



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

Inquiry into Australia's biodiversity in a changing climate

Introduction

The Australian Academy of Science welcomes the House of Representatives Standing Committee on Climate Change, Environment and the Arts *Inquiry into Australia's biodiversity in a changing climate* in relation to nationally important ecosystems.

Australia's biodiversity is very rich, containing a great variety of habitats and ecosystems. Moreover, our flora and fauna is highly endemic. Ninety-three per cent of our reptiles and 94 per cent of amphibians are found nowhere else on Earth, as are about 87% of mammals, 86% of vascular plants, 85% of inshore fish species and 45% of birds.¹ In particular we are renowned for our unique native mammals (the monotremes and marsupials) and flora (eucalypts, banksias etc).

Australia's rate of species extinction is the highest in the developed world – a statistic that should be shocking to all Australians. With climate change already affecting entire ecosystems, Australia's iconic natural areas and national parks will lose species and ultimately change into different landscapes. This inquiry, therefore, is timely as the need to conserve - and understand - our biological diversity has never appeared greater.

However, while there is universal agreement that more needs to be done, we lack basic information on so many of our species and their environments. Fundamentally we need a national effort to describe the species that are affected and their complex interactions with the environment. As Roger Short² stated 'we cannot conserve until we comprehend'.

Conservation of our biodiversity is important not only for the preservation of our national heritage, but also to provide opportunities to improve our health, economy and international reputation. Our biodiversity underpins a burgeoning tourist industry, but less well recognised is the opportunity to develop new therapeutics from diverse, unrelated resources, for example marine therapeutics including cone shell toxins

¹ Australian Bureau of Statistics, Year Book of Australia, 2009-10:
<http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1301.0Feature+Article12009%E2%80%9310>

² Short, R. V. (1985). 'Hopping Mad.' Concluding Address, XXIX Congress International Union of Physiological Sciences, Sydney, 1983. (Eds P. Korner and D. Garlick.) pp. 371–386. (Cambridge University Press.)

(analgesics to relieve chronic pain), rainforest products (dietary supplements, antiseptics, bactericides etc) and novel antibiotics from marsupial milk.

Pressures on biodiversity

Australia's unique biodiversity has been under threat for some time from a wide range of pressures. Landscapes have been altered as a result of such practices as vegetation clearing (including clear felling of native forests), widespread use of fertiliser and other chemicals including toxic substances that can affect animal and human development, health and well being³, urbanisation and mining. Added pressures have also come from introduced plants and animals such as cats, foxes, rabbits, camels, horses, cane toads and goats and prickly pears, overcommitted water resources, changed fire regimes, and over-harvesting.

Australia's biodiversity now faces a further threat from a rapidly changing climate. The interaction of climate change with existing stresses such as land clearing, fire and invasive species, add further levels of complexity. Future climate change will, therefore, act on ecosystems that are already under considerable stress and have reduced adaptive capacity.

Changes to biodiversity as a result of climate change are already evident and include shifts in climatic envelopes, changes in bird migration patterns, expansion of some vegetation types at the expense of others, and mass coral bleaching events as a result of high sea surface temperatures. A number of species which are vulnerable to temperature spikes (eg green ringtail possum) will be affected physiologically.

Some of Australia's most valued and iconic natural areas and the rich biodiversity they support are among the most vulnerable to climate change. Global biodiversity hotspots include:

- Great Barrier Reef
- South-west Western Australia
- Australian Alps
- Queensland Wet Tropics
- Kakadu wetlands – eg threatened by rising sea levels and saltwater intrusion, invasive weeds and feral animals

An increase in extreme events will also take its toll on biodiversity. Predicted changes in the intensity, frequency and extent of the disturbances such as fire, cyclone, drought and flood, will place existing vegetation under stress and favour species able to rapidly colonise denuded areas. This often results in the spread of "weed" species and major changes to the distribution and abundance of many indigenous species.

Reducing climate change impacts

Australia needs to develop an informed and integrated approach to dealing with the management and conservation of Australia's biodiversity. There needs to be an approach that is multi-disciplinary and comprehensive. Our three tiers of government need to work together in responding to the biodiversity challenges.

³ Endocrine disrupters: see NIH web site
<http://www.niehs.nih.gov/health/topics/agents/endocrine/index.cfm>

Moreover, climate change must not be viewed in isolation. Strategies to reduce climate change impacts on Australia's biodiversity include a mixture of adaptation and mitigation measures such as:⁴

- containing human population growth⁵
- significantly reducing greenhouse gas emissions
- ensuring bio-diverse carbon capture
- tackling pre-existing stressors on biodiversity
- preparing for the effects of major natural disturbances, and
- significantly improving off-reserve conservation efforts.

The first strategic assessment of the vulnerability of Australia's biodiversity to impacts to climate change was produced in 2009.⁶ The assessment – undertaken by an independent Expert Advisory Group chaired by Professor Will Steffen from the ANU – reported to the Department of Climate Change. The group of eight leading scientists warned that climate change presents a threat to our diversity 'equivalent to those of the abrupt geological events that triggered the great waves of extinction in the past'.⁷

Its Summary Report indicated that significant changes are required in policy and management for biodiversity conservation to meet these types of challenges.

The Academy supports those required changes, which include:

- Changing management priority – future management objectives aimed at maintaining species in their current composition, locations and ecosystems will no longer be appropriate. The priority must be to maintain the provision of ecosystem services through a diversity of well-functioning ecosystems.
- A central strategy is giving ecosystems the best possible chance to adapt by enhancing their resilience – this can be done in various ways such as managing appropriate connectivity of fragmented ecosystems, enhancing the National Reserve System, protecting key refugia and implementing more effective control of invasive species.
- Risk-spreading conservation strategies, coupled with active adaptive management approaches – risk assessments are a key approach to identify especially vulnerable species and ecosystems, and deal effectively with an uncertain climatic future.

⁴ Lindenmayer DB, Steffen W, Burbidge AA, et al., 2010 Conservation strategies in response to rapid climate change: Australia as a case study *Biological Conservation* 143: 1587-1593.

⁵ *The impact of population growth on tomorrow's world* 2009. Theme issue, Philosophical Transactions of the Royal Society, **364**:2969-3124

⁶ Steffen W, Burbidge AA, Hughes L, Kitching R, Lindenmayer D, Musgrave W, Stafford Smith M and Werner PA (2009) *Australia's Biodiversity and Climate Change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change*. A report to the Natural Resource and Management Ministerial Council commissioned by the Australian Government. CSIRO Publishing. At: <http://www.climatechange.gov.au/publications/biodiversity/~media/publications/biodiversity/biodiversity-vulnerability-assessment-lowres.ashx>

A summary for policy makers 2009 is also available at:

<http://www.climatechange.gov.au/~media/publications/biodiversity/biodiversity-summary-policy-makers.ashx>

⁷ *Ibid* p2

- Reorientation of policy and legislative frameworks, and reform of institutional and governance architecture – these actions can support novel strategies for biodiversity conservation such as integrated regional approaches tailored for regional differences in environments, climate change impacts and socio-economic trends.
- Rapid and effective mitigation of climate change – without it, more effective policy and management strategies alone will not suffice to reduce the high risk of an accelerating wave of extinctions throughout the 21st century and beyond.

The Academy reiterates the five key messages in the report which support effective policy and management responses to the threat to biodiversity from climate change. In summary, they are:

- Reform our management of biodiversity
- Strengthen the national commitment to conserve Australia's biodiversity
- Invest in our natural life support system – our environment
- Build innovative and flexible governance systems so that they can better deal with the challenges of climate change, and
- Meet the mitigation challenge.

Humans are ultimately the main threat to the environment, especially in Australia, per capita the world's most effluent and most affluent nation. We are the drivers of climate change, so the first priority must be containing human population growth, on which everything else depends. This debate is essential if we are to preserve our biodiversity.

Unrecognised effects of human populations on wildlife (as well as on humans themselves) are endocrine disruptors. These are chemicals that disturb the endocrine system and produce serious developmental, reproductive, neurological, and immune effects in both humans and wildlife. There are many substances, both natural and man-made, that cause endocrine disruption, including pharmaceuticals (such as oestrogen from the contraceptive pill released into our waterways), dioxin and dioxin-like compounds, polychlorinated biphenyls, DDT and other pesticides, and plasticizers such as bisphenol A. These substances are increasingly released into the environment, and undoubtedly will influence the health and survival of our fauna.

However, much of our current research has only scratched the surface, and as indicated above, we still don't have a comprehensive knowledge of the species that require urgent efforts to conserve them. Better funding is required in order to carry out the fundamental research that is required to underpin management programs and conservations strategies.

Ecological systems are very complex and modelling climate change impacts on biodiversity requires in depth information about a large number of factors such as species distribution, capacity of species to migrate, reproductive success, degree to which species can naturally adapt to climate change, and evolutionary history of species and previous responses to natural variations in climate.

Key research questions generally remain poorly answered. For example, we need to know what are the most appropriate species and ecosystem indicators for climate change and how should these be best monitored. Ongoing monitoring is vital. We need to build baseline datasets, including key indicators, to measure biodiversity conditions and trends over time. Also needed are a national set of long-term

monitoring protocols and sites. Beyond that, we need to catalogue, study and understand the variety and diversity of species that we do not even know we have.

Many more vital research questions remain such as: what are the important refugia to conserve biodiversity in a changing climate and how should these be appropriately managed; what species will need to and be able to disperse to new locations; and so on.

Finally, consideration might be given to reviewing Australia's existing Federal and State legislation to ensure that there is adequate biodiversity protection in all Australian jurisdictions. It might also be timely to consider harmonisation of relevant State and Federal legislation where there are significant differences in protecting our biodiversity.

Conclusion

The decline of Australia's biodiversity is a result of historical and current human decisions and actions. The impacts are now better understood and more needs to be done to reduce the size of our ecological footprint in order to protect, preserve and restore our rich biodiversity. More people, more feet!

The Australian Academy of Science endorses the view of Steffen et al expressed in their report to the Natural Resource Management Ministerial Council, that in order to avoid an escalating loss of biodiversity with changes to climate, there need to be implemented a number of changes to management and policy.

While initiatives such as establishing and managing reserves, revegetation programs, weed and feral animal control are necessary and play a significant role in protection and restoration, without urgent action to reduce greenhouse gas emissions, the likely scenario will be mass extinctions. Increasing our understanding of the effects of climate change on biodiversity, and developing practical ways of mitigating such effects, are critical to limit the damage. Climate change will tip the balance for some species unless effective action is taken.

Without undertaking further significant work to fill in the gaps that currently exist in our knowledge of the species affected and their interaction with their environment, our endeavours to protect, stabilise and conserve our biodiversity will be flawed.