal species
- maintaining mixed-species meadows to conserve particular plant species
- maintaining warren or burrow areas, or areas of rock or dense vegetation to provide refuges for small mammals
- retaining a continuous vegetation canopy across roads and tracks to allow arboreal mammals to cross without descending to the ground
- controlling feral and domestic dogs, cats and other predators.[461]

[459] Submission 3, Professor Ralf Buckley, Attachment C, p. 1; Submission 6, CSIRO, p. 8; Submission 8, Mr Robert Mason, p. 1; Submission 14, EDO, p. 77; Submission 21, Nature Conservation Council of NSW, p. 2; Submission 24, Friends of Narrabeen Lagoon Catchment, p. 3; Submission 26, NRC, p. 4; Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 10; Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 30; Dr John Williams, Transcript of hearing, 22 June 2009, p. 18; Dr Michael Dunlop, Transcript of hearing, 22 June 2009, p. 42

[460] Dr John Williams, Transcript of hearing, 22 June 2009, p. 19

[461] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, pp. 4-5

Principles of incentive schemes

Coordination and planning

7.4 Many different conservation incentive schemes are offered by a range of government and non-government organisations and each operates under a different set of objectives and rules. The Committee heard that these schemes would be more effective if there was better coordination and planning. This would enable targeting of strategic priorities and focussing efforts on areas of greatest benefit.[462] The Environmental Defender's Office submission stated:

> There is likely to be a need to better align conservation objectives and rules under the various schemes so that taken together, the schemes are more likely to result in the overall protection and management of the right areas of private land under climate change.[463]

7.5 The Committee heard a number of principles should be applied to ensure that incentive schemes provide tangible conservation outcomes:

- Schemes should be planned and coordinated so that they focus on areas of highest conservation value.[464]
- Conservation biologists should be used to design the ecological goals of the schemes.[465]
- The organisation operating the scheme should follow up with landholders over time to ensure actions are being undertaken in accordance with the agreement.[466]

Different schemes for different landholders

7.6 The Committee heard that different incentive programs are required to appeal to different types of landholders with different socioeconomic circumstances in different regions.[467] Professor Ralf Buckley, Director and Chair of the International Centre for Ecotourism Research at Griffith University, told the Committee:

> Some of them, as you say, are tree changers—they have external sources of income—and some of them are long-term farming families and they rely entirely on that land. Those two groups of people need different incentives to put their land into conservation.[468]

7.7 On the visit of inspection to the Bredbo region a delegation of the Committee learnt that having a range of incentive schemes available to landholders introduces land owners to conservation programs relevant to their own level of environmental interest or experience. The Committee heard that some incentive schemes impose a low level of obligation on land owners, making them ideal for those who are new to conservation. Other incentive schemes have legally binding in perpetuity

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462 Submission 14, EDO, p. 77; Submission 26, NRC, p. 4

463 Submission 14, EDO, p. 77

464 Submission 14, EDO, p. 75; R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

465 R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

466 Submission 12, Namoi CMA, p. 6

467 Mr Noel Kesby, Transcript of hearing, 22 June 2009, p. 56; R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

468 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 31

commitments and are more likely to be taken up by land owners who are already environmentally minded.

7.8 A range of schemes is also important because different regions have different conservation priorities and values and incentive schemes should be designed to reflect the different management needs of particular regions.[469]

7.9 The Committee finds that maintaining a range of incentive schemes is useful as it allows all landholders, regardless of their level of environmental knowledge or commitment, to participate and benefit from an incentive scheme of most relevance to their biodiversity management and conservation issues.

Financial incentives

7.10 The Committee heard that it is important for conservation incentive schemes to include financial incentives.[470] Mr Noel Kesby, General Manager of the Southern Rivers Catchment Management Authority (CMA), told the Committee:

> There is a groundswell of a lot of genuine farmers that would grasp climate change remediation work if it were packaged up and funded and if it was taken on farm and shown how it is applied on ground. It actually can help them make money as well as have conservation value.[471]

7.11 There are a variety of financial incentives attached to different incentive schemes, including:

- tax concessions for capital losses and/or ongoing operational costs
- direct grants or subsidies based on predefined rules for particular conservation actions
- negotiated payments for conservation easements on significant areas of land
- tender systems where different landholders can bid competing amounts as the price of adopting conservation management practices
- hybrid schemes.[472]

7.12 New South Wales has also introduced the BioBanking scheme whereby conservation of biodiversity on private property is funded by developers as an offset for the impacts of development elsewhere.[473] The BioBanking scheme is discussed further in paragraph 7.84 below.

7.13 The Committee also heard about the importance of linking incentive schemes to the income tax system. Professor Buckley told the Committee:

> One of the most fundamental measures in any broad-scale program for conservation on private land will be the recognition of conservation management as a legitimate land

[469] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

[470] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 18

[471] Mr Noel Kesby, Transcript of hearing, 22 June 2009, pp. 55-56

[472] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

[473] Submission 14, EDO, p. 76

> use for taxation purposes, with full deductibility of ongoing conservation management expenses against any other source of income.[474]

Legal protection

7.14 To ensure ongoing protection of biodiversity on private land, legal covenants or easements should be attached to the areas being conserved.[475] Depending on the type of incentive program or agreement, legal protection may restrict the use of land, impose obligations to manage the land for conservation or require the preparation of a management plan.[476] The degree of legal protection varies greatly between programs, varying from in perpetuity obligations to no formal legal obligations or restrictions.

Reward behaviour beyond basic requirements

7.15 The Committee heard that if conservation incentive schemes are to be effective, they should only reward conservation management behaviour that is beyond basic legal and agricultural requirements.[477] The Committee was advised that some incentive schemes reward landholders for ceasing to breach laws which require them to remove noxious weeds, prevent pollution of surface waters or protect endangered species.[478] Other schemes provide incentives to landholders for measures that are aimed at increasing agricultural production such as: establishing dams to impound surface runoff; controlling weeds; planting windbreaks, shade trees or hedgegrows; or controlling erosion.[479] A publication by Professor Buckley stated:

> Stewardship and incentive programs, nominally established specifically to promote conservation and enhance connectivity, have largely been ineffective because they have been operated as disguised subsidies for political ends.[480]

7.16 The Committee notes that it is critical to ensure that incentive schemes do in fact contribute to conservation and are not subsidies for complying with land-use regulations.[481]

Conclusion

7.17 The Committee finds that it is critical for natural resource management agencies to offer a range of incentive schemes to appeal to different types of landholders. Additionally, the Committee recognises the importance of having regionally-based staff associated with these schemes to liaise with landholders and encourage uptake of incentive schemes.

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[474] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 18

[475] R Buckley (ed), *Climate response: Issues, costs and liabilities in adapting to climate change in Australia*, Griffith University, Gold Coast & Brisbane, 2007, p. 17

[476] Submission 14, EDO, p. 75

[477] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, pp. 4-5

[478] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 4

[479] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 4

[480] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 6

[481] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

RECOMMENDATION 24: All natural resource management agencies continue to offer a range of conservation incentive schemes to ensure there are schemes available for all landholders regardless of their level of environmental knowledge or commitment.

RECOMMENDATION 25: All natural resource management recognise the importance of regionally-based staff to liaise with landholders and encourage uptake of the schemes.

Current conservation incentive schemes

Conservation Agreements

7.18 As discussed in paragraph 3.16 above, the *National Parks and Wildlife Act 1974* (NPW Act) includes provisions for the creation of a Conservation Agreements, voluntary commitments by landholders to protect and conserve areas of their land that have significant conservation value. They are in perpetuity agreements. Once entered into and registered on the land title, they are binding on all current and successive landholders.[482] As of 30 June 2009, there are 257 Conservation Agreements in New South Wales covering an area of 52,729 hectares.[483]

7.19 Under the NPW Act, a Conservation Agreement can be entered in to for areas that contain:

- scenery, natural environments or natural phenomena worthy of preservation
- places of special scientific interest
- sites of buildings, objects, monuments or events of national significance
- Aboriginal objects or places of special significance.[484]

7.20 The Committee understands that Conservation Agreements provide a range of benefits to landholders including:

- eligibility for funding and grants from state and federal governments and non-government organisations
- exemption from local government rates
- exemption from land tax
- tax deductibility of any decrease in land value
- protection of native plants and animals from unauthorised public access.[485]

7.21 In addition, the Department of Environment, Climate Change and Water (DECCW) provides ongoing support for landholders including:

- property management planning advice
- biodiversity surveying and assessment assistance
- information and practical advice about conservation management strategies

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[482] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 9

[483] DECCW, *Statistics about the Conservation Partnerships Program*, viewed 16 November 2009, <http://www.environment.nsw.gov.au/cpp/ConservationPartnersStatistics.htm>

[484] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 9

[485] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, pp. 12-13

- links and contacts with like-minded people
- notes and news on particular management issues and ecology
- signs
- access to education programs and activities
- assistance programs to support implementation of management plans.[486]

7.22 On the visit of inspection to the Bredbo region, a delegation of the Committee visited a property, 'Black Ridge', which has one of the longest standing and largest Conservation Agreements. The delegation heard that the Conservation Agreement was established in 1997 and protects 1,905 hectares. The delegation had the opportunity to meet with two of the landholders, Mr Dierk and Mrs Rosemary von Behrens, and inspect some recent conservation and rehabilitation works that had been undertaken with the assistance of a DECCW grant.

7.23 The delegation was impressed with the longstanding personal commitment and dedication displayed by the landholders to protect the biodiversity values on the property. The Committee commends the landholders for their efforts and their contribution to conservation in New South Wales.

7.24 At its hearing on 4 May 2009, DECCW advised the Committee that Conservation Agreements were part of the Conservation Partnerships Program which is an ongoing program with funding into the future.[487]

7.25 As discussed in paragraph 5.19 above, the Committee notes the value of having dedicated regionally-based National Parks and Wildlife Service staff working with their local landholders to develop Conservation Agreements. The Committee finds that this is a successful model that should be applied more broadly across DECCW to encourage the uptake of Conservation Agreements.

RECOMMENDATION 26: The Department of Environment, Climate Change and Water expands the practice of having dedicated regionally-based officers working with landholders to encourage the uptake of Conservation Agreements.

Wildlife Refuges

7.26 As discussed in paragraph 3.17 above, the NPW Act provides for the creation of Wildlife Refuges, voluntary commitments by landholders to protect and conserve native wildlife and its habitat. The Wildlife Refuge status is noted on the land title and stays in place for current and future owners unless the landholders requests that it be amended or revoked.[488] As of 30 June 2009, there are 650 wildlife refuges in New South Wales covering more than 1.9 million hectares.[489]

7.27 A Wildlife Refuge can have a variety of land uses including:

- natural habitats such as native vegetation, watercourses and wetlands

[486] DECCW, *Conservation Agreements*, viewed 16 November 2009, <http://www.environment.nsw.gov.au/cpp/ConservationAgreements.htm>

[487] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3

[488] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 24

[489] DECCW, *Statistics about the Conservation Partnerships Program*, viewed 16 November 2009, <http://www.environment.nsw.gov.au/cpp/ConservationPartnersStatistics.htm>

- simulated habitats, such as farm dams and revegetation areas
- parcels of land where the principle use is business-based such as grazing, woodlots and nature tourism
- areas that have special features, including cultural heritage, fossil beds and unusual landforms
- areas where threatened species occur, or where threatened fauna use the areas for feeding or breeding
- areas used by migratory birds.[490]

7.28 One of the benefits of Wildlife Refuges is that they allow multiple use of land, that is, they allow continuing agricultural production, industrial use, utility use or tourism, while also protecting wildlife habitats.[491]

7.29 Landholders receive ongoing support from DECCW including:

- property management planning advice
- biodiversity surveying and assessment assistance
- information about wildlife management
- information about the role of wildlife and native vegetation in sustainable agriculture to control pest species, provide shade and shelter, manage salinity and control wind and water erosion
- links and contacts with like-minded people
- notes and news on particular management issues and ecology
- signs for landholders who have properties registered with the scheme
- access to education programs and activities
- assistance programs to support implementation of management plans.[492]

7.30 Wildlife Refuges are part of DECCW's Conservation Partnerships Program, which the Committee was advised in an ongoing program being funded into the future.[493]

Catchment Management Authorities

7.31 The Committee understands that CMAs across New South Wales offer a wide range of incentive schemes. Mr Kesby told the Committee:

> We also have biodiversity incentives, where we invest on-farm on private land for native vegetation conservation, or native vegetation management, which again includes native grasses. We have a suite of products around conservation of native vegetation on-farm. Our third area of extensive incentive programs is a riparian area. We are managing riparian areas to a more sustainable level, which includes buffering and fencing, and providing alternative water supplies and enhancing vegetation.[494]

[490] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 26
[491] DECC, *Conservation partnerships: A guide for landowners*, Sydney, 2009, p. 24
[492] DECCW, *Wildlife Refuges*, viewed 16 November 2009, <http://www.environment.nsw.gov.au/cpp/WildlifeRefuges.htm>
[493] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3
[494] Mr Noel Kesby, Transcript of hearing, 22 June 2009, p. 53

7.32 The Committee understands that many of these incentive schemes place fewer obligations on landholders than more formal schemes such as Conservation Agreements. The Namoi CMA's submission informed the Committee that:

> On-ground projects include a range of conservation incentive programs targeting private land managers with high conservation value assets, as identified via the development of the Namoi Conservation Strategy. These are based on 10 year contract agreements with a higher standard of conservation management required than in many similar State and Australian Government programs. Whilst there is no guarantee of long term security of tenure on title with these projects as with most other incentive-based programs, landholders involved are provided ongoing support by Namoi CMA staff and thus become better and more committed conservation managers as a result.[495]

7.33 The Committee also heard that CMAs often incorporate capacity building into their incentive schemes. Mr Michael Muston, Deputy Chair of the Southern Rivers CMA, told the Committee:

> [I]n terms of our capacity building we will not invest unless the farmer has done a recognised farm management course. They need to have the training and the capacity and demonstrate that they have actually got the capacity before we will invest so that we are not throwing good money after bad.[496]

Whole of Paddock Rehabilitation

7.34 The Committee heard about the work of Greening Australia, a non-profit organisation. Greening Australia's latest conservation incentive scheme is called Whole of Paddock Rehabilitation (WOPR). The program provides incentives for large-scale native revegetation through a fixed-term stewardship payment, to assist landholders better address climate change impacts, biodiversity loss, paddock tree decline, salinity and other land degradation issues.[497]

7.35 Mr Graham Fifield, Project Manager for Greening Australia, explained the program to the Committee:

> [T]he program involves mechanically direct-seeding a broad range of native trees and shrubs in a series of parallel bands across the paddock. Each band is done on the contour and consists of four rows. We then leave a forty to fifty metre gap to allow for pasture between each band of vegetation. Livestock are excluded from the paddock for five years, during which the landholder is compensated for the loss of production with a $50 per hectare per year stewardship payment, and at the end of five years, once the trees and shrubs are large enough, the grazing animals can be reintroduced.[498]

7.36 The Committee heard that WOPR provides both conservation and production benefits. Conservation benefits include: reduced saline discharges; improved soil health through better infiltration and higher organic carbon; and increased biodiversity, particularly in the abundance of birdlife.[499]

7.37 Mr Fifield also explained the production benefits for farmers:

> [O]ne of the most attractive aspects of this program is the ability to rest a degraded paddock for a five-year period to allow the native grasses to set seed and to treat the cause of production issues such as erosion and salinity. The shade and shelter created for livestock is particularly important for vulnerable livestock such as new lambs and off-

[495] Submission 12, Namoi CMA, pp. 7-8

[496] Mr Michael Muston, Transcript of hearing, 22 June 2009, p. 54

[497] Greening Australia, *Whole of Paddock Rehabilitation (WOPR)*, ACT, 2009, p. 1

[498] Mr Graham Fifield, Transcript of hearing, 20 August 2009, p. 16

[499] Mr Graham Fifield, Transcript of hearing, 20 August 2009, p. 16

> shear sheep, and the shade and shelter aspect will become increasingly important as climate conditions are expected to become more erratic with, potentially, hotter and drier summers.[500]

7.38 The programs involves a stewardship payment to landholders of $50 per hectare per year. Ms Sue Streatfield, Business Development Manager at Greening Australia, explained to the Committee:

> The stewardship payment is for the first five years. The agreement then states that there will be rotational grazing for the following five years. Essentially, Greening Australia enters into a handshake agreement with a farmer. The payments are delivered in the first and fourth years to ensure that no grazing is undertaken during that time; otherwise they do not get their final payment.[501]

7.39 Ms Streatfield explained to the Committee the importance of the stewardship payment:

> I think the stewardship payment is like recognition to farmers that we understand they are running a production enterprise and it is really just partly compensating them for loss of production. The program is recognising that they are running a business and they are going to lose productivity. It is not a lot of money, it is almost a symbolic thing, but farmers respond to it because we are recognising that they are running a business. It is only $50 a hectare a year, it is probably a quarter of what some of them actually lose. It is almost symbolic.[502]

7.40 Mr Fifield explained to the Committee that WOPR was invented by farmers to address paddock scale problems on farms. The Program was piloted in the Lachlan catchment, with the assistance of the Lachlan CMA, with 14 farmers and was very popular with landholders. Mr Fifield informed that Greening Australia has a waiting list of nearly 40 additional farmers who are keen to become involved.[503]

7.41 The Committee understands that widespread implementation of WOPR is currently limited by the lack of available funding. Mr Fifield told the Committee:

> Except for a small amount of funding through the Department of Environment and Climate Change through the Kosciuszko to Coast program, currently Whole of Paddock is largely unfunded across the region. Considering that it is approximately one-third of the price of the traditional windbreak model, I think it represents a fantastic return on investment for funding bodies. At $550 per hectare it is the most efficient model that Greening Australia has been able to come up with in its twenty-five year history.[504]

7.42 The Committee notes that WOPR is a popular scheme that provides both environmental and production benefits. The Committee believes it would be highly beneficial for WOPR to be implemented more broadly.

RECOMMENDATION 27: The Department of Industry and Investment and the Department of Environment, Climate Change and Water consider providing funding for the wide spread implementation of the Whole of Paddock Rehabilitation initiative.

[500] Mr Graham Fifield, Transcript of hearing, 20 August 2009, p. 17
[501] Ms Sue Streatfield, Transcript of hearing, 20 August 2009, pp. 17-18
[502] Ms Sue Streatfield, Transcript of hearing, 20 August 2009, pp. 20-21
[503] Mr Graham Fifield, Transcript of hearing, 20 August 2009, p. 17
[504] Mr Graham Fifield, Transcript of hearing, 20 August 2009, p. 17

Great Eastern Ranges initiative

7.43 The Committee learnt that the Great Eastern Ranges (GER) initiative is a plan to establish a conservation corridor along the great eastern ranges of Australian from the Alps to Atherton. Mr Tom Grosskopf, Director of Landscapes and Ecosystem Conservation for the then Department of Environment and Climate Change (DECC), explained to the Committee the scale of the initiative:

> On a national scale the Great Eastern Ranges runs from the Victorian Alps through to the Atherton Tablelands. The part of the program that we support runs from the Victorian border, from the alpine areas, right up to the Queensland border in the Border Ranges National Park The area of the Great Eastern Ranges runs from the escarpment, that is, the sharp-changing landform from the coastal plain, through to the Divide, which is the change in the watershed. At some points in New South Wales they are somewhat physically separated. In the Illawarra the escarpment is just behind the plain but the watershed is out in the Blue Mountains. At that point it is quite wide but at other points the escarpments are in the same place.[505]

7.44 The initiative is based on the principle of connectivity conservation (discussed in paragraph 4.47 above) and seeks to prevent native species from becoming extinct and protect water supplies in the face of climate change impacts.[506] Dr Graeme Worboys, Vice Chair of Mountains and Connectivity for the International Union for the Conservation of Nature's World Commission on Protected Areas, explained to the Committee:

> [T]he Great Eastern Ranges have a special role, because that concentration of species is located where the GER is. That connectivity will help keep those species extant. The other special point about the GER is that most of the water catchments for every town on the east coast is within the GER—the vision of an urban stream with its black water, or brown water, versus a crystal-clear mountain stream that you are willing to drink the water out of.[507]

7.45 The aim of the GER corridor is to:

- maintain and improve the landscape in a way that provides for the movement of native species as environmental conditions alter because of climate change and other pressures such as population growth
- improve connectivity of habitats between existing core conservation areas
- invest in and exchange information and knowledge with the community
- foster partnerships to maximise the benefits of conservation programs by a range of organisation.[508]

7.46 The GER initiative also provides a strategic framework for investment in conservation incentive schemes. Dr Worboys told the Committee:

> The GER is a strategic response. Instead of dispersed activity and investment in properties it enables us to say we have a focus here and we would like to play our role in a national response to keeping the Alps to Atherton intact.[509]

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[505] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 4

[506] DECC, *Conserving the great eastern ranges from the Australian Alps to Atherton and beyond*, Sydney, 2008, p. 2

[507] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 15

[508] DECC, *Conserving the great eastern ranges from the Australian Alps to Atherton and beyond*, Sydney, 2008, p. 3

[509] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 16

7.47 Within New South Wales, five priority project areas have been identified as the initial focus for efforts in creating the corridor: Slopes to Summit (the area running west from Kosciuszko National Park towards Albury); Kosciuszko to Coast (the area running east from Kosciuszko National Park); Morton to Nattai Southern Highlands Link (the area of the Southern Highlands between Morton National Park and Nattai National Park); Upper Hunter – Barrington Tops (the area around the Hunter Valley); and Border Ranges (the area around the Border Ranges National Park). These areas were chosen because of their biodiversity richness and low representation within the reserve network.[510]

7.48 On the visit of inspection to the Bredbo region, a delegation of the Committee heard about the work being undertaken in the key project areas. Each of the project areas focuses on assisting local landholders to conserve biodiversity on their property by providing education and training (such as field training days, species identification courses and access to local ecological experts) and linking them with a range of conservation incentive schemes, from government and non-government organisations, to manage threats to biodiversity, improve ecosystem resilience and restore degraded lands.

7.49 The delegation of the Committee was particularly interested to hear about the work being undertaken by the Kosciuszko to Coast (K2C) project. The delegation heard that the K2C project employs a facilitator who meets with local landholders and discusses which conservation incentive schemes are most applicable to their needs. Within the K2C project there are twenty different incentive schemes available for landholders to participate in from thirteen different government and non-government organisations.

7.50 The delegation of the Committee also met with a local landholder who had been involved in the K2C project, Ms Sue Connelly. Ms Connelly explained how much she had learned about native flora and fauna since becoming part of the K2C project. Ms Connelly told the delegation that she particularly valued how the project involved a number of partners offering different incentive schemes because this enabled her to participate in the scheme which best suited her situation.

7.51 The Committee heard concerns from Dr Worboys about the future of the funding of the GER initiative:

> My point is that in 2010 that investment finishes. It is too important at an international responsibility level, let alone a national responsibility level, let alone a New South Wales responsibility level, to let that go.[511]

7.52 At its 20 August 2009 the Committee heard about the future of funding for the GER initiative:

> It is funded by the New South Wales Environmental Trust and it is funded for a four-year program. No decision has been made on what happens to the program after that funding expires. That will be something that the Minister will review when we evaluate what has been achieved towards the end of the program and she will consider what happens after that.[512]

7.53 The Committee notes the significant community support for the GER initiative. The Committee finds that the initiative is an excellent example of a conservation

[510] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 5

[511] Dr Graeme Worboys, Transcript of hearing, 4 May 2009, p. 16

[512] Mr Simon Smith, Transcript of hearing, 20 August 2009, p. 42

incentives scheme with a strategic, coordinated framework. In particular, the Committee notes that the GER initiative provides local landholders with a range of incentive schemes and allows them to participate in the scheme most suitable for their situation and involves cooperation across government agencies and non-government agencies.

RECOMMENDATION 28: The Department of Environment, Climate Change and Water continues funding for the Great Eastern Ranges initiative beyond its current funding cycle.

Barriers to the uptake of incentive schemes

7.54 The Committee heard that the lack of tax deductibility for ongoing conservation management expenses was a major disincentive for participation in conservation incentives.[513] At the hearing on 20 August 2009, Professor Buckley told the Committee:

> The other thing is that if you are a private landowner you do not really take anything seriously unless it is part of the income tax system, and unless the ongoing costs of conservation management are treated as a tax-deductible expense then people will not move in a large way towards private conservation.[514]

7.55 A publication by Professor Buckley highlighted the implications of linking conservation incentive schemes to the tax system:

> In the USA, for example, land trusts effectively allow wealthy individuals to offset conservation management costs against other income. In Australia, in contrast, whilst there is a weak provision for tax deductibility of capital losses if land is brought under a conservation agreement, ongoing operational costs of conservation management cannot be offset against other sources of income. Private conservation management is therefore much less common in Australia than the USA.[515]

7.56 The Committee understands that there are currently limited provisions within the income tax system which would provide incentives for landholders. Under the current system, landholders can claim the depreciation of land covered by a Conservation Agreement but must pay for two successive valuations and have no guarantee that the deduction will continue to be allowed by the Australian Tax Office.[516] However, there are currently no provisions for ongoing expenditure on conservation works to be claimed as tax deductions meaning landholders gain no tax benefit from the money they put into conservation activities each year.[517]

7.57 Professor Buckley recommended that to address this barrier, conservation should be recognised as a legitimate land use category for private land and that all conservation related land management expenditure on conservation land should be fully tax deductible for income tax purposes.[518] Professor Buckley explained to the Committee how this could be accommodated within the income tax provisions:

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513 Submission 3, Professor Ralf Buckley, p. 8; Submission 3, Professor Ralf Buckley, Attachment C, p. 1; Submission 14, EDO, p. 77

514 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 24

515 R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 2

516 Submission 3, Professor Ralf Buckley, p. 8

517 Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 31

518 Submission 3, Professor Ralf Buckley, p. 13; Submission 3, Professor Ralf Buckley, Attachment C, p. 1

> I originally made these proposals to the previous Federal Government in my former role on the Biological Diversity Advisory Committee, a Federal committee advising the Federal Minister, and received a response from the Treasurer at the time saying that nothing was tax deductible unless there was an income for it to be deductible against, which is the issue raised. However, if we acknowledge that conservation management can generate income either through government incentive schemes, through opportunities for tourism or by increasing the value of land for re-sale, then in the longer-term sense—even if conservation does not generate cash in a particular year—it seems to me that it is not a fundamental breach of tax principles that the management costs of that should become a deductible expense.[519]

7.58 The Committee also heard that the uptake of incentive schemes is limited by requirement of some schemes to protect land of high biodiversity value in perpetuity.[520] The EDO submission explained the challenges this creates:

> In this regard, a tension exists between designing schemes that provide greater protection to biodiversity (e.g. binding agreements that are difficult to revoke) and more flexible schemes that encourage greater uptake (e.g. non-binding agreements that are easy to revoke).[521]

7.59 On the visit of inspection to the Bredbo region, a delegation of the Committee was told by DECCW staff that in perpetuity agreements on some incentive schemes, such as Conservation Agreements, provided a low risk investment for government funds as there was a greater assurance that the conservation benefits from the grants and incentives would be lasting.

7.60 The EDO also told the Committee that many landholders are deterred by incentive schemes that take too long to negotiate. Mr Jeff Smith, Director of the EDO, told the Committee:

> [F]or people who want to engage in private conservation there is a degree of frustration. If they want to do a voluntary conservation agreement, it takes a long time. You need a certain amount of personal will and dedication to make it happen. At a policy level it should happen a lot more easily than that. There should be enough bells and whistles in the system to encourage farmers to go down that path if that is what the Government wants to happen. There is an enormous degree of frustration about how bureaucratic that process is and how long it takes.[522]

7.61 The Committee heard that barriers such as these may be resulting in landholders hesitating in participating in an incentive scheme. The EDO submission advised:

> [M]any landholders appear to be adopting a 'wait and see' approach. A number of new schemes have recently been developed (e.g. BioBanking) and governments are now paying significant attention to providing incentives for sustainable land management. However, if landholders commit too early, they risk being locked into a scheme which may not be as financially beneficial as others. This is a significant problem for governments, which needs to be addressed if private land conservation schemes are to be effective.[523]

7.62 In light of this hesitance, the EDO have suggested that flexible incentive schemes, such as Wildlife Refuges, will be especially important in the short term. The EDO submission stated:

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[519] Professor Ralf Buckley, Transcript of hearing, 22 June 2009, p. 31

[520] Submission 14, EDO, p. 76

[521] Submission 14, EDO, p. 76

[522] Mr Jeff Smith, Transcript of hearing, 4 May 2009, p. 31

[523] Submission 14, EDO, p. 77

> Such schemes may address the concerns of the 'wait and see' landholders, who are interested in conservation but are reluctant to commit to a binding scheme that forecloses the opportunity to participate in more financially beneficial schemes in the future.[524]

7.63 To achieve the greatest uptake of incentive schemes, Professor Buckley recommends that landholders design the practicalities of scheme implementation.[525] While it is critical that ecological goals are in line with broader conservation priorities, as discussed in paragraph 7.4 above, landholders are the ones best placed to understand the costs, benefits and tradeoffs in conservation management and which schemes will appeal to landholders.[526]

7.64 The Natural Resources Advisory Council (NRAC) submission notes that some government regulation, taxation and public authority pricing schemes may create unintended disincentives for biodiversity conservation.[527] The NRAC submission recommended action to:

> Systematically eliminate all policy and pricing disincentives for biodiversity restoration and conservation on private land and provide targeted incentives where possible[.][528]

7.65 In order to address these disincentives, NRAC has suggested:

> that systematic research and policy analysis is required to clarify the nature and extent of current disincentives and to evaluate the incentives and policies that should be put in place to encourage biodiversity conservation on private land.[529]

7.66 The Committee notes that there are a number of barriers to the uptake of conservation incentive programs that need to be addressed. In particular, the Committee notes that negotiations should take place with the Federal Government for better tax deductibility of conservation works under an approved conservation incentive scheme. Additionally, the Committee believes that landholders who become involved with a current incentive scheme should not be disadvantaged by future schemes offering better incentives.

RECOMMENDATION 29: The Department of Environment, Climate Change and Water negotiates with the Federal Government for better tax incentives for conservation works.

RECOMMENDATION 30: All natural resource managers ensure that landholders who have are already involved with a conservation incentive scheme are not disadvantaged by better incentives attached to new agreements and that any new benefits are retrospectively applied to those with existing agreements.

[524] Submission 14, EDO, p. 78

[525] R Buckley, 'World wild web: Funding connectivity conservation under climate change', *Biodiversity*, vol 9, no. 3&4, p. 5

[526] Submission 3, Professor Ralf Buckley, Attachment D, p. 2

[527] NRAC, Response to questions taken on notice at hearing, 4 May 2009, p. 1

[528] Submission 19, NRAC, p. 3

[529] NRAC, Response to questions taken on notice at hearing, 4 May 2009, p. 1

Land-use planning

7.67 The Committee notes that land-use planning is already subject to intense social, economic and environmental pressures, particularly in urban areas. These pressures are likely to increase when planners take into consideration the possible impacts of climate change.

7.68 Land-use planning on private land is subject to a number of State and local planning tools and instruments to ensure that attention is given to biodiversity conservation. The Committee received a number of submissions from councils and other organisations that commented on the current planning instruments and how it affected their strategies for preserving biodiversity.[530] While most recognised the importance and necessity of the planning strategies, some felt that they were not being implemented or utilised as well as they could be.

7.69 The EDO submission advocated that land-use plans should have an overall legislative requirement that they protect biodiversity adequately including under climate change.[531] They also highlighted the importance of the planning framework incorporating key biodiversity management principles such as promoting connectivity, re-evaluating principles and goals and moving from protecting sites to protecting landscapes.[532]

Regional Strategies

7.70 The Committee notes that from 2006 on, the Department of Planning has released a series of regional strategies designed to provide planning support for key growth areas across the State. Regional strategies have been prepared for Lower Hunter, Far North Coast, Illawarra, South Coast, Central Coast, Sydney-Canberra and Mid North Coast.[533]

7.71 Ms Donna Rygate, Executive Director of Corporate Governance and Policy within the Department of Planning, highlighted how regional strategies had addressed the impacts of climate change on preserving and enhancing biodiversity at a regional scale:

> The regional strategies can address biodiversity priorities through a number of mechanisms, including the identification and protection of regionally significant and wildlife and habitat areas or by encouraging retention of native vegetation. Of particular relevance to the subject matter of this inquiry are the areas identified in those regional strategies to provide protection for resident flora and fauna whilst also allowing for the movement and migration of species along wildlife corridors. Regional strategies can also be used to identify key areas to encourage the restoration of fragmented habitats to improve ecosystem connectivity, which will become increasingly important as the effects of climate change place further pressure on already disconnected ecosystems. Those regional strategies recognise that long-term planning decisions must place a high value on development options that make more sustainable use of land and resources and respond to risks associated with climate change.[534]

[530] Submission 15, Hunter Councils, p. 2; Submission 20, MACROC, p. 4; Submission 25, SHOROC, pp. 3-4

[531] Submission 14, EDO, p. 64

[532] Submission 14, EDO, p. 63; Mr Tom Holden, Transcript of hearing, 4 May 2009, p. 25

[533] Department of Planning, *New South Wales regional strategy update report*, Sydney, 2009, pp. 2-45

[534] Ms Donna Rygate, Transcript of hearing, 20 August 2009, pp. 10-11

7.72 The Committee notes that the regional strategies have designed to interact with other State Government planning policy documents and that they are ongoing documents which respond to changing circumstances.

Local environmental plan template

7.73 As discussed in paragraph 3.19 above, the *Environmental Planning and Assessment Act 1979* (EP&A Act) controls planning in New South Wales and gives legislative force to State local environmental plans (LEPs). The Committee was advised that the Department of Planning has created a common structure and language for LEPs, commonly known as the LEP template, to create a more efficient planning system and increase the level of consistency between each local government area.[535]

7.74 Some submissions from councils expressed concern that the LEP template was not flexible enough and did not allow them to factor in biodiversity and climate change specific to their local areas.

7.75 The Shore Regional Organisation of Councils (SHOROC) commented in their submission that they felt the LEP template was too rigid, stating that it:

> places significant restrictions on Councils that prevents their use of zoning as a tool to protect areas that may be important for the protection of biodiversity such as parts of bushland or a habitat corridor, For example pockets parks and school playgrounds are not able to be zoned for environmental protection regardless of the strategic location of these, or their importance as refuge for local populations of wildlife under pressure from urbanisation.[536]

7.76 The submission by the Hunter Councils stated:

> In regard to the standard LEP template in particular, there appears to be inadequate consideration of climate change in relation to biodiversity. Because LEPs provide a primary mechanism through which councils can regulate land use planning activities to achieve biodiversity outcomes, it is recommended that greater capacity be included within the template to enable councils to proactively plan for this purpose. This could potentially be achieved through the inclusion of appropriate objectives within specific zones and through the use of appropriate constraints mapping to identify areas important for long term biodiversity conservation (e.g. climate change refugia).[537]

7.77 In response to questions taken on notice, the Department of Planning advised the Committee that this was not an accurate assessment, stating:

> For land in the coastal zone, councils drafting their principal LEPs in accordance with the Standard Instrument template, must adopt the clause for "Development within the coastal zone" (5.5) to "protect, enhance, maintain and restore the coastal environment, its associated ecosystems, ecological processes and biological diversity…". The clause also requires councils not to grant consent unless the effect of coastal processes, coastal hazards and potential impacts, including sea level rise have been considered. Councils may give effect to climate change adaptation strategies through inclusion of an additional local objective with the zone, use of an environmental protection zone, where appropriate, or controls through an additional local provision for natural resource management. The Regional Strategies require local environmental plans to protect regionally significant habitat corridors and to protect and zone land with environmental, vegetation and habitat values where these have been identified in the strategy.[538]

[535] Ms Yolande Stone, Transcript of hearing, 20 August 2009, p. 12

[536] Submission 25, SHOROC, p. 3

[537] Submission 15, Hunter Councils, p. 4

[538] Department of Planning, Response to questions taken on notice at hearing, 20 August 2009, p.5

7.78 At the 20 August 2009 hearing, Ms Rygate explained to the Committee that the LEP template contained enough flexibility to meet local demands and furthermore it was being reviewed annually.[539] Additionally, Ms Yolande Stone, Director of Policy, Planning Systems and Reform at the Department of Planning, explained that the Department was working to develop a suite of optional clauses that similar types of councils could adapt to meet their needs.[540]

7.79 The Committee notes that the Department of Planning is working to address the particular concerns of councils in implementing the LEP template.

Regulating development impacts on biodiversity in urban areas

7.80 There are three key mechanisms to regulate the impacts of an action, development or activity (henceforth referred to collectively as 'development') on biodiversity in New South Wales which come from the EP&A Act and *Threatened Species Conservation Act 1995* (TSC Act). These are:

- assessment of significance (EP&A Act, s5A)
- species impact statement (EP&A Act, Part 6, Division 2)
- BioBanking scheme (TSC Act, Part 7A).[541]

Assessment of significance and species impact statement

7.81 The impacts of a development on threatened species, populations or ecological communities (referred to collectively henceforth as threatened species) are assessed through an assessment of significance (AOS). It is commonly known as the seven-part test as there are seven factors considered in determining whether a development is likely to have a significant impact on threatened species.[542] Some of the factors that an AOS must consider are whether a development will place a risk of extinction, the importance of the habitat, and whether the development is consistent with the objectives of a recovery plan or threat abatement plan.[543]

7.82 If it is considered that the development will have a significant impact on a threatened species or is on land that contains critical habitat, then a species impact statement (SIS) is required. An SIS is a more in depth assessment of the impacts on threatened species and is prepared in accordance with the Part 6, Division 2 of the TSC Act.[544]

7.83 The EDO submission raised concerns that both the AOS and SIS processes are failing to protect biodiversity in urban areas in New South Wales.[545] The EDO has identified a number of factors which it believes are causing the processes to fail:

- A lack of information about the existing state of the environment makes it difficult to assess a 'significant impact'.
- Assessments are often inadequate and inconsistent which means that decision makers have incomplete information on the biodiversity to be impacted.

[539] Ms Donna Rygate, Transcript of hearing, 20 August 2009, p. 10
[540] Ms Yolande Stone, Transcript of hearing, 20 August 2009, p. 12
[541] Submission 14, EDO, p. 69
[542] DECC, *Threatened species assessment guidelines: The assessment of significance*, Sydney, 2007, p. 1
[543] Submission 14, EDO, p. 70
[544] D Farrier & P Stein (Eds), *The environmental law handbook: Planning and land use in NSW*, University of New South Wales Press, Sydney, 2006, p. 245
[545] Submission 14, EDO, p. 71

- Accurate evaluation is often hindered by a lack of adequate monitoring.
- The current process does not have the ability to adequately consider cumulative impacts of developments.
- Decision makers have wide discretion in approving developments and are often reluctant to refuse developments on the grounds of biodiversity impacts.[546]

BioBanking

7.84 The Biodiversity Banking and Offsets Scheme (BioBanking Scheme) is a market based mechanism to provide funding for conservation actions from development actions. [547] It was created in 2008 through amendments to the TSC Act. It provides a voluntary alternative to the AOS and SIS route.

7.85 The BioBanking Scheme establishes an 'improve or maintain' test which measures the impacts of development on biodiversity values. A development must improve or maintain biodiversity values if impacts on other areas are counter-balanced (by purchasing and retiring credits) and if 'red flag' areas (areas important for biodiversity conservation that cannot be easily replaced) are avoided.[548]

7.86 Mr Grosskopf explained the rules about offsetting credits:

> The scheme has a very clear set of rules about what offsets are available and how you would offset, and the scheme is based on a like-for-like or better principle. The short answer is, yes; it is like for like. The scheme has two types of credits available: one is an ecosystems credit and the other one is a species credit. Ecosystem credits are where we can predict a species presence by the habitat, and koalas are a very good example of that. If you do not have the right kind of habitat trees, you do not have koalas. That is just a fairly simple example. But then there are some species that are not well predicted by habitat, and they are unique to find a species credit to match. The trading rules are based on a like-for-like principle. There is some flexibility because we use ecosystems as the way that we identify the presence of all of the species. That can then be traded across boundaries. In some of our ecosystem types, the ability to trade is quite large and involves large geographic distances, but in other cases they are very specific and they may only be found in a specific locality.[549]

7.87 Mr Grosskopf provided an example of what this would mean for a proposed development on Cumberland Plain Woodland within the Sydney Basin bioregion:

> Cumberland Plain Woodland can only be traded within a very limited area, and that is Cumberland Plain. If somebody undertakes a BioBanking agreement dealing with Cumberland Plain Woodland, the likely scenario is that they have an area on the margins on the fringe of western Sydney, such as the Camden and Picton parts of the world.[550]

7.88 SHOROC expressed concern that councils and other public property were ineligible to be considered as offset sites. SHOROC believes that the BioBanking Scheme could provide an important income stream to help care for and sustain high value biodiversity areas when council resources alone are inadequate.[551] In response to a question taken on notice by individuals who appeared on behalf of SHOROC, the

[546] Submission 14, EDO, p. 71
[547] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 3
[548] DECC, *BioBanking: Biodiversity Banking and Offsets Scheme*, Sydney, 2007, p. 11
[549] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 6
[550] Mr Tom Grosskopf, Transcript of hearing, 4 May 2009, p. 7
[551] Submission 25, SHOROC, p. 5

Committee was advised that council sites already zoned as reserves were ineligible to be offset sites because:

> it has been assumed that land zoned for environmental protection/retention is already being resourced for management. The reality is that despite there being requirements under the Local Government Act to manage for feral animals etc resources are now and always have been grossly inadequate – grant funding fills holes but proper site management requires steady long-term funding. With changes in climate there will be more resourcing required that the already inadequate resourcing will not cover. [552]

7.89 The Committee asked the then DECC to clarify whether local councils would be able to generate income to assist with increasing management costs by participating in the BioBanking Scheme. The Department responded:

> Local government can participate in the BioBanking Scheme to create biodiversity credits. The existing conservation management obligations of the local government for the land will be taken into consideration when issuing biodiversity credits. As such, this may result in fewer biodiversity credits being issued to local government than a BioBank site owner that does not have existing conservation management obligations. This policy applies to all government entities including State Government and is designed to ensure that government land owners do not have a competitive advantage over private landowners who are not paid to manage land for conservation.[553]

7.90 As the BioBanking Scheme has only recently been established, the EDO consider it to be too early to determine whether or it will be successful in conserving biodiversity values. However, they believe that the methodology was an improvement on the previous AOS and SIS processes by improving the consistency of assessment and reducing decision-making discretion and by addressing cumulative impacts of development.[554]

Biocertification

7.91 In 2004, amendments were made to the TSC Act to establish provisions for biodiversity certification, or 'biocertification', of LEPs and State environmental planning policies (SEPPs). It allows the Minister for the Environment to grant certification that a LEP or SEPP will maintain or improve biodiversity values, thereby avoiding site by site threatened species assessments for subsequent developments within the area covered by the LEP or SEPP.[555]

7.92 DECCW told the Committee of the advantages of biocertification:

> Biodiversity certification offers great potential to streamline development assessment; deliver strategic and tangible conservation outcomes and provide the basis for integrating Commonwealth Government threatened species approvals.[556]

7.93 The Committee understands that to date only one planning instrument, SEPP (Sydney Region Growth Centres) 2006, has been biocertified. DECCW explained to Committee that this biocertification order:

- removes the need for a case by case assessment of threatened species for the construction of 181,000 new homes in Western Sydney
- protects 2,000 hectares of vegetation within the growth centres

[552] SHOROC, Response to questions taken on notice at hearing, 20 August 2009, p. 2
[553] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 3
[554] Submission 14, EDO, p. 71
[555] DECC, *Questions and answers: Biodiversity certification*, Sydney, 2008, p. 2
[556] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 3

- establishes a $530 million dollar conservation fund which will be used to buy new national parks and private conservation covenants over the next thirty years.[557]

7.94 The EDO's submission to the Committee stated that this biocertification allowed the clearing of 1,867 hectares of 'high quality' threatened ecological communities (including 12% of the remaining Cumberland Plain Woodland), populations of 15 threatened flora species and the habitat for 22 threatened fauna species.[558] The offset for this clearing was the protection of 2,300 hectares of vegetation within the broader Sydney Basin bioregion.[559]

7.95 The EDO has stated that they believe the concept of biocertification has the potential to be an important conservation tool under climate change, but has flagged a number of issues that need to be addressed to ensure this.[560] One of these issues is the need to clearly define the 'overall improve or maintain test' as there is a risk that it may not lead to positive conservation results. The EDO have advocated amendments to the TSC Act that would provide more structure to the criteria that the Minister must use to assess if an instrument should be certified, similar to the approach take by the assessment methodologies established under the BioBanking scheme.[561]

Land clearing in rural areas

7.96 As discussed in paragraph 3.31 above, land clearing in rural areas is governed under the *Native Vegetation Act 2003* (NV Act) which allows for the development of Property Vegetation Plans (PVPs). As outlined in paragraph 3.32 above, PVPs are used to allow clearing on some parts of the land by offsetting others.

7.97 The EDO submission stated that the NV Act has been largely successful in ending broad-scale land clearing in rural areas and significantly reducing land clearing in NSW.[562] The EDO believes that mechanisms under the NV Act will be important for the protection of biodiversity under climate change. They noted that:

> [T]he most certain strategy to combat the impacts of climate change on biodiversity is to protect high quality existing habitats. This requires the NSW government to place strict controls on land clearing in rural areas. Clearly, the NV Act 2003 is a large step in the right direction and will be beneficial to biodiversity under climate change. However, land clearing continues to occur in rural areas there is a need to ensure that controls are further tightened wherever possible.[563]

7.98 The Namoi CMA submission raised concerns about the reliance on offsets for preserving biodiversity values under the NV Act:

> The priority should be to avoid clearing of further native vegetation rather than attempting to find 'offsets' to facilitate clearing. It is still unclear if offset areas retained for conservation management are indeed secure for the long term[.][564]

[557] DECCW, Response to questions taken on notice at hearing, 20 August 2009, p. 3
[558] Submission 14, EDO, p. 65
[559] Submission 14, EDO, p. 65
[560] Submission 14, EDO, pp. 66-67
[561] Submission 14, EDO, p. 67
[562] Submission 14, EDO, p. 74
[563] Submission 14, EDO, p. 74
[564] Submission 12, Namoi CMA, p. 3

Conclusion

7.99 The Committee recognises the complexity of land-use planning in New South Wales and notes the ongoing internal and external reviews of the New South Wales planning framework.

Appendix One - Submissions

1 Ms Carol O'Donnell
2 Associate Professor Michael Mahony
3 Professor Ralf Buckley
4 South East Forest Rescue
5 Australian Labor Party – Murrah Day Branch
6 CSIRO
7 University of Sydney – School of Biological Sciences
8 Mr Robert Mason
9 Northern Rivers Catchment Management Authority
10 Department of Environment and Climate Change
11 Taronga Conservation Society Australia
12 Namoi Catchment Management Authority
13 University of New England – School of Environmental and Rural Science
14 Environmental Defender's Office
15 Hunter Councils
16 Mr Jason Smith
17 Australasian Wildlife Management Society
18 Local Government and Shires Associations of NSW
19 Natural Resources Advisory Council
20 Macarthur Regional Organisation of Councils
21 Nature Conservation Council of NSW
22 Australian Deer Association
23 Southern Rivers Catchment Management Authority
24 Friends of Narrabeen Lagoon Catchment
25 Shore Regional Organisation of Councils
26 Natural Resources Commission

Appendix Two - List of witnesses

Monday 4 May 2009

Witness	*Organisation*
Mr Tim Rogers A/Deputy Director General – Climate Change, Policy and Programs Mr Tom Grosskopf Director – Landscapes and Ecosystems Dr Peter Smith Manager – Climate Change Science	Department of Environment and Climate Change
Dr Graeme Worboys Vice Chair of Mountains and Connectivity	International Union for the Conservation of Nature, World Commission on Protected Areas
Dr Philip Gibbs Principal Fisheries Scientist	Department of Primary Industries
Mr Jeff Smith Director Mr Tom Holden Scientific Director	Environmental Defender's Office
Dr Mark Dangerfield	Natural Resources Advisory Council

Monday 22 June 2009

Witness	*Organisation*
Mr Will Meikle General Manager – Scientific Research and Wildlife Conservation Dr Karrie Rose Registrar – Australian Registry of Wildlife Health Dr David Slip Research Biologist	Taronga Conservation Society Australia
Dr Francesca Andreoni Senior Project Officer – Biodiversity and Threatened Species	Namoi Catchment Management Authority

Dr John Williams Commissioner Ms Dianne Flett Program Manager	Natural Resources Commission
Professor Ralf Buckley Director and Chair	Griffith University, International Centre for Ecotourism Research
Dr Mehreen Faruqi Manager – Environment and Services – Mosman Council Ms Jo Tulau Project Leader – Community, Education and Climate Change – Pittwater Council Ms Kim Caswell Biodiversity Officer – Pittwater Council	Shore Regional Organisation of Councils
Dr Michael Dunlop Research Scientist	CSIRO
Mr Michael Muston Deputy Chair Mr Noel Kesby General Manager	Southern Rivers Catchment Management Authority

Thursday 20 August 2009

Witness	***Organisation***
Mr Rod Young Chair – Conservation and Resource Management Committee Mr David Eyre Policy Manager	NSW Farmers' Association
Ms Donna Rygate Executive Director – Corporate Governance and Policy Ms Yolande Stone Director – Policy, Planning Systems and Reform	Department of Planning

Mr Graham Fifield Project Manager Ms Sue Streatfield Business Development Manager	Greening Australia
Mr Tim Seears Pest and Travelling Stock Reserves Manager	Livestock Health and Pest Authorities
Mr Adrian Harte Director – Land Management	Land and Property Management Authority
Mr Bob Conroy Executive Director – Park Management Mr Simon Smith Deputy Director General – Climate Change, Policy and Programs	Department of Environment, Climate Change and Water

Appendix Three - Visit of inspection

On 17 and 18 September 2009, a delegation of the Committee travelled to the Bredbo and Bega regions of NSW to learn about the incentives, obligations and outcomes of different biodiversity conservation programs on private property.

Scottsdale Reserve
On 17 September, three Committee members (Mr David Harris MP, Mrs Karyn Paluzzano MP and Mr Ray Williams MP) and the Senior Committee Officer (Dr Carolyn Littlefair) travelled to Bredbo to visit Scottsdale Reserve. They met Ms Lauren Van Dyke (Kosciuszko to Coast (K2C) facilitator), Mr Ian Pulsford (Manager of Conservation Programs and Planning, Climate Change, Policy and Programs Group, Department of Environment, Climate Change and Water (DECCW)) and Mr Peter Saunders (Scottsdale Reserve Manager).

Mr Saunders explained that Scottsdale Reserve is a 1300 hectare property purchased by Bush Heritage Australia to protect rare plants and animals from the impacts of climate change. The purchase of Scottsdale was part of the regional landscape reconnection project K2C, which is part of the broader Great Eastern Ranges (GER) initiative to re-establish a network of habitats along the Great Escarpment.

Ms Van Dyke and Mr Pulsford explained that the K2C project is a community partnership which aims to reconnect isolated woodlands and grasslands between Kosciuszko and Namadgi National Parks and the coastal forests of the Far South Coast. K2C aims to assist landholders through a range of programs including stewardship payments, conservation agreements, incentive funding for conservation works, field training and species identification courses. The K2C project is one of five priority project areas of the GER initiative.

Mr Saunders described the successful regeneration that was occurring on Scottsdale Reserve as a result of removing grazing pressures and encouraging the growth of ground cover. The delegation also inspected some recent revegetation work that was undertaken by volunteers.

Property of Sue Connelly
The delegation then visited the nearby property of Ms Sue Connelly who has received an incentive grant through the K2C project. Ms Connelly explained how much she had learned since becoming involved with the K2C project. She particularly valued how the project involved a number of partners with different incentive programs so that she was able to apply for the incentive that best suited her situation.

Ms Connelly then showed the delegation the windbreak that she had planted because of an incentive from Greening Australia. Ms Connelly also showed the members the native grasses, including some rare species, she now had growing on her property and spoke about how she was able to identify native grass species through what she has learnt from her involvement with the K2C project.

Black Ridge

The group then travelled to Black Ridge, just south of Bredbo. The delegation met with Mr Dierk and Mrs Rosemary von Behrens (two of the property owners), Ms Sally Ash (A/Manager Conservation Programs, Climate Change, Policy and Programs Group, DECCW), Mr Stuart McMahon (Manager Community Programs, Parks and Wildlife Group, DECCW), Ms Maya Beretta (Community Conservation Officer, Parks and Wildlife Group, DECCW) and Ms Alana Dickerson (Ranger, Parks and Wildlife Group, DECCW).

Mr and Mrs von Behrens explained that the Black Ridge Conservation Agreement, which protects 1,905 hectares, was established in 1997 and, for many years, was the largest Conservation Agreement (CA) in NSW. Mr and Mrs von Behrens showed the delegation around the property and spoke about the conservation and rehabilitation works they had undertaken over the last thirteen years and also spoke about the recent erosion control works that had been undertaken with the assistance of a DECCW grant.

Ms Ash and Mr McMahon provided an overview of CAs which are in perpetuity commitments between current and successive landholders and the Minister and provide permanent protection of special values of the land under a provision in the National Parks and Wildlife Act 1974. As part of the agreement, DECCW provides ongoing support to assist landholders to undertake conservation works. Ms Ash explained that the benefit for the Government in providing incentives for conservation projects under CAs is that they are low risk investments as the landholders have responsibility under the CA to ensure that funding is properly spent on natural resource management actions.

Mr McMahon noted that the Southern Branch of the Parks and Wildlife Group has a dedicated position to work with local landholders to develop CAs. This has contributed to the large number of successful CAs within the Branch. The delegation heard that other field Branches of the Parks and Wildlife Group do not have such a position and the responsibility for developing new CAs lies with the head office staff within the Climate Change, Policy and Programs Group.

Bega dairy farms

On 18 September the delegation travelled to a dairy farm in Bemboka, just outside of Bega. They met with Mr Peter and Mrs Sue Johnston (property owners), Ms Pam Green (Chair, Southern Rivers CMA (SRCMA)), Mr Noel Kesby (General Manager, SRCMA), Ms Sue-Anne Nicol (Catchment Coordinator, SRCMA), Mr Andrew Taylor (Catchment Officer, SRCMA), Mr Justin Gouvernet (Catchment Officer, SRCMA), Mr Richard Platts (Director, Bega Cheese), Mr Ken Garner (Farm Development Manager, Bega Cheese), Ms Melissa Balas (Environment and Sustainability Officer, Bega Cheese), Mr Dave O'Donnell (Water Efficiency Officer, Department of Industry and Investment) and Mr Jock Waugh (Remnant Vegetation Recovery Officer, Bega Valley Shire Council).

Ms Nicol told the delegation about the Bega Dairy Partnerships Program which aims to improve the environmental sustainability of dairy operations in the Bega River catchment. Bega Cheese and the SRCMA have been working cooperatively with farmers on a voluntary basis to implement a range of natural resource management initiatives including: dairy effluent management and reuse; soil sampling and whole farm nutrient budgeting; water metering; more efficient irrigation practices; protection and revegetation of important habitats; and erosion control.

Mr and Mrs Johnston then showed the delegation the revegetation works that they had been carrying out for a number of years, the upgrade of the effluent management system outside the dairy and the biodiversity corridors they had established. They also spoke about the irrigation efficiency monitoring project they were undertaking as part of the Bega Dairy Partnerships Program.

The delegation then visited the property of Mr Barry Irvin to inspect the biodiversity corridors that he and other property owners were creating. The SRCMA explained how they are working with landholders to encourage connectivity across property boundaries to build resilience to all threats, including climate change.

Monaro

The delegation then travelled to Nimmitabel and met with Ms Green, Mr Kesby, Mr Brett Miners (Snowy/South Coast Landscape Manager, SRCMA), Mr Tim Fletcher (Monaro Grasslands Project Officer, SRCMA) and Mr Richard Taylor (local farmer). The delegation discussed the benefits of a regional approach to natural resource management programs, such as through the CMAs, and the need to continue extension programs as an effective means of encouraging best practice natural resource management.

Mr Harris, Mrs Paluzzano and Dr Littlefair then travelled with the SRCMA representatives to the property of Mr Charles and Mrs Fiona Massy. Mr Massy is a merino breeder and has written a book, *The Australian Merino*, documenting the history of the merino in Australia. The group spoke about the need for sustainable farming practices to be more widely adopted within the farming community. Mr Massy also spoke about his current doctoral research which was studying the paradigm shift necessary within the agricultural industry to adopt such environmentally sustainable practices.

Mr Harris, Mrs Paluzzano and Dr Littlefair then travelled with the SRCMA representatives to the Ravensworth Travelling Stock Reserve to inspect the SRCMA's Monaro Grasslands Program. Mr Miners and Mr Fletcher explained that the Program has management agreements on 5,208 hectares of native grasslands and is working to combine sustainable grazing and biodiversity conservation of native grasses. Mr Miners and Mr Fletcher showed the delegation how the Program had been successful in protecting and enhancing native grasslands on the Ravensworth Travelling Stock Reserve.

Appendix Four - Extracts from minutes

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 1)

11.05 am, Wednesday 4 March 2009
Room 1254, Parliament House

Members present

Mr Harris, MP (Chair)
Mr George, MP
Mrs Paluzzano, MP
Mr Williams, MP
Mr Martin, MP
Mr Piper, MP

Minutes

Resolved, on the motion of Mr Piper, seconded by Mr Martin:
That the minutes of the meeting on 3 December 2008 be confirmed and published.

Correspondence

Resolved, on the motion of Mr Piper, seconded by Mr George:
That the Committee note the correspondence from Mr Sukhamay Gangopadhyay.

Recent developments in climate change research, policies and programs

The Committee noted the recent developments in climate change research, policies and programs since the last Committee meeting.

Slides from the National Carbon Offset Standard public consultation forum

The Committee noted the slides from the National Carbon Offset Standard public consultation forum.

New inquiry

The Chair discussed with the Committee that upon further investigation the Committee's previous intention to conduct an inquiry into climate change and coastal settlements and ecosystems would result in significant duplication of the inquiries of other Parliamentary committees. The Committee agreed not to pursue an inquiry into climate change and coastal settlements and ecosystems.

The Chair raised with the Committee the possibility of conducting an inquiry into management strategies to address the impacts of climate change on biodiversity. The Committee discussed the draft terms of reference.

Mr Piper raised with the Committee the possibility of conducting an inquiry into innovative uses of municipal waste to reduce greenhouse gas emissions. The Committee agreed that the issue would be investigated further to determine if such an inquiry would be appropriate within the terms of reference for the Committee.

Resolved, on the motion of Mrs Paluzzano, seconded my Mr Martin:
That the Committee:

1. Adopt the terms of reference and commence an inquiry into management strategies to address the impacts of climate change on biodiversity and

2. Investigate the possibility within the Committee's terms of reference of conducting an inquiry into Mr Piper's suggested topic of innovative uses of waste.

General business
The Committee discussed the upcoming Australian Academy of Technological Sciences and Engineering seminar on 12 March 2009 on Climate Change and Infrastructure.

The Committee also discussed the take note debate of the Committee's report of December 2008, scheduled for Friday 13 March 2009.

The Committee discussed the upcoming visit of inspection to the Hunter Valley on 19-20 March 2009 to visit energy efficiency and carbon sequestration projects.

Briefing
Mr Matthew Warnken, Managing Director, Crucible Carbon briefed the Committee on the research currently being undertaken by Crucible Carbon on the development of pyrolysis and biochar.

The Committee adjourned at 12.05 pm until 11.00 am on Wednesday 25 March 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 2)

11.00 am, Wednesday 1 April 2009
Waratah Room, Parliament House

Members present
Mr Harris, MP (Chair)

Mr George, MP	Mr Martin, MP
Mr Piper, MP	Mr Williams, MP

Apology
An apology was received from Mrs Paluzzano.

Minutes
Resolved, on the motion of Mr Martin, seconded by Mr Piper:
That the minutes of the meeting on 4 March 2009 be confirmed and published.

Visit of inspection to Newcastle and Hunter region
The Committee considered the report of the visit of inspection.

Mr Harris thanked the secretariat for organising the visit of inspection.

The Committee discussed the solar thermal project that they heard about on their visit to the CSIRO Energy Centre. The Committee agreed to request further information on the project in order to determine any appropriate action that the Committee may be able to take regarding the future of the project.

Mr George requested that on future visits of inspection the mobile phone numbers for all members were included for ease of contact. The members agreed for their numbers to be included in the future.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mr Williams, seconded by Mr Martin:
That submissions 1 and 2 be accepted and published.

The Committee noted the upcoming public hearing on Monday 4 May 2009, starting at 9.00 am in room 814/815.

Recent developments in climate change research, policies and programs
Resolved, on the motion of Mr Martin and seconded by Mr Piper:
That the Committee note the recent developments in climate change research, policies and programs since the last Committee meeting.

General business
The Committee discussed the biochar project being undertaken by Crucible Carbon and the new solar energy technologies at the CSIRO that the delegation heard about on their visit of inspection to Newcastle.

The Committee adjourned at 11.35 am until 9.00 am on Monday 4 May 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 3)

9.57 am, Monday 4 May 2009
Room 814/815, Parliament House

Members present
Mr Harris, MP (Chair)
Mr George, MP Mrs Paluzzano, MP
Mr Williams, MP

Apologies
Apologies were received from Mr Martin and Mr Piper.

Minutes
Resolved, on the motion of Mr Williams, seconded by Mr George:
That the minutes of the meeting on 1 April 2009 be confirmed.

CSIRO solar thermal project
The Committee considered the additional information on the solar thermal project provided by CSIRO entitled 'Parkes Sustainable Energy Intelligent Grid (iGRID): Proposal for NSW Government'.

Resolved, on the motion of Mr Williams, seconded by Mrs Paluzzano:
That the Chair write to the Department of Premier and Cabinet to enquire about the status of the project.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mrs Paluzzano, seconded by Mr Williams:
That submissions 3 to 21 be accepted and those that are not confidential be published.

Resolved, on the motion of Mr Williams, seconded by Mr George:
That those part of Ms Donnell's supplementary submission that are relevant to the inquiry's terms of reference be accepted and published as submission 1a.

Recent developments in climate change research, policies and programs
The Committee noted the recent developments in climate change research, policies and programs since the last Committee meeting.

Public hearing
The Chair opened the public hearing

Mr Tim Rogers, A/Deputy Director General Climate Change, Policy and Programs, Mr Tom Grosskopf, Director Landscapes and Ecosystems, and Dr Peter Smith, Manager Climate Change Science, of the Department of Environment and Climate Change were affirmed and examined.

Mr Grosskopf and Mr Rogers undertook to provide the Committee with further information in response to questions.

Evidence completed, the witnesses withdrew.

Dr Graeme Worboys, Vice Chair of Mountains and Connectivity for the International Union for the Conservation of Nature, World Commission on Protected Areas was sworn and examined.

In support of his evidence, Dr Worboys tabled:
- a paper outlining the key points of Dr Worboys' evidence to the Committee
- a case study extract entitled 'Australian 'Alps to Atherton' connectivity conservation corridor' from the book 'Connectivity Conservation Management: A Global Guide'
- a paper outlining responses to climate change impacts for protected area managers
- a brochure entitled 'Conserving the Great Eastern Ranges from the Australian Alps to Atherton and beyond'
- a DVD entitled 'Australia's Great Eastern Ranges: Our vision to protect them forever.'

Evidence completed, the witness withdrew.

Dr Philip Gibbs, Principal Fisheries Scientist, with the Department of Primary Industries was sworn and examined.

Dr Gibbs undertook to provide the Committee with further information in response to questions and agreed to take questions on notice relating to other areas of responsibility within the Department of Primary Industries.

In support of his evidence, Dr Gibbs tabled:
- a paper outlining key issues for the inquiry from the Department of Primary Industries
- a copy of PowerPoint slides outlining the key issues relating to the fisheries sector.

Evidence completed, the witness withdrew.

At 12.30 pm the Committee adjourned for lunch and the public hearing resumed at 1.30 pm.

Mr Jeff Smith, Director, and Mr Tom Holden, Scientific Director, of the Environmental Defender's Office were affirmed and examined.

Evidence completed, the witnesses withdrew.

Dr Mark Dangerfield of the Natural Resources Advisory Council was affirmed and examined. Dr Dangerfield undertook to provide the Committee with further information in response to questions.

Evidence completed, the witness withdrew.

The Committee adjourned at 2.54 pm until 11.00 am on Wednesday 6 May 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 4)

11.12 am, Wednesday 6 May 2009
Room 1254, Parliament House

Members present
Mr Harris, MP (Chair)
Mr Piper, MP Mr Williams, MP

Apologies
Apologies were received from Mr George, Mr Martin and Mrs Paluzzano.

Minutes
Resolved, on the motion of Mr Williams:
That the minutes of the meeting on 4 May 2009 be confirmed.

Biodiversity management strategies public hearing
The Committee noted the apology from Associate Professor Ross Coleman who was unable to attend the public hearing on 4 May due to illness.

Recent developments in climate change policies
The Committee noted the recent developments in the proposed Carbon Pollution Reduction Scheme since its last meeting.

Emissions from landfill
The Committee discussed the issue of legacy greenhouse gas emissions from landfill and the implications this may have for local government under the Carbon Pollution Reduction Scheme.

Mr Piper undertook to provide a briefing to the Committee on the issue at the Committee's next meeting on 3 June 2009.

The Committee adjourned at 11.24 am until 11.00 am on Wednesday 3 June 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 5)

11.07 am, Wednesday 3 June 2009
Room 1254, Parliament House

Members present
Mr Harris, MP (Chair)
Mrs Paluzzano, MP Mr Piper, MP

Apologies
Apologies were received from Mr George, Mr Martin and Mr Williams.

Welcome to visitors
The Chair welcomed Ms Magdalene Taroansi, a member of the Bougainville Parliament and the representatives from Lake Macquarie City Council.

Briefing
Dr Alice Howe, Team Leader Environmental Risk, Mr Brian Bell, General Manager and Mr Quentin Espey, Manager Sustainability, from Lake Macquarie City Council provided a briefing on the implications of the proposed Carbon Pollution Reduction Scheme for local government.

A copy of the PowerPoint slides presented was circulated at the meeting.

Minutes
Resolved, on the motion of Mr Piper:
That the minutes of the meeting on 6 May 2009 be confirmed.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mrs Paluzzano, seconded by Mr Piper:
That submissions 22 to 26 be accepted and published

Public hearing of 4 May 2009
Resolved, on the motion of Mrs Paluzzano, seconded by Mr Piper:
That the corrected transcript be published

Answers to questions on notice taken from the hearing of 4 May 2009 from the Department of Primary Industries were circulated at the meeting.

Resolved, on the motion of Mr Piper, seconded by Mrs Paluzzano:
That the answers to questions on notice from the Department of Environment and Climate Change, the Natural Resources Advisory Council and the Department of Primary Industries be noted and published.

Recent developments in climate change research, policies and programs
The Committee noted the recent developments in climate change research, policies and programs since the last Committee meeting.

General business
The Committee discussed arrangements for the upcoming public hearing on 22 June 2009.

The Committee adjourned at 12.02 pm until 9.30 am on Monday 22 June 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 6)

9.30 am, Monday 22 June 2009
Room 814/815, Parliament House

Members present

Mr Harris, MP (Chair)	
Mr George, MP	Mr Martin, MP
Mr Piper, MP	Mr Williams, MP

Apology
An apology was received from Mrs Paluzzano.

Public hearing
The Chair opened the public hearing.

Mr Will Meikle, General Manager, Scientific Research and Wildlife Conservation, and Dr David Slip, Research Biologist of the Taronga Conservation Society Australia were affirmed and examined. Dr Karrie Rose, Registrar, Australian Registry of Wildlife Health of the Taronga Conservation Society Australia was sworn and examined.

Evidence completed, the witnesses withdrew.

Dr Francesca Andreoni, Senior Project Officer, Biodiversity and Threatened Species of the Namoi Catchment Management Authority was affirmed and examined.

Evidence completed, the witness withdrew.

Dr John Williams, Commissioner and Ms Dianne Flett, Program Manager of the Natural Resources Commission were sworn and examined.

Dr Williams undertook to provide the Committee with further information in response to a question.

Evidence completed, the witnesses withdrew.

Professor Ralf Buckley was affirmed and examined.

Resolved, on the motion of Mr Martin, seconded by Mr Williams:

That the submission and additional attachments from Professor Buckley be accepted and published.

Evidence completed, the witness withdrew.
Dr Mehreen Faruqi, Manager, Environment and Services, Mosman Council, Ms Jo Tulau, Project Leader, Community, Education and Climate Change, Pittwater Council, and Ms Kim Caswell, Biodiversity Officer, Pittwater Council of Shore Regional Organisation of Councils were affirmed and examined.

Ms Tulau undertook to provide the Committee with further information in response to a question.

Evidence completed, the witnesses withdrew.

Dr Michael Dunlop, Research Scientist from the CSIRO was affirmed and examined.

In support of his evidence, Dr Dunlop tabled:
- PowerPoint slides entitled Implications of climate change for biodiversity management
- Implications of Climate Change for Australia's National Reserve System: A Preliminary Assessment
- Overview of the report Implications of Climate Change for Australia's National Reserve System: A Preliminary Assessment.

Evidence completed, the witness withdrew.

Mr Michael Muston, Deputy Chair and Mr Noel Kesby, General Manager of the Southern Rivers Catchment Management Authority were affirmed and examined.

In support of his evidence, Mr Kesby tabled:
- Scoping Study of Climate Change Vulnerability and Adaptation Options in The Southern Rivers Region: Focus on Natural, Built, Coastal and Marine Ecosystems.

Evidence completed, the witnesses withdrew.

The Committee adjourned at 4.15 pm until 11.00 am on Wednesday 24 June 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 7)

11.00 am, Wednesday 24 June 2009
Room 1254, Parliament House

Members present
Mr Harris, MP (Chair)
Mr Martin, MP Mr Williams, MP

Apologies
Apologies were received from Mr George, Mrs Paluzzano and Mr Piper.

Minutes
Resolved, on the motion of Mr Martin, seconded by Mr Williams:
That the minutes of the meeting on 22 June 2009 be confirmed.

The Committee deferred consideration of the minutes of the meeting on 3 June 2009.

Transcript of hearing
Resolved, on the motion of Mr Martin, seconded by Mr Williams:
That the transcript of the hearing on 22 June 2009 be published once witnesses have had the opportunity to make corrections.

Inquiry into biodiversity management strategies
The Committee considered the future directions of the inquiry and agreed to further investigate the following issues:

- incentives for conservation of biodiversity on private land
- protection of travelling stock routes
- conservation of biodiversity in urban areas.

The Committee agreed that members should advise the secretariat of any additional issues for further investigation in the inquiry by 1 July 2009.

The Committee agreed to hold a further hearing during August 2009 and to agree to a date by email.

The Committee agreed to investigate the possibility of visiting Taronga Western Plains Zoo and landholders who were taking part in programs to conserve biodiversity on their properties on a date to be agreed by email.

Recent developments in climate change research, policies and programs
The Committee noted:

- the recent developments in climate change research, policies and programs since the last Committee meeting
- the slides from the Department of Climate Change's workshop on incorporating voluntary action into the design and targets for the Carbon Pollution Reduction Scheme (CPRS) which took place on 16 June 2009
- the slides from the Australian Academy of Technological Sciences and Engineering (ATSE) seminar for Parliamentarians on Carbon Capture and Storage (CCS) which took place on 18 June 2009.

General business
Mr Williams raised with the Committee the possibility of holding a climate change forum and inviting speakers with varying views on climate change, such as Professor Ian Plimer. The Committee agreed to investigate the matter further.

The Committee adjourned at 11.36 am until 11.00 am on Wednesday 2 September 2009.

Appendix Four

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 8)

10.05 am, Thursday 20 August 2009
Room 814/815, Parliament House

Members present
Mrs Paluzzano, MP (Deputy Chair)
Mr George, MP Mr Piper, MP
Mr Williams, MP

Apologies
Apologies were received from Mr Harris and Mr Martin.

Public hearing
The Deputy Chair opened the public hearing.

Mr Rod Young, Chair of the Conservation and Resource Management Committee at the NSW Farmers' Association was sworn and examined. Mr David Eyre, Policy Manager at the NSW Farmers' Association was affirmed and examined.

Evidence completed, the witnesses withdrew.

Ms Donna Rygate, Executive Director of Corporate Governance and Policy at the Department of Planning was sworn and examined. Ms Yolande Stone, Director of Policy, Planning Systems and Reform at the Department of Planning was affirmed and examined.

Ms Rygate and Ms Stone undertook to provide the Committee with further information in response to questions.

Evidence completed, the witnesses withdrew.

Mr Graham Fifield, Project Manager at Greening Australia – Capital Region and Ms Sue Streatfield, Business Development Manager at Greening Australia – Capital Region were affirmed and examined.

Mr Fifield tabled PowerPoint slides entitled Whole of Paddock Rehabilitation (WOPR): A new approach to regreening the farm.

Evidence completed, the witnesses withdrew.

Mr Tim Seears, Pest and Travelling Stock Reserves Manager at the State Management Council of the Livestock Health and Pest Authorities and Mr Adrian Harte, Director of Land Management at the Land and Property Management Authority were affirmed and examined.

Mr Seears tabled a background paper entitled Travelling Stock Reserve Management by Livestock Health and Pest Authorities. Mr Harte tabled a series of pictures illustrating the values of travelling stock reserves.

Evidence completed, the witnesses withdrew.

Mr Bob Conroy, Executive Director of Park Management for the Parks and Wildlife Group at the Department of Environment, Climate Change and Water and Mr Simon Smith, Deputy Director General of the Climate Change, Policy and Programs Group at the Department of Environment, Climate Change and Water were affirmed and examined.

Mr Conroy and Mr Smith agreed to take questions on notice regarding matters that were not covered during their evidence.

Evidence completed, the witnesses withdrew.

The Committee adjourned at 2.25 pm until 11.00 am on Wednesday 2 September 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 9)

11.01 am, Wednesday 2 September 2009
Room 1254, Parliament House

Members present
Mr Harris, MP (Chair)
Mr Martin, MP Mrs Paluzzano, MP
Mr Williams, MP

Apologies
Apologies were received from Mr George and Mr Piper.

Visitor
The Chair welcomed Ms Beth Mulock, an intern working in the office of Mrs Paluzzano, as an observer to the meeting.

Minutes
Resolved, on the motion of Mrs Paluzzano:
That the minutes of the meeting on 3 June 2009 be confirmed.

Resolved, on the motion of Mr Martin:
That the minutes of the meeting on 24 June 2009 be confirmed.

Resolved, on the motion of Mrs Paluzzano:
That the minutes of the meeting on 20 August 2009 be confirmed.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mrs Paluzzano, seconded by Mr Martin:
That the Committee note and publish the responses to questions on notice from the Natural Resources Commission and the Shore Regional Organisation of Councils from the hearing on 22 June 2009.

Resolved, on the motion of Mrs Paluzzano, seconded by Mr Martin:
That the transcript of the hearing on 20 August 2009 be published once witnesses have had the opportunity to make corrections.

Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the agreed additional questions on notice be forwarded to the Department of Planning, following their appearance at the 20 August 2009 hearing.

The Committee noted the overview of a recent report from the Department of Climate Change entitled Australia's Biodiversity and Climate Change.

Inquiry into emissions trading schemes
Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the Committee note and publish the Government response to the Committee's report on its website.

Visit of inspection to Bredbo and Bega regions
The Committee discussed arrangements for the upcoming visit of inspection to the Bredbo and Bega regions.

Resolved, on the motion of Mrs Paluzzano, seconded by Mr Martin:
That as many members as wished and one member of staff should attend the proposed visit of inspection to the Bredbo and Bega regions on 17 and 18 September 2009.

Commonwealth Parliamentary Association Climate Change Conference
The Chair provided an overview of his experience at the annual Commonwealth Parliamentary Association Climate Change Conference held in the British House of Commons in July 2009. The Chair undertook to forward a copy of the Conference Communiqué to the Committee members and advised that slides of the presentations at the conference are available at the conference website.

Recent developments in climate change research, policies and programs
The Committee noted the recent developments in climate change research, policies and programs since the last Committee meeting

General business
The Committee discussed attendance at the upcoming CEDA Discussion Forum Climate Policy - International Perspectives on Tuesday 15 September 2009 in Sydney.

Resolved, on the motion of Mr Williams, seconded by Mrs Paluzzano:
That as many members as wished should attend the CEDA event on 15 September 2009.

The Committee adjourned at 11.30 am until 11.00 am on Wednesday 23 September 2009.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 10)

11.00 am, Wednesday 28 October 2009
Room 1254, Parliament House

Members present
Mrs Paluzzano, MP (Deputy Chair)

Mr George, MP	Ms Hay, MP
Mr Martin, MP	Mr Piper, MP

Mr Williams, MP

Acting Chair
In the absence of a Committee Chair, the Deputy Chair took charge of the meeting.

Change in Committee membership
The Deputy Chair reported that, earlier that morning, Mr Harris had been discharged from the Committee and Ms Hay had been appointed to serve in his place. The Deputy Chair welcomed Ms Hay to the Committee.

Election of Chair
As a vacancy had arisen in the in the position of Chair, the Deputy Chair called for nominations for election of a new Chair.

Mr Williams, seconded by Mr George nominated Mr Piper.
Ms Hay, seconded by Mrs Paluzzano nominated Ms Hay.

There being two nominations, a vote of the Committee was taken.

Mr Piper received 3 votes [Mr George, Mr Piper, Mr Williams]
Ms Hay received 3 votes [Ms Hay, Mr Martin, Mrs Paluzzano]

The Committee Manager advised that in the event of an equality of votes, the Chair had a casting vote.

Mr Williams requested confirmation of this advice by the Clerk. The meeting adjourned while this advice was sought. The Committee Manager advised the meeting that the Clerk, Deputy Clerk and Clerk Assistant (Procedure) concurred that Mrs Paluzzano as Acting Chair had the casting vote and Ms Hay was elected Chair.

Visitor
The Chair welcomed Mr Harris, the former Chair of the Committee as a guest to the meeting.

Minutes
Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the minutes of the meeting on 2 September 2009 be confirmed.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mr Piper, seconded by Mr Martin:
That the Committee notes and agrees to the publication of the responses to questions on notice from the Department of Planning and the Department of Environment, Climate Change and Water on its website.

Resolved, on the motion of Mrs Paluzzano, seconded by Mr Martin:
That the Committee accepts the revised submission from the Environmental Defender's Office and publishes it on its website

CEDA Discussion Forum Climate Policy – International Perspectives
The Committee noted a verbal report from Mr Harris on his attendance at the CEDA discussion forum on international climate policy, held at the Shangri-La Hotel on 15 September 2009.

Meeting with South Australian committee member
The Committee Manager reported on the secretariat's meeting with Mr John Rau, Presiding Officer of South Australia's Natural Resource Committee Rau on 17 September 2009 and passed on Mr Rau's invitation to the Committee to inspect certain issues relating to water management in South Australia.

Visit of inspection to Bredbo and Bega regions
Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the Committee note the report on the visit of inspection to the Bredbo and Bega regions by a delegation of the Committee.

The Committee thanked Dr Carolyn Littlefair for all her hard work in organising the visit and ensuring that it ran smoothly.

Recent developments in climate change research, policies and programs
Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the Committee note the recent developments in climate change research, policies and programs since the last Committee meeting.

General business
The Committee discussed potential topics for future inquiries and agreed to develop a discussion paper for the next Committee meeting.

Members noted that the next meeting was scheduled to coincide with Remembrance Day services and agree to determine whether this should be rescheduled by email.

The Committee adjourned at 11.25 am until Wednesday 11 November at a time to be fixed.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 11)

11.00 am, Wednesday 25 November 2009
Room 1254, Parliament House

Members present

Ms Hay, MP (Chair)	
Mr Martin, MP	Mrs Paluzzano, MP
Mr Piper, MP	Mr Williams, MP

Apology
An apology was received from Mr George.

Minutes
Resolved, on the motion of Mr Piper, seconded by Mrs Paluzzano:
That the minutes of the meeting on 28 October 2009 be confirmed.

Inquiry into biodiversity management strategies
Resolved, on the motion of Mr Martin, seconded by Mrs Paluzzano:
That the Committee consider the report and advise the secretariat of any proposed amendments by Monday 30 November 2009 for consideration by the Committee at its meeting on Wednesday 2 December 2009.

Inquiry into agricultural water management
The Committee discussed the proposed inquiry into agricultural water management and agreed to defer a decision in relation to the scope of the inquiry until its next meeting.

Meeting dates for 2010
Resolved, on the motion of Mr Martin, seconded by Mr Williams
That the Committee adopt the times and dates for meeting in 2010 as circulated.

Recent developments in climate change research, policies and programs
The Committee noted the summary of media coverage of climate change research, policies and programs.

The Committee adjourned at 11.16 am until Wednesday 2 December at 11.00 am.

Minutes of Proceedings of the Standing Committee on Natural Resource Management (Climate Change) (No. 12)

11.05 am, Wednesday 2 December 2009
Room 1254, Parliament House

Members present
Ms Hay, MP (Chair)
Mr Martin, MP Mr Piper, MP
Mr Williams, MP

Apologies
Apologies were received from Mr George and Mrs Paluzzano.

Minutes
Resolved, on the motion of Mr Piper, seconded by Mr Martin:
That the minutes of the meeting on 25 November 2009 be confirmed.

Inquiry into biodiversity management strategies – draft report
The Chair proposed that the Committee agree to the following amendments to the Chair's draft report that were circulated on 1 December 2009:

Paragraph 2.12 (pages 5-6) (Proposed by Mr Piper)
Remove first dot point 'increases in the atmospheric concentration of carbon dioxide'.

Paragraph 5.22 and Recommendation 14 (page 56) (Proposed by Mr Piper)
Add to end of paragraph 5.22:
As discussed in paragraph 5.6 above, there is scope for CMAs to improve their coordination with other regional natural resource management agencies, particularly local governments.

The Committee finds that all CMAs should work to improve relationships and links with other agencies and organisations involved in the delivery of natural resource management within their region such as local governments and Landcare groups.

Recommendation 14
Delete 'including the conservation of biodiversity'
Insert 'and all Catchment Management Authorities should work to improve relationships and links with other regional natural resource management agencies and organisations such as local governments and Landcare groups'

Paragraphs 3.24 – 3.26 (page 22) (Proposed by secretariat)
Replace the existing paragraphs 3.24-3.26 with the revised paragraphs as follows:

3.24 The TSC Act establishes the process for the listing of species, populations or ecological communities as either vulnerable, endangered or critically endangered. There are currently 942 species, 42 populations and 90 ecological communities listed under the TSC Act. The TSC Act also identifies key threatening processes (KTPs). In November 2000, anthropogenic climate change was listed as a KTP.

3.25 The TSC Act requires the Department of Environment, Climate Change and Water (DECCW) to prepare and adopt a NSW Threatened Species Priorities Action Statement (PAS) that:

- sets out the recovery and threat abatement strategies to be adopted for each threatened species
- establishes relative priorities and actions to implement the above strategies
- establishes performance indicators to report achievements in implementing recovery and threat abatement strategies in their effectiveness
- contains a status report on each threaten species (where information is available)
- set outs clear timetables for recovery and threat abatement planning and achievement.

3.26 The PAS outlines thirty-four broad recovery and threat abatement strategies as well as detailed actions for these strategies. Each strategy and action has been prioritised according to its relative importance for achieving recovery or threat abatement for each species and KTP.

3.27 The PAS identifies which threatened species, populations or ecological communities a recovery plan should be prepared for. Recovery plans are likely to be developed for iconic species, where there are complex conservation issues involving a suite of management actions and where the input and agreement of multiple stakeholders (including Aboriginal communities) is required.

3.28 The PAS also identifies which KTPs will require the a threat abatement plan (TAP). There are a number of circumstances in which a TAP is likely to be prepared:

- The KTP significantly affects biodiversity or is the main threat to many species.
- The severity of impact from the KTP varies across different locations and requires and planned and coordinated approach.
- Existing threat abatement strategies in other conservation planning documents and policy instruments need to be combined into one document.
- Management of the KTP requires coordination and commitment from several public authorities and stakeholders.

3.29 Additionally, DECCW prepares statements of intent for each KTP listed under the TSC Act which outline DECCW's response to the KTP. Mr Tim Rogers, the acting Deputy Director General of the Climate Change, Policy and Programs Group for the then Department of Environment and Climate Change (DECC), told the Committee:

> A statement of intent in response to the listing of climate change as a key threatening process under the Threatened Species Conservation Act is being prepared. That will be a summary of specific actions that DECC will undertake to improve the resilience of biodiversity over the next five years.

The Committee agreed to these amendments.

Resolved, on the motion of Mr Piper, seconded by Mr Martin:
That the Committee agree to the Chair tabling the report as amended subject to typographical corrections and formatting by the secretariat.

The Committee adjourned at 11.16 am until Wednesday 24 February 2010 at 11.00 am.