Climate change and the legal framework for biodiversity protection in Australia: a legal and scientific analysis

DISCUSSION PAPER

Prepared by the Environmental Defender's Office (NSW)
June, 2009

Climate change and the legal framework for biodiversity protection in Australia: a legal and scientific analysis

Discussion paper

Prepared by the Environmental Defender's Office (NSW)
June, 2009

EXECUTIVE SUMMARY

Introduction

Climate change has profound implications for biodiversity conservation in Australia. It will require us to re-evaluate our current approach to conservation, which will involve consideration of ethical questions such as what to protect and why. It will require dynamic and responsive tools, and overarching approaches.

This paper analyses the current legal regime at a Federal level in Australia and its adequacy to protect biodiversity under climate change. The paper was prepared with the assistance of a number of legal and scientific experts who provided written feedback on a draft discussion paper, and attended a one-day roundtable.

The first part of the paper outlines the predicted impacts of climate change on biodiversity and identifies general scientific principles for the protection of biodiversity under climate change.

The second part of the paper describes and analyses a range of legislative tools in terms of their efficacy in protecting biodiversity currently, as well as how adaptive and applicable they will continue to be in the future, in light of climate change.

The paper provides a set of recommendations for legislative and policy reform necessary for the conservation of biodiversity under climate change. The recommendations are as follows:

Recommendations

Legislative objectives

- Maintain the aspirational legislative objective of seeking to protect all species from extinction
- Ensure that the legislation reflects the realities of climate change by providing sufficient guidance as to how we will try to achieve the legislative objectives.
- Facilitate a national debate on the appropriateness of our current approach to biodiversity conservation under climate change.
- Ensure that the Scientific Committee maintains its independence from the Australian government and plays a key role in informing decisions.

Protected areas

Establishment of protected areas

- The NRS framework should be maintained as it provides a robust framework to combat the impacts of climate change on protected areas.

- Much greater funding and resources should be provided to ensure that the implementation of the NRS framework occurs at a much faster rate.
- 'Threat' should be included as a criterion in the process to prioritise what areas should be protected under the NRS framework.
- The 'adequacy' goal and alternative strategies to combat the impacts of climate change on the NRS system should be evaluated by using tools that can analyse the persistence probabilities of a range of species.
- Decision-theory frameworks should be developed for protected area establishment to ensure the most effective investment of funds under climate change.

Management of protected areas

- Barriers to the effective implementation of adaptive management frameworks in protected area management should be identified and addressed.
- Adaptive management should be incorporated as a management principle under the *EPBC Act 1999* for all types of protected areas.
- Funding for protected area management should be increased to allow for the effective implementation of adaptive management frameworks.

Lists

- The listing of species that play a key role in ecosystem function ('key functional species') should be enabled under the *EPBC Act 1999.*
- The listing of species that are not currently threatened but that are likely to be vulnerable to climate change should be explicitly enabled under the *EBPC Act 1999.*
- The definition of 'native' under the *EPBC Act 1999* should be changed to address the situation of native species moving in response to climate change.
- A review of how ecological communities are defined under the *EBPC Act 1999* should be undertaken with a view to ensuring their efficacy under climate change.
- The *EPBC Act 1999* should be amended to enable the listing of populations.
- The listing process under the *EPBC Act 1999* should be amended to de-politicise listing decisions and give a greater role to the Scientific Committee.

Critical habitat

- The definition of critical habitat under the *EPBC Act 1999* should be amended to cover 'an area of land that is considered essential for the conservation of protected wildlife, even though the area is not presently occupied by the wildlife' (as in Queensland).

Recovery planning

- A framework for prioritisation between listed species should be developed under the *EPBC Act 1999*, taking into account four related criteria: species value, the cost of management, the benefit of management, the likelihood of success. The criteria should take into account the impacts of climate change.
- The framework for prioritisation between listed species should be informed by the public debate over what we try to protect and why.

- Conservation budgets for threatened species recovery and threat abatement actions should be increased to address the continued decline in biodiversity and deal with the challenges of climate change.
- Recovery plans under the *EPBC Act 1999* should be made shorter, simpler, and be more tightly focused on recovery actions and outcomes.
- Recovery plans under the *EBPC Act 1999* should facilitate adaptive management and be more flexible and responsive to change and uncertainty.
- A greater focus should be given operationally under the *EPBC Act 1999* to threat abatement planning over recovery planning.
- A greater focus should be given operationally under the *EBPC Act 1999* to multi-species recovery plans over single-species plans only where species can be appropriately grouped based on threat similarity using robust approaches.

Threat abatement planning

- A greater focus should be given operationally under the *EPBC Act 1999* to threat abatement planning over recovery planning (as noted above).
- Threat abatement efforts under the *EPBC Act 1999* should generally be focussed on sets of threats that overlap and interact to affect large numbers of species.
- Threat abatement plans under the *EBPC Act 1999* should be made shorter, simpler, and be more tightly focused on threat abatement actions and outcomes.

Landscape-scale assessment

A suggested model for landscape-scale assessment is as follows:

- Before approving a strategic assessment under the *EPBC Act 1999*, the Minister must be satisfied on reasonable grounds that the policy, plan or program will meet the 'overall improve or maintain' test.
- In deciding whether the 'overall improve or maintain' test has been met under the *EPBC Act 1999*, the Minister must be satisfied that the following criteria are met –
    - o Areas of high conservation value for listed threatened species and ecological communities are protected
    - o Any loss of other areas of less value for listed threatened species and ecological communities is offset in accordance with offset rules
- Notwithstanding the above, if the Minister is of the opinion that a better outcome can be achieved through a minor variation of the rules relating to high conservation value areas and offsets under the *EPBC Act 1999*, he/she can refer the strategic assessment to an expert panel
- The expert panel should be required under the *EPBC Act 1999* to assess whether a better outcome is likely to be achieved without strict application of rules relating to high conservation value areas and offsets.
- The expert panel may seek public submissions and should make recommendations in a report to the Minister, which should be made publicly available under the *EPBC Act 1999.*

- The Minister should be required under the *EBPC Act 1999* to consider the expert panel's report when making a decision, and should publish reasons for the decision.

Bioregional plans

- Enabling the adaptation of biodiversity to climate change should form a key component of any bioregional plans made.

Site scale assessment

- A greater focus should be given to landscape assessment as opposed to site scale assessment, however site scale assessment will remain relevant.
- The site based assessment process should be amended to require the Minister to consider whether a site will be important for biodiversity under climate change.

Conservation on private land

- Financial and bureaucratic barriers that impede the take-up of conservation initiatives should be identified and removed.
- The objectives and rules of the different schemes should be better co-ordinated/aligned so that conservation efforts are more effectively targeted.
- Greater incentives should be provided for the restoration of land, including for the conservation of land which is not of high conservation value.
- An equal focus should be given operationally to more flexible schemes, such as wildlife refuges under the to improve the range of options for private conservation.
- A native vegetation trigger should be introduced under the EPBC Act to enable the Commonwealth to take a lead role in stopping broadscale clearing of native vegetation across Australia.

External influences

- Funding for biodiversity conservation should be increased to allow for the effective utilisation of statutory conservation tools.
- The conservation of biodiversity must remain a fundamental principle in all adaptation and mitigation responses to climate change.

Climate change and the legal framework for biodiversity protection in Australia: a legal and scientific analysis

Discussion paper

Prepared by the Environmental Defender's Office (NSW)
June, 2009

Introduction

.1 The issue

We are already failing to adequately address the decline of biodiversity in Australia as a result of current key threats such as habitat loss, invasive species, changed disturbance regimes, and over-exploitation of native species. Climate change has emerged relatively recently as a key additional threat to biodiversity and presents a further major challenge to biodiversity conservation in Australia.

Our current approach to biodiversity conservation in Australia is based largely on a 'snapshot'; a static approach informed by where things are at a particular point in time and seeking to preserve species and communities as, and where, they are. As Dunlop and Brown have stated:[1]

> *Fundamental to the vast majority of reserve declarations and conservation programs, is the idea that the basic character of the biodiversity being protected in any area will remain essentially the same over time*.

Climate change requires us to re-evaluate our current approach to conservation, which will involve consideration of ethical questions such as what to protect and why. It will require dynamic and responsive tools, and overarching approaches.

.2 The process

This paper begins the process of evaluating whether the current legal framework for the protection of biodiversity at a Federal level is capable of such dynamism and hence is adaptable to the challenges ahead. Very little has been written from a legal point of view on this issue. There is much more work and thinking that needs to be done, and it is in this spirit that the paper has been written.

The topic covered by the paper is very large and complex and it was not possible to discuss the implications of climate change on every aspect of the legal framework at a Federal level that affects biodiversity. The paper focuses on:

- Terrestrial biodiversity (and not freshwater or marine biodiversity).
- Legislation that is specifically designed to protect biodiversity or legislation that has significant application to biodiversity (and not legislation that may adversely affect biodiversity, such as water, forestry, or mining laws).[2]

---

[1] Dunlop M and Brown P (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

[2] As Bates has noted there are three categories of legislation pertaining to biodiversity conservation:

- Category 1 – Legislation that is specifically designed to protect biodiversity, for example, threatened species and protected areas legislation.
- Category 2 – Legislation that has significant application to biodiversity protection, but that is not specifically designed to protect biodiversity (e.g. planning laws).

- Key *statutory* tools for the protection of biodiversity at a Federal level (and not non-statutory policies, strategies, plans or programs).

The paper was prepared by the Environmental Defender's Office (NSW) (EDO) with the assistance of a number of legal and scientific experts. The EDO engaged experts in two ways: by holding a roundtable to discuss the draft paper; and by seeking written feedback on the draft paper. The experts who participated in the roundtable and provided written feedback are listed below.

Roundtable attendees	**Written feedback**
Tony Auld Dept of Environment and Climate Change	Paul Adam University of New South Wales
Gerry Bates University of Sydney	Sarah Bekessy RMIT University
Michael Dunlop CSIRO Sustainable Ecosystems	Chris Dickman University of Sydney
Martin Fallding Land & Environment Planning	Brendan Wintle University of Melbourne
David Farrier University of Wollongong	
Simon Ferrier CSIRO Entomology	
Jan McDonald Griffith University	
Chair - Judy Lambert Community Solutions	

The purpose of the roundtable and the written feedback processes was to provide a mechanism to discuss and seek feedback on the ideas in the draft paper. Importantly, the purpose was not to seek endorsement of the paper from participants. The views expressed in the paper are the views of the EDO, and are not necessarily the views of the experts.

The discussion points and a summary of the discussion that was had in relation to those points at the roundtable are provided in the Appendix.

Importantly also, the paper was not prepared in consultation with conservation and community groups or any other stakeholders. Rather, the paper is intended to be a legal and scientific analysis of the issues for consideration by government. The EDO sees consultation on these issues as a role for the Australian government.

.3 The structure

The paper is structured as follows:

- Section 2 – This section briefly describes the predicted impacts of climate change on biodiversity.
- Section 3 – This section briefly describes how species have adapted to climate change in the past.

- Category 3 – Legislation that is not designed to protect biodiversity, but the application of which may adversely affect biodiversity (e.g. forestry, mining, water, and fisheries laws).

The focus of this paper is on Category 1 and Category 2 legislation.

Bates G (2006) *Environmental Law in Australia* 6th ed, LexisNexis, Butterworths, Australia.

- Section 4 – This section identifies some general scientific principles for the protection of biodiversity under climate change.
- Section 5 – This section:
    - o Describes each statutory conservation tool.
    - o Briefly evaluates how well each statutory conservation tool is currently working in terms of protecting biodiversity.
    - o Briefly evaluates how adaptive and applicable each statutory conservation tool is in light of climate change.
- Section 6 – This section discusses a range of external factors that may influence the ability of the statutory conservation tools to protect biodiversity.

In section 5 of the paper, boxes appear under each statutory conservation tool, which summarise the key recommendations that we feel the Australian government needs to consider in relation to each statutory conservation tool.

Impacts of climate change on biodiversity

It is well established that climate change is already impacting, and is likely to have more extensive impacts on, biodiversity, both globally[3] and in Australia.[4] Climate change is expected to become the first or second greatest driver of global biodiversity loss over the next century.[5]

Past climate changes have caused species extinctions and major reorganizations of ecological communities. Current climate change is likely to cause a greater problem for species due to a combination of the rapid pace of change (predicted to be faster than most changes during the last 1.8 million years) and the extent of existing pressures on biodiversity.[6] Indeed, independent of climate change, biodiversity is predicted to decrease in the future due to multiple existing pressures such as habitat loss, habitat fragmentation, invasive species, etc.[7]

There are a large number of studies that document the impacts that climate change has already had on biodiversity and that attempt to predict the future impacts. However, there is considerable scientific uncertainty regarding the exact nature and extent of the impacts.[8] Such uncertainty will have a significant

---

[3] Intergovernmental Panel on Climate Change (2007) *Climate Change 2007: Synthesis Report* IPCC Geneva.

[4] Hughes L (2003) 'Climate change and Australia: Trends, projections and impacts' *Austral Ecology* 28: 423-443.

[5] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[6] Secretariat of the Convention on Biological Diversity (2003). *Interlinkages between biological diversity and climate change. Advice on the integration of biodiversity considerations into the implementation of the United Nations Framework Convention on Climate Change and its Kyoto protocol.* Montreal, SCBD, 154p. (CBD Technical Series no. 10); Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[7] Intergovernmental Panel on Climate Change (2002) *Climate Change and Biodiversity* IPCC Technical Paper IV, IPCC, Geneva.

[8] Dunlop M and Brown P (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia; Hennesy K, Fitzharris B, Bates B, Harvey N, Howden S, Hughes L, Salinger J and Warrick R (2007) Australia and New Zealand. *Climate Change 2007: Impacts,*

influence over the way we think about how to address the impacts of climate change on biodiversity and the solutions we arrive at.

In summary, the impacts of climate change are likely to include:[9]

- Reductions in the geographic range of species.
- Changes to the timing of species' lifecycle events.
- Changes in population dynamics and survival.
- Changes in the location of species' habitats.
- Increases in the risk of extinction for species that are already vulnerable.
- Increased opportunity for range expansion of invasive species.
- Changes in the structure and composition of ecosystems and communities.
- Changes in coastal and estuarine habitat due to rising sea levels.

Indirect impacts include impacts due to changes to the intensity and magnitude of existing pressures, such as fire regimes and invasive species.[10]

It is important to note that climate change will impact biodiversity not only as a result of average changes to climatic variables, but also because of changes to extreme events, which are predicted to increase in frequency and severity. Changes to extreme events are likely to have a major influence in determining the impacts of climate change on biodiversity.[11]

Species most vulnerable to climate change will be those with long generation times, low mobility, small or isolated ranges, and low genetic variation,[12] as well as species with restricted population sizes or specific habitat requirements. Certain ecosystems will also be particularly vulnerable, including alpine ecosystems, coral reefs, and mangrove systems.[13]

Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK.

[9] *National Biodiversity and Climate Change Action Plan 2004-2007*. See also Thomas C (2003) "Climate change and habitat fragmentation" in Green RE, Harley M, Miles L, Scharlemann J, Watkinson A and Watts O (2003) *Global Climate Change and Biodiversity* University of East Anglia, Norwich.

[10] *National Biodiversity and Climate Change Action Plan 2004 -2007* at pp 12 and 14. See also Thomas C (2003) "Climate change and habitat fragmentation" in Green RE, Harley M, Miles L, Scharlemann J, Watkinson A and Watts O (2003) *Global Climate Change and Biodiversity* University of East Anglia, Norwich.

[11] Intergovernmental Panel on Climate Change (2002) *Climate Change and Biodiversity* IPCC Technical Paper IV, IPCC, Geneva.

[12] Howden M, Hughes L, Dunlop M, Zethoven I, Hilbert D and Chilcott C (2003) *Climate change impacts on biodiversity in Australia*, Outcomes of a workshop sponsored by the Biological Diversity Advisory Committee, 1-2 October 2002, Commonwealth of Australia.

[13] Secretariat of the Convention on Biological Diversity (2003). Interlinkages between biological diversity and climate change. Advice on the integration of biodiversity considerations into the implementation of the United Nations Framework Convention on Climate Change and its Kyoto protocol. Montreal, SCBD, 154p. (CBD Technical Series no. 10).

How will species adapt to climate change?

In the past, species have adapted to climate change through a combination of the following mechanisms:[14]

- Acclimatization. This mechanism involves changes in behaviour or the development of life history strategies (such as the timing or location of flowering events or breeding) more suited to the new climate within the lifetime of an individual. It is likely to primarily occur in species that already encounter a wide range of climatic conditions.[15]
- Migration and dispersal. This mechanism involves the movement of species to more suitable climates over generations. Scientists have suggested two mechanisms by which this occurs: 1) rapid long-distance dispersal along a range margin, or 2) local dispersal from climate refugia. The relative importance of each mechanism is under debate.[16] This mechanism appears to be the primary way that species have survived past climate changes.[17]
- Evolutionary adaptation. This mechanism involves the development of new genetic attributes more suited to the new climate over generations. It ultimately depends on adequate levels of genetic variation within and between populations and a slow enough rate of climate change for evolution to occur.[18]

During past climate changes, a species potentially had all three of these adaptation mechanisms available to it. However, as suggested, this may no longer be the case.[19] For example, due to the predicted rapid pace of climate change, many species may not be able to migrate fast enough and in-situ evolutionary adaptation is unlikely to be possible for most populations.[20] Also, due to the extent of habitat loss and fragmentation, many species may no longer be able to migrate to more suitable habitats.[21]

---

[14] Mackey B (2007) 'Climate change, connectivity and biodiversity conservation' In: *Protected Areas: buffering nature against climate change. Proceedings of a WWF and IUCN World Commission on Protected Areas symposium, 18-19 June 2007, Canberra.* (eds Taylor and Figgis). WWF-Australia, Sydney; Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

[15] Bawa K and Dayanandan S (1998) 'Global climate change and tropical forest genetic resources' *Climatic Change* 39: 473-485.

[16] Pearson R (2006) 'Climate change and the migration capacity of species' *TRENDS in Ecology and Evolution* 21: 111-113.

[17] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

[18] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

[19] Mackey B (2007) 'Climate change, connectivity and biodiversity conservation' In: Protected Areas: buffering nature against climate change. Proceedings of a WWF and IUCN World Commission on Protected Areas symposium, 18-19 June 2007, Canberra. (eds Taylor and Figgis). WWF-Australia, Sydney.

[20] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[21] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

General principles for biodiversity protection under climate change

As noted, there is considerable scientific uncertainty regarding the exact nature and extent of the impacts of climate change on biodiversity. However, a number of papers have identified some general principles that various scientists argue we need to implement to address impacts. Most of these general principles are not new in the context of biodiversity conservation.

We have identified these general principles as a way of assisting us analyse the adequacy and adaptability of the current legal framework to protect biodiversity under climate change. We have not undertaken a comprehensive review of the literature, but rather have identified the principles from key review papers.

We recognise that there may not be scientific consensus on all of these general principles or on the relative importance of each, and that for many there is considerable debate as to how the principle should be applied in practice. We also recognise that some principles are controversial within the general public.

.1 Facilitate adaptation and enhance resilience and resistance

As noted, in the past, species have adapted to climate change through a range of adaptation mechanisms. It follows that to minimise the impacts of climate change on biodiversity, our overarching goal should be to facilitate adaptation by minimising disruption to these adaptation mechanisms as much as possible.[22]

However, as noted, we also need to recognise that compared to past changes, current climate change is likely to cause additional problems for species because of the extent of existing pressures on biodiversity. So, for example, while as a general rule we need to facilitate adaptation by facilitating dispersal, we also need to be aware that this may not always get the best outcome (e.g. facilitating dispersal may cause the further spread of invasive species).

The goal of adaptation can be defined as reducing the risk of adverse impacts by enhancing the 'resilience' or 'resistance' of ecosystems to change.[23] Resilience refers to the ability of a system to 'bounce back' after change, while resistance refers to the ability of a system to remain un-impacted by change.[24] So, resilience strategies attempt to enhance a systems ability to recover from change, while resistance strategies attempt to enhance a systems ability to resist change.[25]

A key issue for managers under climate change will be the question of whether and when to attempt to build resilience to change (resilience strategies) or to

---

[22] Mackey B (2007) 'Climate change, connectivity and biodiversity conservation' In: Protected Areas: buffering nature against climate change'. Proceedings of a WWF and IUCN World Commission on Protected Areas symposium, 18-19 June 2007, Canberra. (eds Taylor and Figgis). WWF-Australia, Sydney.

[23] Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

[24] Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

[25] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

attempt to resist change (resistance strategies). Over the last 20 years, scientists have advocated more resilience strategies than resistance strategies.[26] However, the strategies are not mutually exclusive. Some threatened species and ecosystems may warrant highly intensive management to maintain them as and where they are, while resilience strategies may be more appropriate for other, more widespread species and ecosystems.[27]

A number of scientists have identified general principles that can be applied to enhance the resilience of ecosystems.[28] Each of these principles is discussed briefly below along with the other general principles that various scientists argue we need to implement to address the impacts of climate change on biodiversity.

.2 Ensure representation (diversity of habitat types) and replication

'Representation' and 'replication' are well established principles of biodiversity conservation (and in particular, conservation planning)[29] and are also key principles in building 'ecosystem resilience'.[30] Representation refers to the need to protect the full range of biodiversity (e.g. each vegetation type). Replication refers to the need to protect multiple examples of each unit of biodiversity (e.g. each vegetation type) to order to spread risk (e.g. a fire might destroy one example, but replication aims to ensure that other examples remain).

Scientists argue that these two principles will continue to be important in protecting biodiversity under climate change.[31] Indeed, Dunlop and Brown argue that the protection of a diversity of habitat types (representation) should be one of the key strategies to combat the impacts of climate change. As they state:[32]

> *By sampling a diversity of communities…[we] are also sampling the underlying geographic diversity of the landscape…Thus, a set of areas that samples a high diversity of communities now will probably also capture a*

---

[26] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[27] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[28] Forman R (1995) 'Some general principles of landscape and regional ecology' *Landscape Ecology* 10(3):133-142; Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86; Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

[29] Margules C and Pressey B (2000) 'Systematic conservation planning' *Nature* 405: 243-253.

[30] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

[31] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

[32] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia at p 116.

high diversity of communities under future climates, even if the composition of the communities is different in the future.

Many other scientists argue along a similar theme. They argue that a key strategy under climate change should be to ensure that the full range of bioclimatic variability is captured within protected areas and across landscapes.[33]

Hodgson et al[34] argue that a primary focus of conservation efforts under climate change should be regions with high existing environmental heterogeneity, such as high topographic diversity (e.g. mountain ranges) and high habitat diversity.

Noss argues further that because there is considerable uncertainty over which forest or vegetation types will be most sensitive to climate change, protecting a range of types will help ensure that some resistant and resilient types persist.[35]

.3 Protect and create large patches of vegetation

Protecting large patches is another well established principle of biodiversity conservation. 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.[36]

In addition, large patches are the only parts of a landscape that sustain viable populations of interior species, provide core habitat for large vertebrates, and permit near-natural disturbance regimes.[37] Large patches are also vital in supporting genetically diverse populations.[38]

However, while large patches are important, it is important to note that many studies have shown that small and medium sized patches may be of significant ecological value. In addition, the size of a patch is relative – what constitutes a large patch of habitat for a beetle may be a small patch for a bird or mammal.[39]

---

[33] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[34] Hodgson J, Thomas C, Wintle B, Moilanen A (in press) 'Climate change, connectivity and conservation decision-making – back to basics' *Journal of Applied Ecology*.

[35] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590.

[36] Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

[37] Forman R (1995) 'Some general principles of landscape and regional ecology' *Landscape Ecology* 10(3):133-142.

[38] Lindenmayer D and Burgman M (2005) *Practical Conservation Biology.* CSIRO Publishing, Australia.

[39] Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

Many scientists argue that increasing the size of protected areas and maintaining and restoring large patches of vegetation will remain a key strategy under climate change.[40] Indeed, some scientists argue that because habitat loss remains the key threat to biodiversity and because the relationship between the size of a patch and the conservation value of the patch is so well established, this strategy should remain the primary focus of conservation efforts under climate change.[41]

.4 Consider connectivity

Connectivity refers to the ability of species and ecological processes to move through landscapes. Connectivity can be defined in terms of:[42]

- Habitat connectivity (the connectedness of habitat patches for a given species).
- Landscape connectivity (the connectedness of patches of a particular land cover type).
- Ecological connectivity (the connectedness of ecological processes).

Connectivity, and in particular the value of habitat corridors, has been much debated by scientists. Although scientists agree about the importance of connectivity, disagreement arises when connectivity is equated simply with habitat corridors or linear strips of vegetation linking other patches.[43] Connectivity science is still young, and the assessment of the effectiveness of various connectivity strategies is still in its infancy.[44] Some of the key difficulties associated with establishing the importance of connectivity include:[45]

- The difficulty in studying it (connectivity is interrelated with the difficult area of dispersal biology).
- The difficulty of measuring it (connectivity metrics can be very problematic).
- The appropriate scale over which it should be understood (e.g. landscape or patch scale).

---

[40] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[41] Hodgson J, Thomas C, Wintle B, Moilanen A (in press) 'Climate change, connectivity and conservation decision-making – back to basics' *Journal of Applied Ecology*.

[42] Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

[43] Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

[44] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[45] Lindenmayer D, Hobbs R, Montague-Drake R, Alexandra J, Bennett A, Burgman M, Cale P, Calhoun A, Cramer V, Cullen P, Driscoll D, Fahrig L, Fischer J, Franklin J, Haila Y, Hunter M, Gibbons P, Lake S, Luck G, MacGregor C, McIntyre S, MacNally R, Manning A, Miller J, Mooney H, Noss R, Possingham H, Saunders D, Schmieglow F, Scott M, Simberloff D, Sisk T, Tabor G, Walker B, Wiens J, Woinarski J and Zavaleta E (2008) 'A checklist for ecological management of landscapes for conservation' *Ecology Letters* 11: 78-91.

- The fact that suitable habitat connectivity will vary between different species.

Despite these difficulties, many scientists agree that, as a general principle, increasing connectivity is a robust strategy to address the impacts of climate change on biodiversity.[46] Indeed, increasing connectivity is the strategy most recommended by scientists to combat climate change over the last 20 years.[47]

However, many scientists warn of a significant need for more empirical data to support the effectiveness of various connectivity strategies.[48] Some scientists argue that the significant uncertainties associated with connectivity science make it potentially inefficient as a primary conservation strategy and are concerned that it may redirect resources away from more certain and effective strategies.[49]

Other scientists point out that increasing connectivity may have adverse effects. For example, it may increase the spread of invasive species or undesirable fire.[50] As Dunlop and Brown identify, reducing connectivity (by placing populations on islands, or fencing, etc) is a key element of many threatened species programs.[51]

.5 Improve the management of the 'matrix'

It is well established that protected areas will not adequately protect biodiversity because they are too few, too isolated, not always well managed,[52] and are often not located appropriately to contribute to representation.[53] As such, biodiversity conservation must be complemented by the appropriate management of biodiversity in the modified areas surrounding habitat patches (the 'matrix').[54]

---

[46] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86; Mackey B (2007) 'Climate change, connectivity and biodiversity conservation' In: *Protected Areas: buffering nature against climate change. Proceedings of a WWF and IUCN World Commission on Protected Areas symposium, 18-19 June 2007, Canberra.* (eds Taylor and Figgis) pp 90-96. WWF-Australia, Sydney; Pressey R, Cabeza M, Watts M, Cowling R, and Wilson K (2007) 'Conservation planning in a changing world' *Trends in Ecology and Evolution* 22(11): 583-592.

[47] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[48] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[49] Hodgson J, Thomas C, Wintle B, Moilanen A (in press) 'Climate change, connectivity and conservation decision-making – back to basics' *Journal of Applied Ecology*.

[50] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[51] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[52] Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

[53] Margules C, Pressey B (2000) 'Systematic conservation planning' *Nature* 405: 243-253.

[54] Franklin J and Lindenmayer D (2009) 'Importance of matrix habitats in maintaining biological diversity' Proc Natl Acad Sci 106: 349-350; Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

A recent paper highlighted the importance of the matrix in determining the species composition of adjacent habitat patches,[55] and suggested that the appropriate management of the matrix is fundamental to the protection of the vast majority of species.[56] The paper concluded that:

> *Improving matrix quality may lead to higher conservation returns than manipulating the size and configuration of remnant patches for many of the species that persist in the aftermath of habitat destruction*.

A review by Fischer et al.[57] has established general principles for the management of biodiversity in the agricultural matrix. The principles identified in the review include many of the principles described above that are likely to enhance ecosystem resilience, such as protecting large patches or increasing connectivity, but also include three additional principles, namely:

- Maintain structural complexity in the matrix.
- Maintain landscape heterogeneity (the spatial patchiness and variability in landscape patterns, such as different land uses and land-use intensities).
- Create buffer zones around protected areas and important habitat patches.

They argue that a matrix with a similar vegetation structure to surrounding habitat patches will provide habitat for some species, increase landscape connectivity, and reduce edge effects at the boundaries of habitat patches. The maintenance of a structurally complex matrix is particularly important where protected areas or habitat patches are small or poorly connected.[58]

The creation of buffer zones around protected areas and important habitats is a strategy that is commonly advocated by scientists to combat the impacts of climate change.[59] The creation of buffers is an alternative, but not mutually exclusive strategy to maintaining structural complexity in the matrix. Buffer zones may reduce edge effects and may enhance connectivity. Buffers can be applied at various scales (local to regional). They are a particularly important strategy where land surrounding vegetation patches exerts a strong negative influence over the patches (e.g. by acting as a source of invasive species).[60]

The management of biodiversity in the matrix is likely to become more important under climate change as many species migrate from large habitat patches and

---

[55] Prugh L, Hodges K, Sinclair R, Brashares J (2008) 'Effect of habitat area and isolation on fragmented animal populations' *Proc Natl Acad Sci* 105: 20770-20775.

[56] Franklin J and Lindenmayer D (2009) 'Importance of matrix habitats in maintaining biological diversity' *Proc Natl Acad Sci* 106: 349-350.

[57] Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

[58] Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

[59] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[60] Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

the buffering of protected areas and important habitat patches becomes more important to ensure the survival of the populations they currently protect.[61]

.6 Identify and protect climate refugia

Climate refugia are those areas where species are able to persist during periods of climatic stress and from which they can then recolonise over the long term when conditions favourable for their survival and reproduction return.[62]

Refugia occur at various scales (e.g. past glacial refuges covering large areas or local refuges such as riparian areas) and usually include areas that have high topographic diversity (e.g. mountain ranges), wet or damp areas, areas protected from fire, or areas with reliable access to surface or groundwater.[63]

Many scientists argue that identifying and protecting past climate refugia is an important strategy to protect biodiversity under climate change.[64] As suggested, climate refugia are likely to be important sources for recolonization in the future, as well as providing retreats for migrating or translocated species.[65]

As many climate refugia are likely to occur in areas with high topographic diversity, they are also usually areas of high habitat and species diversity and endemism, especially in areas with steep elevation and climatic gradients. Some scientists argue that protecting biodiversity 'hotspots' and centres of endemism is also likely to be a robust strategy to combat the impacts of climate change.[66]

However, Dunlop and Brown argue that merely protecting past refuges will not be sufficient, and that identifying future refuges will be difficult for various reasons. They argue that future refuges are likely to be determined by processes other than merely changes to temperature and other climatic gradients such as changed fire regimes, changed species interactions, land-use changes, or hydrological changes and will vary between species and regions.[67]

.7 Increase the focus on protecting ecosystem functions

---

[61] Heller; Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590

[62] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Dunlop, M. and Brown, P. (2008) 'Implications of climate change for Australia's National Reserve System: A preliminary assessment.' Report to the Department of Climate Change, February 2008. Department of Climate Change, Canberra, Australia.

[63] Dunlop M and Brown P (2008) 'Implications of climate change for Australia's National Reserve System: A preliminary assessment.' Report to the Department of Climate Change, February 2008. Department of Climate Change, Canberra, Australia.

[64] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.; Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Dunlop, M. and Brown, P. (2008) 'Implications of climate change for Australia's National Reserve System: A preliminary assessment.' Report to the Department of Climate Change, February 2008. Department of Climate Change, Canberra, Australia.

[65] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[66] Hodgson J, Thomas C, Wintle B, Moilanen A (in press) 'Climate change, connectivity and conservation decision-making – back to basics' *Journal of Applied Ecology*.

[67] Noss R (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Dunlop, M. and Brown, P. (2008) 'Implications of climate change for Australia's National Reserve System: A preliminary assessment.' Report to the Department of Climate Change, February 2008. Department of Climate Change, Canberra, Australia.

Some scientists have argued for some time that the best way to protect biodiversity and increase the resilience of ecosystems is to focus on protecting the groups of species that play the most important role in maintaining the ecological functions and processes of an ecosystem.

For example, Walker[68] argues that not all species are ecologically equal. Some groups of species (called 'key functional groups') play a more important role in maintaining ecological functions than others. Removing key functional groups causes a 'cascade effect' of impacts throughout the ecosystem, while the loss of the other species has little effect.

Walker[69] argues for a greater focus on identifying and protecting key functional groups, as opposed to a single-species approach focused, for example, on threatened species. He argues that because this will better ensure the ecological functions of an ecosystem are maintained, this approach will maximise the number of species protected, including the many we have not yet identified.

The key functional group approach has lead to the concept of 'ecological redundancy'. An ecosystem will be more stable if it contains many species within each key functional group because if one species is lost from a group, another can step in to play the same role. Conservation efforts should be targeted towards maintaining the diversity amongst key functional groups.[70]

Key functional groups are a key aspect of ecosystem resilience. For example, Bellwood et al.[71] highlighted the importance of three key functional groups amongst fish ('bioeroders', 'scrapers', and 'grazers') and the 'redundancy' amongst the groups in the recovery of coral reefs after disturbance events such as coral bleaching. Many of these fish are not currently adequately protected.

Some scientists argue that the key functional group approach, by maintaining ecological functions and processes, and as a key aspect of ecosystem resilience, will be particularly important in the face of uncertainty under climate change.[72]

However, it will not always be easy to identify what species play key functional roles.[73] Some species, called 'sleeping functional groups', may only play key functional roles in certain circumstances. For example, scientists recently

---

[68] Walker B (1995) 'Conserving biodiversity through ecosystem resilience' *Conservation Biology* 9(4): 747-752.

[69] Walker B (1995) 'Conserving biodiversity through ecosystem resilience' *Conservation Biology* 9(4): 747-752.

[70] Bellwood D, Hughes T, Folke C and Nystrom M (2004) 'Confronting the coral reef crisis' *Nature* 429:827-833.

[71] Bellwood D, Hughes T, Folke C and Nystrom M (2004) 'Confronting the coral reef crisis' *Nature* 429:827-833.

[72] Walker, B. (1995) 'Conserving biodiversity through ecosystem resilience' *Conservation Biology* 9(4): 747-752; Noss, R. (2001) 'Beyond Kyoto: Forest management in a time of rapid climate change' *Conservation Biology* 15(3): 578-590; Elmqvist T, Folke C, Nystrom M, Peterson G, Bengtsson J, Walker B and Norberg J (2003) 'Response diversity, ecosystem change, and resilience' *Frontiers in Ecology and Environment* 1(9): 488-49; Bellwood D, Hughes T, Folke C and Nystrom M (2004) 'Confronting the coral reef crisis' *Nature* 429:827-833; Fischer, J., Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

[73] Walker B (1995) 'Conserving biodiversity through ecosystem resilience' *Conservation Biology* 9(4): 747-752.

discovered that a batfish species, previously thought to play no role in reef recovery, actually played a key role in recovery after a coral bleaching event.[74]

.8 Consider translocation

As noted, the predicted rapid pace of climate change and the extent of existing pressures on biodiversity may mean that many species will be unable to adapt fast enough or to disperse to more suitable climates to ensure their survival.[75] Even if a landscape has good connectivity, species with poor dispersal abilities or those restricted to rare habitat types may not be able to migrate.[76]

A significant number of scientists have advocated translocation (also called 'assisted migration'), which involves moving species from their current locations to habitats that will be suitable in the future, as an appropriate strategy to combat the impacts of climate change on some species.[77]

However, there have been very few studies that analyse the feasibility of translocation programs.[78] In addition, translocation is a contentious issue, for at least three main reasons:[79]

- The challenges associated with moving species successfully. For example, translocations of animals tend to be unsuccessful and costly.
- The difficultly in predicting habitats that will be suitable in the future.
- The significant potential for adverse impacts as a result of introducing new species into existing ecosystems.

Hoegh-Guldberg et al.[80] have developed a decision-making framework for translocation, which aims to identify situations where translocation can be undertaken at low risk and for appropriate conservation benefits. The framework considers factors such as risk of extinction, the dispersal ability of a species, whether other conservation strategies are more appropriate, whether establishment at the new site is technically feasible, whether the ecological risks are acceptable, and whether it is socially and economically acceptable to do so.

.9 Prioritise conservation actions

---

[74] Bellwood D, Hughes T and Hoey A (2006) "Sleeping Functional Group Drives Coral-Reef Recovery" 16 *Current Biology* at pp 2434-2439.

[75] Hoegh-Guldburg O, Hughes L, McIntyre S, Lindenmayer D, Parmesan C, Possingham H and Thomas C (2008) 'Assisted colonisation and rapid climate change' *Science* 321:345-346.

[76] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[77] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[78] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[79] Hoegh-Guldburg O, Hughes L, McIntyre S, Lindenmayer D, Parmesan C, Possingham H and Thomas C (2008) 'Assisted colonisation and rapid climate change' *Science* 321:345-346; Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[80] Hoegh-Guldburg O, Hughes L, McIntyre S, Lindenmayer D, Parmesan C, Possingham H and Thomas C (2008) 'Assisted colonisation and rapid climate change' *Science* 321:345-346.

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. For example, the New Zealand Department of Conservation currently only funds the active management of nine percent of all listed threatened species.[81]

Scientists have long argued for the need to allocate limited resources for biodiversity protection in the most efficient way, which involves a process called 'triage'.[82] In a conservation context, triage can be defined as the process of prioritising the allocation of limited resources to maximise conservation outcomes, relative to conservation goals, under a constrained budget.[83] In essence, triage is about getting the best outcome from limited resources.

Triage is regularly applied implicitly by decision-makers,[84] including in relation to threatened species, where prioritisation occurs largely on the basis of conservation status.[85] In general, more funding is allocated to threatened species listed in the highest category of threat (i.e. those with the highest extinction risk). For example, in 2000, of the 18 completed Federal recovery plans for plants, 17 were for species listed in the highest category of threat.[86]

Scientists have argued that spending the most money on the species with the highest extinction risk is not the most efficient way of minimizing species extinctions, because often these species will require significant resources with only a small chance of success.[87] Joseph et al[88] demonstrated that to maximise conservation outcomes within a limited budget, prioritisation must take into account four factors:

- Species value (this could be defined by conservation status, evolutionary distinctiveness, social value, economic value, ecological function, etc).

---

[81] Joseph L, Maloney R, O'Conner S, Cromarty P, Jansen P, Stephens T, Possingham P (in press) 'Improving methods for allocating resources among threatened species: the case for a new national approach in New Zealand' *Pacific Conservation Biology.*

[82] McIntyre S, Barrett G, Kitching R and Recher H (1992) 'Species triage – seeing beyond wounded rhinos' *Conservation Biology* 6(4): 604-606; Hobbs R and Kristjanson L (2003) 'Triage: How do we prioritise health care for landscapes?' *Ecological Management and Restoration* 4: S39-S4.

[83] Bottrill M, Joseph L, Carwardine J, Bode M, Cook C, Game E, Grantham H, Kark S, Linke S, McDonald-Madden E, Pressey R, Walker S, Wilson K, Possingham H (2008) 'Is conservation triage just smart decision making? *Trends in Ecology and Evolution* 23: 649-654.

[84] McIntyre S, Barrett G, Kitching R and Recher H (1992) 'Species triage – seeing beyond wounded rhinos' *Conservation Biology* 6(4): 604-606; Bottrill M, Joseph L, Carwardine J, Bode M, Cook C, Game E, Grantham H, Kark S, Linke S, McDonald-Madden E, Pressey R, Walker S, Wilson K, Possingham H (2008) 'Is conservation triage just smart decision making? *Trends in Ecology and Evolution* 23: 649-654.

[85] Joseph L, Maloney R and Possingham H (in press) 'Optimal allocation of resources: a project prioritisation protocol' *Conservation Biology.*

[86] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[87] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[88] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology*; Bottrill M, Joseph L, Carwardine J, Bode M, Cook C, Game E, Grantham H, Kark S, Linke S, McDonald-Madden E, Pressey R, Walker S, Wilson K, Possingham H (2008) 'Is conservation triage just smart decision making? *Trends in Ecology and Evolution* 23: 649-654.

- 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).

In addition, any prioritisation process needs to clearly establish the objective of the process and a timeframe over which the objective should be achieved.[89]

A number of prioritisation processes have recently been developed, including 'Back on Track' used in Queensland, the Project Prioritisation Protocol[90] used in New Zealand, and a further approach recently outlined by Briggs.[91]

As noted, climate change is likely to increase the extinction risk of many species, which will further exacerbate the problem of limited conservation budgets. As such, there is likely to be a much greater need to prioritise conservation actions under climate change. It is important to note that prioritisation does not just apply to the recovery of threatened species, but to any situation where a decision involves allocating limited resources with the aim of maximising outcomes.[92]

.10 Recognise and manage for uncertainty

Due to significant uncertainty regarding natural systems, scientists have argued for some time that management within an adaptive framework is vital to improving the protection of ecosystems, particularly those that are highly complex or poorly understood.[93] Adaptive management is an iterative process that seeks to improve management by testing hypotheses and learning from the results, and then incorporating lessons learnt into future management actions.[94]

Under 'active' adaptive management, management is viewed as a large scale experiment where different management actions are applied and the results monitored. It broadly involves the following steps:

- Identifying alternative strategies to meet objectives.

---

[89] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology*; Briggs S (2009) 'Priorities and paradigms: directions in threatened species recovery' Online early: http://www3.interscience.wiley.com/journal/119881249/issue

[90] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*

[91] Briggs S (2009) 'Priorities and paradigms: directions in threatened species recovery' Online early: http://www3.interscience.wiley.com/journal/119881249/issue

[92] Possingham H (2005) 'The business of biodiversity: Applying decision theory principles to nature conservation' Issue 9, *TELA series* Australian Conservation Foundation, Melbourne.

[93] Holling CS (1978) *Adaptive Environmental Assessment and Management*. Blackburn Press, Caldwell, NJ.; Walters C (1986) *Adaptive Management of Renewable Resources*. McGraw Hill, New York.

[94] Holling CS (1978) *Adaptive Environmental Assessment and Management*. Blackburn Press, Caldwell, NJ.; Walters C (1986) *Adaptive Management of Renewable Resources*. McGraw Hill, New York; Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA, 873 pp.

- Predicting the outcome of the alternatives based on what is currently known.
- Implementing one or more alternatives.
- Monitoring each alternative to determine the one that best meets objectives.
- Updating knowledge and adjusting management actions according to results.

'Passive' adaptive management also involves the incorporation of knowledge from monitoring and evaluation from previous management actions. However, it does not involve the comparison of different management actions as active adaptive management does and generally there is no control site. Consequently, fewer conclusions can be drawn from using passive adaptive management.

Adaptive management is a useful tool for dealing with uncertainty in sequential decision-making processes (e.g. where you are aiming to test the effectiveness of one strategy to inform future decisions on alternative strategies). However, it does not assist in making one-off investment decisions (e.g. in determining what strategy out of a number of alternatives is the best in cases where there is no plan to test the strategies in the future). In addition, implementation of adaptive management is costly and time consuming, and there is a need to make decisions about conservation investments now that are likely to be most beneficial to biodiversity and most robust to uncertainty under climate change.

Decision theory, and particularly information-gap decision theory, is a tool that explicitly incorporates uncertainty into decision-making processes, and can address situations where one-off decisions are required to be made. It also enables evaluation of the trade-offs between the conservation value of various investment decisions and the certainty of information that underpins this.[95] By explicitly incorporating the uncertainty of information or predictions into decision-making, the process ensures that the 'least regret' decisions are made, ensuring the greatest probability of achieving the desired outcome.[96]

As noted, the nature of the impacts of climate change on biodiversity is highly uncertain. Many scientists therefore argue that adaptive management and decision theory frameworks will be important to the management of biodiversity under climate change.[97]

Current legislative framework

The Federal legislative tools with implications for biodiversity conservation can be broadly divided into a number of categories, each of which is discussed below.

- Legislative objectives.
- Protected areas.

---

[95] Moilanen A., Wintle B., Elith J. and Burgman M (2006) 'Uncertainty analysis for regional –scale reserve selection' *Conservation Biology* 20(6):1688-1697; Regan H., Ben-Haim Y., Langford B., Wilson W., Lundberg P., Andelman S. and Burgman M (2005) 'Robust decision making under severe uncertainty for conservation management' *Ecological Applications* 15(4): 1471-1477.

[96] Regan H., Ben-Haim Y., Langford B., Wilson W., Lundberg P., Andelman S. and Burgman M (2005) 'Robust decision making under severe uncertainty for conservation management' *Ecological Applications* 15(4): 1471-1477.

[97] Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

- Listing of threatened species.
- Critical habitat.
- Recovery planning and threat abatement planning.
- Landscape-scale assessment and bioregional planning.
- Site-scale assessment.
- Mechanisms for conservation on private land.

.1 Legislative objectives

What is the tool?

Consistent with Australia's international obligations, primarily the United Nations Convention on Biological Diversity, the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*) has as a key objective 'to promote the conservation of biodiversity'.[98]

How is it currently working?

Australia's track record on threatened species and the protection of biodiversity is unenviable. Indeed, Australia is facing an extinction crisis, with at least 100 known species already lost,[99] while some populations in the wild may already be at levels that are not viable. This picture has been confirmed by the National Land and Water Resources Audit which found:[100]

> *There has been a massive contraction in the geographical ranges and species composition of Australia's indigenous mammal fauna over the last 100+ years. One-third of the world's extinct mammals since 1600 AD are Australian. Such a record is unparalleled in any other component of Australia's biodiversity, or anywhere else in the world.*

All of the above indicates that the *EPBC Act 1999* is falling well short of its stated objective to promote the conservation of biodiversity.

Will it conserve biodiversity under climate change?

Some scientists argue that current overarching goals and legislative objectives, which generally aim to protect all species from extinction and to prevent change to biodiversity, will be impossible to achieve under climate change.[101] A recent report commissioned by the Australian government was blunt in its assessment:

---

[98] *Environment Protection and Biodiversity Conservation Act 1999* s 3.

[99] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia at p 41.

[100] NLWRA (2002) *Australian Terrestrial Biodiversity Assessment 2002* National Land and Water Resources Audit, Canberra at: audit.ea.gov.au/ANRA/vegetation/docs/biodiversity/bio_assess_contents.cfm

[101] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia; Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA.

The current goal of preventing change to species and ecosystems is impossible to achieve under climate change.[102]

The report went on to state that:

Some…conservation aspirations may become conceptually difficult if not practically impossible (in a natural setting). For example, maintaining:

- *specific populations, communities or ecosystems in a given location,*
- *particular communities and ecosystems anywhere,*
- *species richness at a given location, or in a region, and*
- *specific patterns of ecosystems at a landscape scale'.*[103]

As such, it is arguable that a new set of goals and objectives, which recognise the realities of climate change, need to be developed for biodiversity conservation in Australia. This will be a very difficult and problematic task. 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 Australia, but both internationally and nationally. These gains have been hard fought.

It is also difficult to disentangle structural legal and policy problems underpinning the approach to biodiversity conservation in Australia from a number of external factors, such as inadequate resourcing, lack of political will, and dysfunctional institutional frameworks (see section 6). In other words, many of the legislative tools have been underutilised for a variety of political, economic, and social reasons. The public may well point to this in defence of the current approach.

Dunlop and Brown argue that the task under climate change is one of 'managing change to minimise loss' rather than 'preventing change' and in this context, they suggest the following two overarching conservation goals are appropriate:

- To facilitate natural changes in species and ecosystems, including natural adaptation to climate change.
- To preserve elements of biodiversity that are both particularly valued and threatened.

They recognise that this is a pragmatic approach, which combines two distinct goals that will be in conflict from time to time. The rationale put forward for the facilitating change goal is that, in the long-term, this will minimise the risk that species will become extinct (i.e. this goal aims to maximise the number of species that can adapt to climate change). The rationale for the preservation goal is that society is not prepared to accept extinctions of certain elements of biodiversity (i.e. this goal provides a 'safety net').[104]

---

[102] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

[103] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

[104] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

If the Dunlop and Brown overarching goals are appropriate, how should they be translated into legislation? What changes to species and ecosystems are acceptable and what elements of biodiversity should be protected? What implications do the goals have for our current approach to biodiversity conservation? What are the roles of society and science in informing this debate?

These are difficult questions to answer, and it is not the purpose of this paper to devise a new philosophical approach to biodiversity conservation in Australia. However, we make the following points in relation to these questions:

First, we feel that there is no room to resile from the current aspirational legislative objectives of seeking to protect all species from extinction, and indeed, we believe that it would be very unwise to do so. However, we believe that legislation should better reflect the realities of climate change by providing much greater guidance on how the legislative objectives should be achieved. In this regard, a possible way of framing the legislation could be as follows:

> *For example, the object of this Act is to conserve biodiversity and prevent extinction of species and ecosystems, etc, through,* for example:
>
> a)….Facilitating natural adaptation of species to climate change… etc.
>
> b)….Enhancing the resilience and resistance of ecosystems… etc.
>
> c)….Prioritising conservation actions, including the recovery and threat abatement of threatened species… etc.
>
> d)….
>
> e)….

Under climate change, we will not be able to protect all species from extinction or prevent change to biodiversity – to keep things as and where they are. Trying to protect everything and trying to prevent change is likely to mean that we will focus our conservation efforts in the wrong areas, which is likely to result in greater extinctions. We feel that the above approach, while not weakening the current legislative objectives, would better reflect the realities of climate change and the more realistic overarching goals of Dunlop and Brown by acknowledging that if we are to save as much biodiversity as possible under climate change, then we must change the way we go about trying to achieve these objectives.

Second, decisions about our approach to biodiversity conservation under climate change involve ethical questions such as what to protect and why, which must be guided primarily by society, rather then by science. We believe there is a clear need for national debates over the next few years on the appropriateness of our current approach to biodiversity conservation. The debate should discuss the realities of the impacts of climate change on biodiversity and should focus on the fundamental question of how we should go about trying to achieve our aspirational legislative objectives under climate change. The debate could discuss questions such as:

- Should we continue to seek to prevent change to biodiversity?
- What changes to species and ecosystems are acceptable?
- What elements of biodiversity should be protected?
- What should our conservation priorities be?

We believe that the recently released draft 'Australia's Biodiversity Conservation Strategy' is an appropriate mechanism to facilitate the debate. Biodiversity strategies set the overarching conservation goals and provide a mechanism to regularly review our approach, while at the same time enable us to set our gaze over longer time frames. Biodiversity strategies should play a key role in informing statutory reviews of key biodiversity legislation nationally and so they should be reviewed in synchronicity with such reviews.

We support amending the *EPBC Act 1999* to require that a biodiversity strategy be prepared to set out how the objects of the Act are to be achieved, as occurs in some other States, including NSW under the *Threatened Species Conservation Act 1995*. Importantly, the Act should specify that the draft strategy should be finalised prior to the beginning of any review process of the *EPBC Act 1999*.

Although decisions about our approach to biodiversity conservation under climate change involve ethical questions that should be informed primarily by society, science should play a key role in informing the debate. Science should identify what changes are likely due to climate change, what sorts of overarching goals might be achievable, and what are the best ways of achieving these goals once they are set. For example, if the legislative objective remains to protect all species from extinction, a key role of science will be to determine how to make the best use of limited resources to achieve this (i.e. prioritisation), which involves consideration of a range of scientific and economic questions.

Third, we believe that the uncertainty around climate change necessitates a much greater role for scientific committees established under legislation, such as the Scientific Committee established under the *EPBC Act 1999*, and other scientific bodies and research institutions, in informing decisions. The appropriate empowerment of scientific committees and their independence from governments will be crucial to the credibility of biodiversity conservation in Australia under climate change.

Recommendations: legislative objectives

- Maintain the aspirational legislative objective of seeking to protect all species from extinction.
- Ensure that the legislation reflects the realities of climate change by providing sufficient guidance as to how we will try to achieve the legislative objectives.
- Facilitate a national debate on the appropriateness of our current approach to biodiversity conservation under climate change.
- Ensure that the Scientific Committee maintains its independence from the Australian government and plays a key role in informing decisions.

.2 Protected areas

What is the tool?

An ecosystems approach to biodiversity conservation, as promoted by the *Rio Declaration on Environment and Development* 1992 to which Australia is a signatory, emphasises habitat preservation as integral to species survival.[105] The Preamble to the *Convention on Biological Diversity* 1992 acknowledges:

[105] Article 2 of the *Convention on Biological Diversity* 1992 defines an ecosystem as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. "

the fundamental requirement for the conservation of biological diversity is the in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings.[106]

Protection and management of the most intact habitats is therefore a central principle of biodiversity protection in Australia and globally. On public land, this is achieved through the declaration of protected areas. Certain conservation initiatives on private land that result in in-perpetuity protection of high conservation value land are also recognised as part of the protected area system.

The system of protected areas in Australia is called the National Reserve System (NRS). The goal of the NRS, which was endorsed by all Australian governments, is to achieve a system of protected areas that is comprehensive, adequate and representative (CAR). Specifically, CAR means:[107]

- *Comprehensive:* The NRS should protect examples of each regional ecosystem within each region.
- *Adequate*: The NRS should protect sufficient amounts of each regional ecosystem to ensure ecological viability, resilience, and integrity.
- *Representative:* The NRS should protect areas that reflect the variability of habitat within each regional ecosystem.

The 'Interim Biogeographic Regionalisation for Australia' (IBRA) provides the framework for developing the NRS. The IBRA divides Australia into 85 IBRA regions based on similar climate, lithology/geology, landform, vegetation and flora and fauna. IBRA regions are further divided up into 403 IBRA sub-regions. The IBRA regions are used as the basis for determining land that requires priority inclusion in the NRS and for assessing progress in developing the NRS.[108]

Targets for the NRS were derived on the basis of the Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests (referred to as the JANIS criteria). Key targets include:[109]

- Examples of at least 80 per cent of the number of extant regional ecosystems in each IBRA region are represented in the NRS by 2010-2015 (the comprehensiveness goal).
- Examples of at least 80 per cent of the number of extant regional ecosystems in each IBRA sub-region are represented in the National Reserve System by 2010-2020 (the representativeness goal).
- 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 support (no quantified target is set).

[106] See Convention on Biological Diversity: http://www.biodiv.org/convention/convention.shtml.

[107] Natural Resource Management Ministerial Council (2005) *Directions for the National Reserve System: A Partnership Approach* Department of the Environment and Heritage, Canberra.

[108] See Department of Environment, Water, Heritage, and the Arts at: http://www.environment.gov.au/parks/nrs/science/ibra.html

[109] Natural Resource Management Ministerial Council (2005) *Directions for the National Reserve System: A Partnership Approach* Department of the Environment and Heritage, Canberra.

Other priorities in addition to the above include the protection of critically endangered and endangered species and regional ecosystems in each IBRA sub-region by 2010. The primary focus of the NRS is to protect examples of each regional ecosystem within each IBRA region (the comprehensiveness goal).[110]

All Australian governments have agreed on a set of minimum standards that must be met before a protected area can be included in the NRS. These include:[111]

- The area must be protected in-perpetuity.
- The area must contribute to meeting the CAR goal of the NRS.
- The area must be able to be classified into one or more of the six International Union for the Conservation of Nature (IUCN) protected area management categories.
- The area must be managed in a manner that is open to public scrutiny.

Establishment of protected areas

The *EPBC Act 1999* allows the Australian government to create and manage several types of protected areas[112] - namely, world heritage properties; national heritage places; Commonwealth heritage places; Commonwealth reserves (including conservation zones); wetlands of international significance (called Ramsar wetlands); and biosphere reserves. Bioregional plans[113] and conservation agreements on private land[114] are also provided for under the *EPBC Act 1999*.

For the Australian government to declare any type of protected area outside of Commonwealth land, the government must first seek agreement from the land owner or occupier as to the designation of the area and the proposed management arrangements for the area.[115]

Management of protected areas

Management plans for protected areas are required under the *EPBC Act 1999* for five distinct categories of areas:

- Commonwealth Reserves.[116]
- Commonwealth Heritage Places.[117]
- National Heritage Places.[118]

---

[110] Natural Resource Management Ministerial Council (2005) *Directions for the National Reserve System: A Partnership Approach* Department of the Environment and Heritage, Canberra.

[111] Natural Resource Management Ministerial Council (2005) *Directions for the National Reserve System: A Partnership Approach* Department of the Environment and Heritage, Canberra.

[112] *Environment Protection and Biodiversity Conservation Act 1999* Part 15 (Protected Areas).

[113] *Environment Protection and Biodiversity Conservation Act 1999* s 176.

[114] *Environment Protection and Biodiversity Conservation Act 1999* Part 14 (Conservation Agreements).

[115] *Environment Protection and Biodiversity Conservation Act 1999* Part 15 (Protected Areas).

[116] *Environment Protection and Biodiversity Conservation Act 1999* s 366.

[117] *Environment Protection and Biodiversity Conservation Act 1999* s 341S.

- World Heritage Places.[119]
- Ramsar Wetlands.[120]

All of these plans must generally be made in accordance with management principles relevant to their designation, the conservation of biodiversity, the protection of landscape values and so on, as well as set out management outcomes and actions to achieve those objectives.[121] Moreover, extensive procedural steps, including consultation are generally required.[122] Management plans must be reviewed every five years for most protected areas[123] on Australian government controlled land, and remade after 10 years for Commonwealth reserves.[124] Review provisions for Commonwealth listed areas that are managed by state agencies are subject to the review provisions under state legislation.[125]

The Director of National Parks is a corporation established under the *EPBC Act 1999* with the function of managing Commonwealth reserves.[126] The Director has responsibilities including the administration, management and control of Commonwealth reserves and conservation zones and the protection, conservation and management of biodiversity and heritage in Commonwealth reserves and conservation zones.[127]

How is it currently working?

Establishment of protected areas

The National Reserve System includes over 9,000 protected areas. It is made up of national parks, indigenous lands, private protected areas and land held by landholders under covenants. The National Reserve System comprise more than 11% of Australia - over 89 million hectares – most of which are managed at a State level.[128]

---

[118] *Environment Protection and Biodiversity Conservation Act 1999* s 324S.

[119] *Environment Protection and Biodiversity Conservation Act 1999* s 316.

[120] *Environment Protection and Biodiversity Conservation Act 1999* s 328.

[121] For example see *Environment Protection and Biodiversity Conservation Act 1999* s 367 in relation to Commonwealth Reserves.

[122] For example see *Environment Protection and Biodiversity Conservation Act 1999* s 368 in relation to Commonwealth Reserves.

[123] *Environment Protection and Biodiversity Conservation Act 1999* s 341X in relation to Commonwealth Heritage places, s 331 for listed wetlands in Commonwealth areas, s 324W National Heritage places in Commonwealth areas, s319 for World Heritage places in Commonwealth areas.

[124] *Environment Protection and Biodiversity Conservation Act 1999* s 373

[125] E.g. in NSW there is no requirement under the *National Parks and Wildlife Act 1974* to review plans of management for protected areas.

[126] *Environment Protection and Biodiversity Conservation Act 1999* s514A

[127] *Environment Protection and Biodiversity Conservation Act 1999* s514B

[128] See Department of Environment, Water, Heritage, and the Arts at: http://www.environment.gov.au/parks/nrs/index.html

Despite this, there is still more to be done. Reserve allocation has historically been in largely unproductive landscapes. As Dunlop and Brown have noted:

> *at present the effectiveness of the NRS is limited as habitat in many regions is very poorly represented.*[129]

More generally, a review undertaken by the Organisation for Economic Co-operation and Development in 2007 concluded that:

> *The National Reserve System does not yet meet the test of being comprehensive, adequate and representative.*[130]

At 2006, there was still 1 bioregion in which there is no reserved area, and 32 bioregions where less than 5% of the area is reserved (generally in inland Australia).[131] All this indicates that the CAR principles are far from being achieved, and the rate of reservation needs to increase dramatically, particularly given the challenges of climate change. It has also been observed that, to date, reserve design does not systematically consider biodiversity change due to climate change.[132]

Management of protected areas

Although all the terrestrial Commonwealth reserves have a current management plan prepared,[133] the *EPBC Act 1999* is currently not prescriptive enough in terms of the strategies that should be contained in management plans. As a result, climate change considerations have not been at the forefront of thinking when formulating these plans. The Australian government has commissioned two major reports into the management of protected areas to assess the impacts and management implications of climate change. Both these reports raise profound issues for the management of these areas in coming years, and demonstrate that climate change considerations are not explicitly included in management plans.[134]

For example, the 2008 report, *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, found that:

---

[129] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia at p 16.

[130] Organisation for Economic Co-operation and Development (2007) *Environmental Performance Reviews: Australia* at p 15.

[131] Gilligan, B. (2006) The National Reserve System Programme: 2006 Evaluation by Brian Gilligan Available online at http://www.environment.gov.au/parks/publications/nrs/pubs/evaluation-large-2006.pdf [28/4/09]

[132] Margules CR and Pressey RL (2000) "Systematic conservation planning" *Nature* 405 at pp 243–253.

[133] Department of Environment, Water, Heritage and the Arts, Parks and Reserves. http://www.environment.gov.au/parks/parks/index.html [Date accessed 8/6/09]

[134] Hyder Consulting (2008) *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts; Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

> *Existing management strategies may no longer be appropriate under changed climatic conditions and may therefore require review.*[135]

As a result, the report recommended that management plans for protected areas should be amended to include strategies that build resilience and manage for uncertainty in light of projected climate change impacts.

Will it conserve biodiversity under climate change?

Establishment of protected areas

While historically, the design of protected area systems has not generally taken into account the impacts of climate change on biodiversity,[136] there is general agreement that the NRS provides a robust framework to combat the impacts of climate change.[137] The CAR goals are based on sampling the diversity of ecosystem types (comprehensiveness) and the diversity within ecosystem types (representativeness) across their geographic ranges.[138] As noted, by focusing on protecting a high diversity of habitat types, the NRS framework should maximise the number of species whose habitat is contained within the protected area system, even as conditions change under climate change (see section 4.2).

However, the ability of the NRS framework to protect biodiversity under climate change will depend largely on the ability to achieve the CAR goals within each IBRA region.[139] This will depend in particular on adequate funding to purchase and manage land and the availability of suitable land for purchase, which depends largely on the extent of clearing in a region. In response to the Dunlop and Brown report, the Australian government recently announced $180m for the NRS, specifically in light of the challenges posed by climate change.[140]

A key issue in relation to the current process under the NRS framework for prioritising what land should be protected is that the process does not appear to consider 'threats'.[141] Given that protected areas are often 'residual' to human requirements, it appears to us that threat is an important consideration in this

---

[135] Hyder Consulting (2008) *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts, p xviii.

[136] Margules CR and Pressey RL (2000) "Systematic conservation planning" *Nature* 405 at pp 243–253.

[137] Hyder Consulting (2008) *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts; Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[138] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[139] Lovejoy TE (2006) 'Protected areas: a prism for a changing world' *Trends in Ecology and Evolution* 21 at pp 329-333; Scott D (2005) 'Integrating climate change into Canada's National Parks System' in Lovejoy TE and Hannah LJ (eds) *Climate Change and Biodiversity* Yale University Press, New Haven and Sattler P and Glanznig A (2006) *Building natures safety net: a review of Australia's terrestrial protected area system 1991-2004* WWF Australia, Sydney.

[140] Media release by the Hon Peter Garrett, Minister for Environment and Heritage, 31 March 2008.

[141] Pressey B (2009) 'The mis-measure of conservation: How much do we find out how much difference we make?' Abstract, Fenner Conference on the Environment. Available at: www.landscapelogic.org.au/Fenner_2009.html

process. Without its consideration, there is no way of determining whether an action to protect land is having a conservation outcome that is additional to what would have otherwise occurred.[142] As Pressey puts it:[143]

> *An increase in representation of vegetation types from 35 to 52 in an Australian biogeographic region is not necessarily an advance for conservation. Much depends on whether the additional 17 vegetation types were the ones that most needed protection because they were most prone to depletion in the absence of conservation intervention.*

Other scientists have also similarly argued that any effective prioritisation process must consider the net benefit of conservation actions in determining where to invest resources. The net benefit of an action is measured as the difference in outcomes with and without the action taking place, which therefore accounts for the relative 'threat' facing each asset. If an asset is likely to persist without a particular action, then the action will have a low net biodiversity benefit.[144]

While the issue of incorporating threat into the NRS prioritisation process is not necessarily an issue specific to climate change, it is likely to become more important in the future because climate change will exacerbate tensions between protecting more land and freeing up land to meet basic human needs.[145] As such, under climate change, there will be an even greater need to ensure that the land we prioritise for protection maximises conservation outcomes.

It appears that of the three CAR goals, climate change will pose particular problems for the 'adequacy' goal. It will cause changes to species abundances and distributions, species interactions, habitat suitability, and the nature of threats, and so will affect the ability of protected areas to maintain the long-term viability of populations. In general, climate change is likely to require greater effort to ensure current levels of adequacy are maintained for a given species.[146]

A number of strategies are available to ensure progress towards the adequacy goal, including increasing the size of protected areas, increasing the connectivity of areas, decreasing threats, and appropriate management of the surrounding matrix.[147] The first three of these are commonly advocated by scientists.[148] Indeed, the connectivity approach is gaining much currency in Australia at present (e.g. the Great Eastern Ranges Initiative, and see also the Department of

---

[142] This is the concept of 'additionality', which is an important concept that is applied in relation to both carbon offsetting and biodiversity offsetting under the NSW BioBanking scheme.

[143] Pressey B (2009) 'The mis-measure of conservation: How much do we find out how much difference we make?' Abstract, Fenner Conference on the Environment. Available at: www.landscapelogic.org.au/Fenner_2009.html

[144] Bottrill M, Joseph L, Carwardine J, Bode M, Cook C, Game E, Grantham H, Kark S, Linke S, McDonald-Madden E, Pressey R, Walker S, Wilson K, Possingham H (2008) 'Is conservation triage just smart decision making? *Trends in Ecology and Evolution* 23: 649-654.

[145] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[146] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[147] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[148] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

Environment and Climate Change (DECC) Adaptation Strategy).[149] However, as noted, some scientists are warning against putting too much emphasise on connectivity over other, more certain, strategies.

The key purpose of the adequacy goal (and of conservation planning in general)[150] is to ensure the persistence of species. As such, it appears to us that the question of adequacy must be addressed by evaluating the probabilities that species will persist under the current NRS system. We understand that we have tools available that can do this, and which can also take into account climate change. Such tools can be used to evaluate strategies to combat the impacts of climate change on the NRS (e.g. protecting more land, increasing connectivity, etc) in terms of persistence. As noted, the adequacy goal is currently poorly defined from an operational perspective. Such tools may be useful in better defining and measuring progress towards meeting the adequacy goal.

Management of protected areas

The view has been expressed that – at present - management plans may not be the place for dealing with climate change, being short in duration and dealing with on the ground issues.[151] However, as a Commonwealth agency must not contravene the provisions of a management plan, or allow anyone else to do so[152], they may be important documents in allowing park managers to respond to the impacts of climate change. There may also be a clear educative and "heads-up" effect of providing information and preparatory actions in management plans.

Climate change will pose significant challenges for the management of protected areas. Protected areas will be subject to changes in biodiversity (e.g. the arrival of new native and non-native species), changes to existing threats (e.g. an increase in fire frequency or a decrease in water availability), and unpredicted new threats. As Dunlop and Brown note, protected area managers will need to:[153]

- Decide what changes are acceptable and how to facilitate acceptable changes.
- Decide what changes are unacceptable and what management responses are suitable.

Making such decisions will be difficult and may conflict with existing management goals, may not be contemplated in existing decision-making frameworks or guidelines, or may be outside the existing experience of park managers (e.g. the 'invasion' of native species into new areas).[154] While many scientists argue that addressing existing threats is a key strategy to combat the impacts of climate

---

[149] NSW Department of Environment and Climate Change, *Adaptation Strategy for Climate Change Impacts on Biodiversity*, November 2007, at pp 29-31.

[150] Margules C and Pressey B (2000) 'Systematic conservation planning' *Nature* 405: 243-253.

[151] Personal communication, Max Chappell, Wet Tropics Management Authority.

[152] *Environment Protection and Biodiversity Conservation Act 1999* s 318

[153] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[154] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

change[155], current management strategies that address existing threats may become less applicable and will need to be modified, or new, untried approaches implemented. It will become increasingly difficult to decide what new management strategies to try and making such decisions will be subject to significant uncertainty and may be based less on the existing experience of managers and more on modelling and monitoring. In addition, the effectiveness of current management strategies will become more uncertain.[156]

Increasing uncertainty in relation to the management of protected areas under climate change strongly suggests the need to apply adaptive management frameworks to the implementation of management strategies, which deals specifically with uncertainty (see section 4.10).

While various forms of passive adaptive management are more common, active adaptive management is rarely implemented across any area of natural resource management.[157] Park managers will require the legislative and institutional backing to adopt adaptive management approaches, and there is a clear need to identify and overcome the barriers to effective implementation. Such barriers may include:[158]

- Lack of institutional support.
- High costs and lack of funding.
- Stakeholder concerns regarding the uncertainty of outcomes and the risk and implications of failure.
- Long-term nature of adaptive management experiments, which tend to discourage the involvement of academic scientists.

One way to potentially create greater institutional support could include incorporating adaptive management as a management principle under the *EPBC Act 1999*. As noted, management principles must be taken into consideration in preparing management plans. Incorporating adaptive management in management plans explicitly would clearly encourage its uptake by park managers and would give stakeholders the opportunity to any raise concerns through the public exhibition process, which increases transparency and may help to alleviate concerns. Clearly also, the Australian government should recognise that adaptive management will be a vital strategy to combat the impacts of climate change on the protected area system and will require increased funding to implement effectively.

Recommendations: protected areas

[155] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32.

[156] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[157] Lindenmayer D and Burgman M (2005) *Practical Conservation Biology.* CSIRO Publishing, Australia.

[158] Bormann B, Haynes R. and Martin J (2007) 'Adaptive management of forest ecosystems: did some rubber hit the road' *BioScience* 57(2):186-191; Climate Change Science Program (US) (2008): *Preliminary review of adaptation options for climate-sensitive ecosystems and resources.* A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius SH and West JM (eds), Baron JS, Griffith B, Joyce LA, Kareiva P, Keller BD, Palmer MA, Peterson CH, and Scott JM (Authors)]. U.S. Environmental Protection Agency, Washington, DC, USA; Lindenmayer D and Burgman M (2005) *Practical Conservation Biology.* CSIRO Publishing, Australia.

Establishment of protected areas

- The NRS framework should be maintained as it provides a robust framework to combat the impacts of climate change on protected areas.
- Much greater funding and resources should be provided to ensure that the implementation of the NRS framework occurs at a much faster rate.
- 'Threat' should be included as a criterion in the process to prioritise what areas should be protected under the NRS framework.
- The 'adequacy' goal and alternative strategies to combat the impacts of climate change on the NRS system should be evaluated by using tools that can analyse the persistence probabilities of a range of species.
- Decision-theory frameworks should be developed for protected area establishment to ensure the most effective investment of funds under climate change.

Management of protected areas

- Barriers to the effective implementation of adaptive management frameworks in protected area management should be identified and addressed.
- Adaptive management should be incorporated as a management principle under the *EPBC Act 1999* for all types of protected areas.
- Funding for protected area management should be increased to allow for the effective implementation of adaptive management frameworks.

.3 Listing of threatened species, etc

What is the tool?

The listing of threatened species and ecological communities is a crucial element in the operationalisation of biodiversity conservation laws around Australia. Approvals, permits, licences, recovery plans, threat abatement plans and strategies, key threatening processes, declarations of critical habitat, interim protection orders, environmental impact assessment, offences and a range of duties and functions all turn on whether a list has been made.

At the inception of the *EPBC Act 1999*, the Federal Minister had an obligation to establish lists of threatened species, threatening processes and so on.[159] However, Federal listings now take place annually, and, if the Minister determines, according to specified conservation themes.[160] This is designed to produce a priority assessment list in each 12 month period.[161] The Scientific Committee advises the Minister whether a nomination meets the criteria for listing and under which category,[162] however it is the Minister who ultimately decides what is listed.[163]

How is it currently working?

---

[159] *Environment Protection and Biodiversity Conservation Act 1999* ss 178, 181 and 182.

[160] *Environment Protection and Biodiversity Conservation Act 1999* s 194D.

[161] *Environment Protection and Biodiversity Conservation Act 1999* Part 13, Subdivision AA.

[162] *Environment Protection and Biodiversity Conservation Act 1999* s189

[163] *Environment Protection and Biodiversity Conservation Act 1999* s 184.

There are currently 259 fauna and 1269 flora species listed as either vulnerable, endangered or critically endangered under the *EPBC Act 1999*. In addition, there are 44 threatened ecological communities listed.[164]

It should be noted that most changes in the number of items listed on threatened species lists reflects changes in knowledge rather than true changes in conservation status. As such, species lists should not generally be used as an indicator of changes in the status of biodiversity.[165] In addition, it is well established that threatened species lists generally show considerable bias towards mammals, birds, and other iconic species. Consequently, there are substantial gaps in representation on lists, particularly in relation to insects and fungi.[166] Due to this bias, as well as time lags and lack of knowledge, many species at risk of extinction may not be currently listed.[167]

There are a number of problems with focusing on threatened species as a basis for biodiversity protection, which have been much discussed.[168] A key criticism has been that threatened species lists reflect a single-species approach to conservation, which often fails to adequately protect entire habitats and ecosystems. This criticism has been addressed to some extent in Australia by enabling the listing of ecological communities and key threatening processes. A further key problem with focusing on threatened species is that it may result in perverse outcomes for biodiversity in general. For example, a development that clears a large amount of habitat for non-listed species may be allowed to proceed, while a development that clears a small amount of habitat for threatened species may not be approved.[169]

Will it conserve biodiversity under climate change?

As noted, there are a number of problems with focusing on threatened species as a basis for biodiversity protection. Climate change is likely to exacerbate such problems and is likely to raise additional issues associated with the listing process. We make a number of points in relation to the listing process:

First, there may often be a mismatch between threatened species and what needs to be done to protect biodiversity under climate change. For example, areas important for connectivity for a wide range of species may not be properly considered in decision-making without a connection to threatened species. Related to this point, a focus on threatened species may direct attention away from resourcing other strategies to protect biodiversity under climate change.[170]

---

[164] http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=flora (17 February 2009).

[165] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[166] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[167] See Department of Environment and Climate Change *NSW State of the Environment Report 2006* at: http://www.environment.nsw.gov.au/soe/soe2006/chapter6/chp_6.3.htm#6.3.22

[168] For example, see Rohlf D (1991) 'Six Biological Reasons Why the Endangered Species Act Doesn't Work – And What to Do About It' *Conservation Biology* 5 273-282.

[169] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[170] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

Second, and related to the first point, a key criticism of focusing on threatened species is that it often fails to protect biodiversity in general. However, the listing process provides a potential tool to protect 'key functional groups', which are groups of species that play an important role in maintaining ecosystem functions. As noted, some 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.[171]

Third, decisions to list species, etc are made on the basis of current conservation status, which, as noted, is determined in accordance with criteria prescribed by the EPBC Regulation. Species, etc are only eligible to be listed if they are currently threatened, and are not eligible to be listed if they are not currently threatened, but are likely to become threatened in the future under climate change. One way of addressing this issue would be to enable listings on the basis of vulnerability assessments or 'susceptibility traits'.[172]

Fourth, the listing of ecological communities, which are described (amongst other ways) in terms of community composition and location in a particular area, may become problematic. As Dunlop and Brown puts it:

> *Some communities will expand, others will contract; most will change in their nature, some will dissolve and new ones will form.*[173]

Fifth, the ability to list populations is an important aspect of the NSW *Threatened Species Conservation Act 1995,* which is not provided for under the *EPBC Act 1999*. Inclusion of equivalent provisions under the *EPBC Act 1999* would add flexibility, which is likely to be required under climate change. For example, by providing protection to populations at the limits of their range or disjunct or genetically distinct populations, it would provide a mechanism to protect advancing populations as they migrate across Australia in response to climate change, even though the species itself would not qualify for listing.

Sixth, for a species to be eligible for listing under the *EPBC Act 1999*, it must be native to Australia, which is defined as being present in Australia or an external territory before 1400.[174] This definition may become problematic if our overarching goal is to facilitate natural adaptation under climate change. For example, a species previously restricted to Papua New Guinea may move into Australia in response to climate change and establish small populations. Under the current definition of native, this species would not be eligible for listing under the *EPBC Act 1999*, despite its tenuous hold in Australia.[175]

---

[171] Possingham HP, Andelman SJ, Burgman MA, Medellin RA, Master LL and Keith DA (2002) "Limits to the use of threatened species lists" *Trends in Ecology and Evolution* 17(11) at pp 503–7.

[172] Bradshaw C, Giam X, Tan H, Brook B and Sodhi N (2008) "Threat or invasive status in legumes is related to opposite extremes of the same ecological and life-history attributes" *Journal of Ecology* at 96 869 – 883.

[173] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[174] *Environment Protection and Biodiversity Conservation Act 1999* s528

[175] Adam P (2009) 'Going with the flow? Threatened species management and legislation in the face of climate change' *Ecological Management and Restoration* 10 S44-S45.

Finally, as noted, climate change is likely to increase the extinction risk of many species, which will further exacerbate the problem of limited conservation budgets. In terms of the listing of threatened species, prioritisation can occur on two levels:

- In determining what species should be the focus of nominations and assessment for listing in any given year, and
- In determining what listed species should receive recovery and threat abatement funding.

The second point is discussed in section 5.5.

In terms of the first point, as noted, the *EPBC Act 1999* provides that the Minister decides on an annual theme to be given priority for a particular assessment period. The Minister has broad discretion when deciding on a theme, which may include a particular group of species, a particular species or particular regions of Australia.[176] After nominations are received, the Scientific Committee then establishes a proposed priority assessment list based on the theme, and other matters that the Committee considers appropriate.[177] In finalising the priority assessment list, the Minister may then have regard to any matters he/she deems appropriate.[178] This process is highly discretionary and provides a large role for the Minister, with a more limited role for the Scientific Committee as compared with equivalent state based processes.[179]

In our view, the Scientific Committee and not the Minister should have a much greater role in the entire listing process. The Scientific Committee should be given the authority to develop the priority theme, as a way of identifying particular species, groups of species, or regions that may be eligible to be listed, but due to lack of knowledge, are underrepresented on the list. They should also be charged with the responsibility to finalise the priority assessment list, and make the final decision on which species are listed, as this is a scientific question and should not be influence by any political, economic or social considerations.[180]

As climate change is likely to increase the extinction risk of many species, we believe there is a key role for the Scientific Committee in ensuring that nominations and assessment for threatened species listings focus on the areas of greatest need, such as groups of species particularly vulnerable to climate change or species that play a key role in ecosystem function (see section 4.7). As such, the provision under the *EPBC Act 1999* that allows prioritisation of nominations will remain important, provided Ministerial discretion is fettered, as it gives the Scientific Committee the ability to prioritise nominations of increased importance under climate change.

---

[176] *Environment Protection and Biodiversity Conservation Act 1999* s194D

[177] *Environment Protection and Biodiversity Conservation Act 1999* s194G

[178] *Environment Protection and Biodiversity Conservation Act 1999* s194K

[179] E.g. Listing under the NSW *Threatened Species Conservation Act 1995*

[180] For further detail on proposed changes to the listing process under the EPBC Act, see ANEDO submission to the 10 year review of the *Environment Protection and Biodiversity Conservation Act 1999* available online at http://www.edo.org.au/policy/090219epbc.pdf and supplementary material provided to the review panel at http://www.edo.org.au/edonsw/site/policy.php#2

Recommendations: lists

- The listing of species that play a key role in ecosystem function ('key functional species') should be enabled under the *EPBC Act 1999*.
- The listing of species that are not currently threatened but that are likely to be vulnerable to climate change should be explicitly enabled under the *EBPC Act 1999*.
- The definition of 'native' under the *EPBC Act 1999* should be changed to address the situation of native species moving in response to climate change.
- A review of how ecological communities and populations are defined under the *EBPC Act 1999* should be undertaken with a view to ensuring their efficacy under climate change.
- The *EPBC Act 1999* should be amended to enable the listing of populations.
- The listing process under the *EPBC Act 1999* should be amended to de-politicise listing decisions and give a greater role to the Scientific Committee

.4 Critical habitat

What is the tool?

Under the *EPBC Act 1999*, critical habitat may be registered for any nationally listed threatened species or ecological community.[181] If the Commonwealth sells or leases land on which there is critical habitat, a covenant must be attached to the land protecting the habitat.[182] On Commonwealth land, it is an offence under the *EPBC Act 1999* for a person to knowingly take an action that will significantly damage critical habitat (unless the action is specifically exempted by the *EPBC Act 1999*).[183]

How is it currently working?

Critical habitat has been rarely used as a management tool at the Federal level. There are five areas declared as critical habitat under the *EPBC Act 1999*.[184] Most of these areas are currently under Commonwealth or State management for conservation purposes which means that listing these areas as critical habitat provides little additional protection to that already provided under the *EPBC Act 1999* and reserve management plans.

Will it conserve biodiversity under climate change?

Critical habitat will remain an important conservation tool under climate change. Its main value lies in its ability to provide added protection[185] (through requirements for additional assessment) to areas important for the survival of

---

[181] *Environment Protection and Biodiversity Conservation Act 1999* 207A.

[182] *Environment Protection and Biodiversity Conservation Act 1999* 207C(2).

[183] *Environment Protection and Biodiversity Conservation Act 1999* 207B.

[184] See Department of Environment, Heritage, Water and the Arts register of critical habitat http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl

[185] If it is used in areas not already managed for conservation

specific threatened species, etc. In addition, it provides a mechanism to protect over-cleared and rare habitat types, and, as noted, the protection of a diversity of habitat types is a key strategy in combating the impacts of climate change.

However, the problems noted above are likely to continue to limit the effectiveness of critical habitat as a conservation tool under climate change. In addition, we make two further points:

First, the definition of critical habitat implies that for habitat to be declared critical, it must be current habitat for a threatened species, although there is some uncertainty here. This would mean that critical habitat cannot be declared on land that is not current habitat for a threatened species, etc, but that is likely to be required by a threatened species in the future under climate change (e.g. habitat corridors, climate refuges, or suitable habitat types within the likely future distribution of a species). We note that the Queensland *Nature Conservation Act 1992* provides greater certainty about this by defining critical habitat as including 'an area of land that is considered essential for the conservation of protected wildlife, even though the area is not presently occupied by the wildlife'.[186]

Second, and similar to the first point, there is also uncertainty over whether buffer areas comprising non-habitat for a threatened species, etc, can be included in the area declared to be critical habitat. As noted, buffering important habitats (such as critical habitat) is likely to be an important strategy to protect biodiversity under climate change. For example, can an area with no Ginninderra Peppercress (the buffer) be declared as part of the critical habitat for the Ginninderra Peppercress? This uncertainty may increase the risk of legal challenge, particularly if declarations begin to be made over private land. Again, the Queensland definition provides greater certainty about this issue.

Recommendations critical habitat

- The definition of critical habitat under the *EPBC Act 1999* should be amended to cover 'an area of land that is considered essential for the conservation of protected wildlife, even though the area is not presently occupied by the wildlife' (as in Queensland).

.5 Recovery planning and threat abatement planning

(a) Recovery planning

What is the tool?

Under the *EPBC Act 1999*, the Minister has a discretion whether to prepare a recovery plan for threatened species and communities.[187] The preparation of recovery plans was mandatory until amendments made in 2007.

Where a recovery plan is in place, the Australian government must not take any action which contravenes the recovery plan.[188] Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long term survival in the wild of a

[186] (Qld) *Nature Conservation Act 1992* s13(2)

[187] *Environment Protection and Biodiversity Conservation Act 1999* s 269AA.

[188] *Environment Protection and Biodiversity Conservation Act 1999* s 268.

threatened species or ecological community.[189] Recovery plans should state what must be done to protect and restore important populations of threatened species and habitat, as well as how to manage and reduce threatening processes.[190] The Minister must take account of the precautionary principle in making a decision as to whether to have a recovery plan.[191]

Conservation advices are essentially "quick and dirty" recovery plans introduced as part of the 2007 reforms to the *EPBC Act 1999*. These are mandatory documents which need to be approved by the Minister for all threatened species and communities. These must contain information about what can be done to recover species and communities or a statement to the effect that nothing can be done.[192]

How is it currently working?

Under the *EPBC Act 1999*, developed or adopted plans total 368 for flora, 118 for fauna and 16 for ecological communities. A large number were uncommenced in 2007 (the time that amendments were made to the Act making recovery plans discretionary).

Recovery planning has been a key mechanism for planning the recovery of threatened species under Federal law. Despite the lack of scientific evidence linking recovery actions with direct improvements in the conservation status of threatened species, [193] recovery planning has generally been seen to be successful for those species with plans in place. For example, the NSW State of the Environment Report 2006 states:[194]

> *Recovery plans have been effective in assisting the long-term survival of many priority species. For example, recovery actions for the little tern have successfully increased their numbers in NSW, while the number of breeding pairs for Gould's petrel recovered to over 900 in 2004–05.*

As such, and given that they have demonstrated success in some instances for high priority species,[195] recovery planning will remain an important mechanism for the protection of biodiversity under climate change.

Notwithstanding this, there are several essential, and related, problems for recovery plans which effects their efficacy in protecting biodiversity presently and into a future, more climate-constrained environment.

---

[189] *Environment Protection and Biodiversity Conservation Act 1999* s 270(1).

[190] *Environment Protection and Biodiversity Conservation Act 1999* s 270(2).

[191] *Environment Protection and Biodiversity Conservation Act 1999* s 391(3).

[192] *Environment Protection and Biodiversity Conservation Act 1999* s 266B(2)(b)

[193] Priddel, D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10(S1):s97-s102

[194] Department of the Environment and Climate Change *NSW State of the Environment Report 2006* at: http://www.environment.nsw.gov.au/soe/soe2006/chapter6/chp_6.3.htm See also: Hutchings P, Lunney D, Dickman C (eds) (2004) 'Threatened species legislation: is it just an Act? Royal Zoological Society of New South Wales.

[195] Priddel, D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10(S1):s97-s102

First, demand far outstrips supply and recovery plans have lacked adequate funding for implementation. As a result, the Australian government has introduced a more prioritised, discretionary system for recovery plans through legislative amendments in recent years.

Secondly, recovery plans are expensive and resource intensive to prepare. Over 10 years ago, recovery plans were estimated to cost $100,000 for fauna and $50,000 for plants.[196] No doubt they cost more today. Even on these costings, the preparation of recovery plans for all species under the *EPBC Act 1999* would likely cost in the order of $30m to $80m. This is a significant component of any agency budget.

Thirdly, and related to the above, the preparation of recovery plans and the attendant costs, diverts resources away from actions on the ground. On ground implementation of recovery actions is chronically underfunded at the State and Federal level.[197]

Fourth, recovery plans lack teeth. Although the *EPBC Act 1999* contains provisions to ensure that in deciding whether or not to approve an action, or conditions of approval for an action, the Minister must not act inconsistently with a recovery plan,[198] this does not in effect prevent actions that damage threatened species habitat, or will impact threatened species, even if a recovery plan has been made and that area is identified in the recovery plan.[199] In our experience, recovery plans consistently fail to protect populations of threatened species targeted under the plan from the impacts of development.

Fifth, recovery plans are not flexible enough in their approach, making the use of adaptive management difficult. The complexity and uncertainty associated with undertaking recovery actions for threatened species means that adaptive management is a particularly useful approach, but one that requires flexibility in the recovery plan.[200]

Sixth, the effectiveness of recovery plans and recovery actions is rarely monitored and evaluated.[201] In a review of 181 recovery plans in the U.S, on

---

[196] Brebach K (1996) 'The Role of the Community in the Threatened Species Conservation Act 1995' Unpublished paper at the (NSW) Threatened Species Conservation Act...In Action Seminar (Australian Museum 31 May 1996). These figures seems to be consistent with US costings at the time of an average of $US 60,000 per species: see Kubasek N, Browne N and Mohn-Klee R (1994) "The Endangered Species Act: Time for a New Approach?" 23 *Environmental Law* pp 329-353 at p 336.

[197] Priddel, D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10(S1):s97-s102

[198] *Environment Protection and Biodiversity Conservation Act 1999* s 139

[199] In a recent development application for a quarry on the NSW Central Coast, impacts were identified on one of 6 populations identified in the approved Recovery Plan, however despite this, the project was not even referred as a controlled action to DEWHA.

[200] Priddel, D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10(S1):s97-s102

[201] Clark J, Hoekstra J, Boersma P, Kareiva P. 'Improving U.S. Endangered Species Act Recovery Plans: key Fndings and Recommendations of the SCB Recovery Plan Project' *Conservation Biology* 16 1510-1519.

average, only about 50% of actions were monitored.[202] Monitoring is often identified as an important action in plans, but is often assigned a low priority and is rarely funded.[203] Lack of monitoring severely hampers the ability of managers to learn from and refine recovery actions within an adaptive management framework (see section 4.10), which in turn reduces the effectiveness of recovery plans.[204]

Will it conserve biodiversity under climate change?

Recovery planning will remain a key mechanism to ensure the long-term survival of some species under climate change. However, the problems noted above are likely to continue to limit the effectiveness of recovery planning as a conservation tool under climate change. In addition, we make a number of further points:

First, as noted, climate change is likely to further exacerbate the problem of limited conservation budgets. This is likely to increase the need to provide more funding for recovery planning and increase the need to prioritise recovery actions. A key aspect of any prioritisation process will be determining in a transparent and objective way, what species get recovery plans and why.

The prioritisation of threatened species is consistent with reconsidering the goal of trying to protect all species from extinction. It recognises that achieving the protection of all species is unlikely, and therefore we should allocate limited resources for biodiversity protection in a way that achieves the best overall outcome (e.g. that maximises the number of species that are protected).[205]

We are aware of various prioritisation processes, including 'Back on Track' used in Queensland, the Project Prioritisation Protocol[206] used in New Zealand, and a further approach recently outlined by Briggs.[207] Determining the best prioritisation approach to use is a difficult technical question requiring expert input. However, we make the following general comments about prioritisation:

- A key driver of prioritisation is limited conservation budgets. As noted, there is generally a significant mismatch between the amount of money required to implement recovery and threat abatement actions for threatened species and

---

[202] Clark J, Hoekstra J, Boersma P, Kareiva P. 'Improving U.S. Endangered Species Act Recovery Plans: key Fndings and Recommendations of the SCB Recovery Plan Project' *Conservation Biology* 16 1510-1519.

[203] Priddel D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10 S97-S102; Clark J, Hoekstra J, Boersma P, Kareiva P. 'Improving U.S. Endangered Species Act Recovery Plans: key Fndings and Recommendations of the SCB Recovery Plan Project' *Conservation Biology* 16 1510-1519.

[204] Clark J, Hoekstra J, Boersma P, Kareiva P. 'Improving U.S. Endangered Species Act Recovery Plans: key Fndings and Recommendations of the SCB Recovery Plan Project' *Conservation Biology* 16 1510-1519.

[205] Bottrill M, Joseph L, Carwardine J, Bode M, Cook C, Game E, Grantham H, Kark S, Linke S, McDonald-Madden E, Pressey R, Walker S, Wilson K, Possingham H (2008) 'Is conservation triage just smart decision making? *Trends in Ecology and Evolution* 23: 649-654.

[206] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*

[207] Briggs S (2009) 'Priorities and paradigms: directions in threatened species recovery' Online early: www3.interscience.wiley.com/journal/119881249/issue

the amount of money allocated to these activities.[208] We maintain that current budgets are inadequate and will need to be increased under climate change. Prioritisation does not reduce the need to increase budgets, nor does the idea of prioritisation legitimate inadequate levels of funding.

- Any prioritisation process needs to clearly establish the objective of the process and a timeframe over which the objective should be achieved.[209] For example, do we want to secure the greatest number of threatened species, or the greatest number of threatened species of highest social value, or the greatest number of threatened or non-threatened species of highest functional value, etc?[210] Clearly, the objective sets the context for the prioritisation process (e.g. it determines what features of a species are used to value or weight that species) and enables transparent and consistent decision-making in cases where trade-offs are identified (e.g. for a given budget, do we secure one 'expensive' species of very high ecological value or five 'cheaper' species of lower value).[211] Any prioritisation process is clearly tied closely to the public debate that should be had over what we try to protect and why (see section 5.1).
- As previously noted, many prioritisation processes only take into account species value, which is usually defined by the conservation status of a species. However, Joseph et al[212] demonstrated that to maximise conservation outcomes with a limited budget, prioritisation must take into account not only species value, but also three additional factors (see section 4.9). It appears to us therefore that any prioritisation criteria must include at least these four factors.
- Finally, the impacts of climate change must be taken into account in any prioritisation process. Climate change will exacerbate existing threats and may have a strong influence over some prioritisation criteria, in particular, the cost of management and the likelihood of success of management. In addition, climate change is likely to significantly increase uncertainty for biodiversity management, which may increase the need to ensure that uncertainty is explicitly accounted for in prioritisation criteria (i.e. all other things being equal, you would generally prioritise a certain outcome over an uncertain outcome).

Second, in addition to prioritisation between species and recovery actions, there appears to be a need to make recovery plans shorter, simpler, and more tightly focused on recovery actions and outcomes.[213] In this regard, the mandatory

---

[208] Joseph L.N. et al (in review) 'Improving methods for allocating resources among threatened species: the case for a new national approach in New Zealand'.

[209] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology*; Briggs S (2009) 'Priorities and paradigms: directions in threatened species recovery' Online early: www3.interscience.wiley.com/journal/119881249/issue

[210] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*

[211] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*

[212] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*

[213] Priddel D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10 S97-S102.; Clark J, Hoekstra J, Boersma P, Kareiva P. 'Improving U.S. Endangered Species Act Recovery Plans: key Fndings and Recommendations of the SCB Recovery Plan Project' *Conservation Biology* 16 1510-1519.

'conservation advices' under the *EPBC Act 1999* will become increasingly important. They are much less resource intensive to prepare and must be pragmatic about the potential for recovery actions to make a difference.[214]

Third, climate change is likely to increase uncertainty in relation to the effectiveness of recovery actions and threat abatement. There has always been considerable uncertainty in relation to what actions are appropriate to recovery species and reduce threats,[215] and this is likely to increase under climate change as the nature of threats change in ways that are difficult to predict.[216] This places even greater importance on ensuring that recovery planning is undertaken within an adaptive management framework, which will require plans to be flexible and responsive to change. However, in practice, recovery plans are often inflexible. They undergo a long process of preparation, public exhibition, costing, and approval, and so once approved, they are not easily modified and funding is rarely available for actions not already identified.[217] As Clark et al stated:

> *Recovery plans need to be dynamic and action-oriented documents rather than edicts eternally etched in stone*.

Fourth, one criticism of recovery planning programs is that there is generally an unwillingness to accept risk as part of the process. For example, the successful Gould's Petrel recovery program involved the culling of native birds, the destruction of native vegetation and aerial baiting in a protected area, and translocation, which caused significant community opposition and problems in obtaining approvals.[218] Given that climate change will increase uncertainty, it is also likely to require greater risk-taking in relation to recovery actions. The recovery planning process needs to be able to address this significant issue.

Fifth, multi-species recovery plans have been put forward by many as a way of improving the cost-effectiveness and species coverage of the recovery planning process, and clearly therefore are a tempting approach to recovery planning under climate change. However, recent studies comparing multi-species plans with single-species plans in the US identified significant problems, including that species covered by multi-species plans are four times more likely to exhibit a declining trend in conservation status compared to species covered by single-species plans.[219] While multi-species plans have the potential to improve cost-effectiveness and increase species coverage, which will be very important under climate change, there is clearly a need to ensure that plans are effective. A key

---

[214] *Environment Protection and Biodiversity Conservation Act 1999* s266B.

[215] See generally Hutchings P, Lunney D, Dickman C (eds) (2004) 'Threatened species legislation: is it just an Act? Royal Zoological Society of New South Wales.

[216] Dunlop M and Brown PR (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change, Canberra, Australia.

[217] Priddel D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10 S97-S102.

[218] Priddel D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10 S97-S102.

[219] Boersma P, Kareiva P, Fagan W, Clark J, and J Hoekstra (2001) 'How good are endangered species recovery plans? *Bioscience* 51 643-650; Clark A and Harvey E (2002) 'Assessing multi-species recovery plans under the Endangered Species Act' *Ecological Applications* 12 655-662.

conclusion of one of the US studies was that, while grouping species based on taxonomic similarity or within the same area may allow greater species coverage, the key factor to consider in multi-species plans is threat similarity. For multi-species plans to be effective, species must be grouped only after proper analysis of the distribution of threats using appropriate tools.[220]

Recommendations: Recovery Planning

- A framework for prioritisation between listed species should be developed under the *EPBC Act 1999*, taking into account four related criteria: species value, the cost of management, the benefit of management, the likelihood of success. The criteria should take into account the impacts of climate change.
- The framework for prioritisation between listed species should be informed by the public debate that we should have over what we try to protect and why.
- Conservation budgets for threatened species recovery and threat abatement actions should be increased to address the continued decline in biodiversity and deal with the challenges of climate change.
- Recovery plans under the *EPBC Act 1999* should be made shorter, simpler, and be more tightly focused on recovery actions and outcomes.
- Recovery plans under the *EBPC Act 1999* should facilitate adaptive management and be more flexible and responsive to change and uncertainty.
- A greater focus should be given operationally under the *EPBC Act 1999* to threat abatement planning over recovery planning.
- A greater focus should be given operationally under the *EBPC Act 1999* to multi-species recovery plans over single-species plans only where species can be appropriately grouped based on threat similarity using robust approaches.

(b) Key threatening processes and threat abatement planning

What is the tool?

Under the *EPBC Act 1999*, key threatening processes may be listed.[221] These are processes which threaten, or may threaten, the survival, abundance or evolutionary development, of a native species, or ecological community in that it adversely affects an already listed species or community, or because it might result in an unlisted species or community becoming listed.[222] The listing of key threatening processes is a precondition for a decision as to whether to prepare a threat abatement plan.

The Federal Minister may decide whether to have a threat abatement plan for key threatening processes.[223] Threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.[224]

---

[220] Clark A and Harvey E (2002) 'Assessing multi-species recovery plans under the Endangered Species Act' *Ecological Applications* 12 655-662.

[221] *Environment Protection and Biodiversity Conservation Act 1999* s 183.

[222] *Environment Protection and Biodiversity Conservation Act 1999* s 188(4).

[223] *Environment Protection and Biodiversity Conservation Act 1999* s 270A.

[224] *Environment Protection and Biodiversity Conservation Act 1999* s 271.

Implementing the plan is intended to assist the long term survival in the wild of affected native species or ecological communities.[225]

The decision as to whether a threat abatement plan should be made or adopted is based on whether having and implementing a plan is the most 'feasible, effective and efficient way to abate the process'[226] and the Minister must consider advice from the Threatened Species Scientific Committee and consult, where relevant, with interested government agencies before making this decision.[227] The Minister must take account of the precautionary principle in making a decision as to whether to have a threat abatement plan.[228]

How is it currently working?

There are 17 key threatening processes under the *EPBC Act 1999*, including "loss of climatic habitat caused by anthropogenic emissions of greenhouse gases". Habitat fragmentation and threats posed by invasive species are also defined as threatening processes under the *EPBC Act 1999*.[229]

Fire frequency and the alteration of natural flow regimes are threats we are presently facing and climate change is likely to exacerbate them. Although these are listed in NSW and Victoria, they not listed under the *EPBC Act 1999*.

Ten threat abatement plans have been prepared under the *EPBC Act 1999*, mainly related to introduced species. However, there is no plan for climate change and none under consideration. The issue has been considered but it was felt that a national threat abatement plan would be difficult to implement because "most emissions of greenhouse gases are produced outside of Australia and a reduction in emissions will require complex national and international negotiations".[230]

Threat abatement planning provides an important mechanism for identifying and coordinating the management of threats at a broad scale.[231] However, there are a number of problems with the process, which are similar to the problems identified for recovery plans, including:

---

[225] *Environment Protection and Biodiversity Conservation Act 1999* s 271.

[226] *Environment Protection and Biodiversity Conservation Act 1999* s 270A(2).

[227] *Environment Protection and Biodiversity Conservation Act 1999* s 270A(3), 270B(5), 274.

[228] *Environment Protection and Biodiversity Conservation Act 1999* s 391(3).

[229] the Commonwealth list per section 183 at:
http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl

[230] The issue was originally considered by the then Endangered Species Scientific Sub-Committee and reaffirmed by the Threatened Species Scientific Committee.

[231] Mahon P (2009) 'Targeted control of widespread exotic species for biodiversity conservation: The Red Fox (*Vulpes vulpes*) in New South Wales, Australia *Ecological Management and Restoration* 10 S59-69; Downey P, Williams M, Whiffen L, Turner P, Burley A, and Hamilton M (2009) 'Weeds and biodiversity conservation: A review of managing weeds under the New South Wales Threatened Species Conservation Act 1995' *Ecological Management and Restoration* 10 S53-58; Auld T and Keith D (2009) 'Dealing with threats: integrating science and management' *Ecological Management and Restoration* 10 S79-87.

- Funding for the implementation of actions to abate threats is often inadequate.[232]
- Monitoring of the effectiveness of actions to abate threats is often inadequate.[233]
- Threat abatement plans lack 'teeth' (e.g. again, decision-makers must merely take threat abatement plans into account in deciding whether to approve a development).

However, threat abatement planning may have an important advantage over recovery planning. A key property of threatening processes is that they operate in ways that affect multiple species usually simultaneously, and therefore actions to abate threats are likely to benefit multiple species.[234] Threat abatement planning is therefore an important tool for addressing conservation issues above the species level (i.e. it moves beyond single-species approaches).

Will it conserve biodiversity under climate change?

Threat abatement planning will remain a key mechanism to protect biodiversity under climate change. In particular, a key impact of climate change will be the exacerbation of existing threats. Reducing existing threats is one of the most widely advocated strategies to combat the impacts of climate change.[235] However, climate change poses a number of challenges to the threat abatement planning process:

First, unlike many other threatening processes, the development of strategies to combat the impacts of climate change on biodiversity are only just beginning and lack of knowledge and uncertainty poses a significant barrier to effective threat abatement.[236] Climate change will exacerbate and change the nature of existing threats in ways that will be difficult to predict. Dunlop and Brown argue that climate change will significantly influence four existing threats in particular: invasive species, changes to fire regimes, changes to hydrology, and changes to land use.[237] Climate change will also create novel threats, such as impacts due to

---

[232] Mahon P (2009) 'Targeted control of widespread exotic species for biodiversity conservation: The Red Fox (*Vulpes vulpes*) in New South Wales, Australia *Ecological Management and Restoration* 10 S59-69; Downey P, Williams M, Whiffen L, Turner P, Burley A, and Hamilton M (2009) 'Weeds and biodiversity conservation: A review of managing weeds under the New South Wales Threatened Species Conservation Act 1995' *Ecological Management and Restoration* 10 S53-58.

[233] Mahon P (2009) 'Targeted control of widespread exotic species for biodiversity conservation: The Red Fox (*Vulpes vulpes*) in New South Wales, Australia *Ecological Management and Restoration* 10 S59-69; Downey P, Williams M, Whiffen L, Turner P, Burley A, and Hamilton M (2009) 'Weeds and biodiversity conservation: A review of managing weeds under the New South Wales Threatened Species Conservation Act 1995' *Ecological Management and Restoration* 10 S53-58.

[234] Auld T and Keith D (2009) 'Dealing with threats: integrating science and management' *Ecological Management and Restoration* 10 S79-87.

[235] Heller N and Zavaleta E (2009) 'Biodiversity management in the face of climate change: A review of 22 years of recommendations *Biological Conservation* 142 14-32; Reaser JK, Pomerance R and Thomas PO (2000) "Coral Bleaching and Global Climate Change: Scientific Findings and Policy Recommendations" *Conservation Biology* 14(5) at pp 1500-1511.

[236] Auld T and Keith D (2009) 'Dealing with threats: integrating science and management' *Ecological Management and Restoration* 10 S79-87.

[237] Dunlop M and Brown P (2008) *Implications of climate change for Australia's National Reserve System: A preliminary assessment. Report to the Department of Climate Change* Department of Climate Change Canberra, Australia.

higher temperatures and carbon dioxide levels, and more frequent extreme weather events.[238]

Second, climate change may justify a greater focus on threat abatement planning over recovery planning. As noted, threat abatement planning addresses the drivers of biodiversity decline, is likely to benefit multiple species, and may be more cost-effective.[239] As climate change is likely to cause many species to become threatened, it is likely to be most effective to focus conservation efforts on the broad processes that cause species to decline.[240] However, some scientists argue that we should be cautious in focusing too much on threat abatement plans at the expense of recovery plans. Many species are affected by multiple threats and a failure to abate all threats may not achieve a successful outcome at the species level.[241] Threat abatement plans are likely to work well in cases where one threat is causing the primary impact on many species and the control of that threat is feasible at a large-scale.

Third, many of the key threats likely to be exacerbated by climate change (e.g. invasive species, changes in fire regimes, changes in hydrology) operate at a landscape scale, and can rarely be managed on a site by site basis.[242] As such, climate change may increase the need to manage threats at a landscape scale. Threat abatement plans provide a good mechanism to co-ordinate threat abatement actions across regions and targeted to priority areas.[243] In addition, it is likely to be most cost effective to identify and focus threat abatement efforts on sets of threats that overlap and interact to affect large numbers of species (these have been called 'threat syndromes').[244]

Fourth, as for recovery plans, climate change is likely to further exacerbate the problem of limited conservation budgets. This has similar implications as for recovery planning, including: increasing the need to provide more funding for threat abatement planning; prioritising threat abatement planning, both in terms of between threats and between actions associated with a single threat, and making threat abatement plans shorter, simpler, and more tightly focused on threat abatement actions and outcomes.

Recommendations: threat abatement plans

---

[238] Auld T and Keith D (2009) 'Dealing with threats: integrating science and management' *Ecological Management and Restoration* 10 S79-87.

[239] Caughley G and Gunn A (1996) *Conservation Biology in Theory and Practice* Blackweel Science, Cambridge, Massachusetts; McIntyre S, Barrett G, Kitching R and Recher H. (1992) 'Species triage – seeing beyond wounded rhinos' *Conservation Biology* 6(4): 604-606;

[240] Caughley G and Gunn A (1996) *Conservation Biology in Theory and Practice* Blackweel Science, Cambridge, Massachusetts.

[241] Priddel D and Carlile N. (2009) 'Key elements in achieving a successful recovery programme: A discussion illustrated by the Gould's Petrel case study' *Ecological Management and Restoration* 10 S97-S102.

[242] Burgman M, Keith D, Hopper S, Widyatmoko D, and Drill C (2007) 'Threat syndromes and conservation of the Australian flora' *Biological Conservation* 134 73-82.

[243] Downey P, Williams M, Whiffen L, Turner P, Burley A, and Hamilton M (2009) 'Weeds and biodiversity conservation: A review of managing weeds under the New South Wales Threatened Species Conservation Act 1995' *Ecological Management and Restoration* 10 S53-58.

[244] Burgman M, Keith D, Hopper S, Widyatmoko D, and Drill C (2007) 'Threat syndromes and conservation of the Australian flora' *Biological Conservation* 134 73-82.

- A greater focus should be given operationally under the *EPBC Act 1999* to threat abatement planning over recovery planning (as noted above).
- Threat abatement efforts under the *EPBC Act 1999* should generally be focussed on sets of threats that overlap and interact to affect large numbers of species.
- Threat abatement plans under the *EBPC Act 1999* should be made shorter, simpler, and be more tightly focused on threat abatement actions and outcomes.

.6 Landscape-scale assessment and bioregional planning

(a) Landscape-scale assessment

What is the tool?

The Australian government has recently introduced optional conservation management tools called strategic assessments, which are intended to move the focus away from site-scale assessments to protecting biodiversity at a landscape scale.[245] Strategic assessments allow for an up-front assessment of the impacts of a policy, plan or program on matters of national environmental significance.[246] Once conducted, they allow the Federal Minister to exempt certain future actions from a site-specific assessment if they are carried out in accordance with a plan or policy approved under s146B of the Act.

How is it currently working?

Strategic assessments are presently under-utilised. They have only been used for offshore petroleum exploration, for military exercises and, more positively and most recently, for a host of fisheries and the Kimberley region of Western Australia. There remains a concern about the ability of the present framework to deliver strategic assessments which protect the environment and deliver sustainable development, rather than simply facilitating development.[247]

Will it conserve biodiversity under climate change?

The site-scale approach to conservation management has not worked well to date,[248] and is unlikely to do so under climate change. Strategic assessments provide a broader, macro-level approach to biodiversity conservation and enable principles such as connectivity, representation, etc to be considered in land-use planning.

However, the extent to which strategic assessments will provide adequate protection of biodiversity across the landscape will depend on the criteria considered and the process of assessment. There is a danger that if not done properly, they will instil a much lower level of environmental protection than a

---

245 *Environment Protection and Biodiversity Conservation Act 1999* Part 10.

246 *Environment Protection and Biodiversity Conservation Act 1999* s 146.

247 See, for example http://www.edo.org.au/policy/epbc_amendment_bill061027.pdf

248 Bubna-Litic K (2008) "Ten Years of Threatened Species Legislation in NSW – What Are the Lessons?" in Jeffery M, Firestone J and Bubna-Litic K (2008) *Biodiversity Conservation, Law and Livelihoods: Bridging the North-south Divide* Cambridge University Press at pp 265-279.

site by site approach. This has already been observed in the Regional Forest Agreement process which has clearly failed in its protection of biodiversity.

The challenge will be to make strategic assessments work in practice, and operationalise the theory, in a manner that protects biodiversity in Australia. Checks and balances will need to be built into these approaches to ensure this outcome. A number of concerns with the current strategic assessment process are discussed below, as well as a proposed model, designed to ensure biodiversity is protected under strategic assessment provisions.

First, under the current provisions the Minister has wide discretion in deciding whether to grant approval to a policy, plan or program, although importantly, discretion is limited to some extent by the requirement that the Minister not act inconsistently with various international conventions and domestic policies. However, except in the case of recovery plans, which usually contain quite specific provisions, the factors limiting the discretion are primarily broad principles, which are often difficult to interpret and apply to specific situations.

Second, there is no clearly defined standard or level of protection that the Minister must be satisfied is met prior to granting approval to a policy, plan or program.

Third, there are no guidelines that define the appropriate level of environmental information required to properly undertake a strategic assessment.

Fourth, our current ability to undertake landscape-scale assessments to ensure the protection of biodiversity is currently limited and subject to much uncertainty. Climate change is likely to significantly increase this uncertainty. For example, it is likely to require us to focus less on planning for biodiversity pattern (the elements of biodiversity that can be mapped and are regarded as static in time and space) and more on planning for biodiversity processes (the things that maintain biodiversity, such as pollination, predation, daily movements, migration in response to climate change, etc).[249] However, planning for biodiversity processes is a relatively new and undeveloped concept.

We have given some preliminary thought to how the strategic assessment process could potentially be improved. We feel that the process could be improved by establishing a structured discretion under the Act, with criteria that the Minister must be satisfied are met before granting approval to a policy, plan or program under the strategic assessment process (with some allowance for discretion).

A brief summary of a potential model follows:

For example, the *EPBC Act* could be amended to specify that:

- The Minister must be satisfied on reasonable grounds that the policy, plan or program will meet the 'overall improve or maintain' test.
- In deciding whether the 'overall improve or maintain' test has been met, the Minister must be satisfied that the following criteria are met –

  1)…..

  2)…..

[249] Pressey R, Cabeza M, Watts M, Cowling R, and Wilson K (2007) 'Conservation planning in a changing world' *Trends in Ecology and Evolution* 22(11): 583-592.

3)…..

Such criteria should include a requirement to consider areas of high conservation value for listed threatened species and ecological communities that must be protected in order to meet the 'overall improve or maintain' test, and areas of lower value that can be cleared, but must be offset.

For example, the *EPBC Act 1999* could specify that in deciding whether the 'improve or maintain' test has been met, the Minister must be satisfied that:

- Areas of high conservation value for listed threatened species and ecological communities are protected.
- Any loss of other areas of less value for listed threatened species and ecological communities is offset in accordance with offset rules.

This is similar to the approach taken by the assessment methodologies established under BioBanking (NSW *TSC Act 1995)* and under the NSW *Native Vegetation Act 2003*. Under these methodologies, areas of high conservation value for threatened species were determined through the use of expert panels. We feel this is a more defensible process than the current site based assessment process, which essentially involves ecological consultants making such decisions on a case by case basis. We suggest that high conservation value areas should be clearly defined under the EBPC Regulation.

Offsetting is controversial, but it is an inherent requirement of any policy that aims to 'improve or maintain' biodiversity values, while simultaneously allowing some impacts to occur. Offsetting can be appropriate in limited circumstances.[250] We suggest that offsetting rules in the context of the strategic assessment provisions should be clearly defined under the EBPC Regulation and that the offset rules be defined in accordance with the principles set out in Gibbons and Lindenmayer.[251]

We recognise that due to the ecological complexity of landscape-scale assessment processes, it is unlikely to be possible to define a set of rules for determining high conservation value areas and offsets whose strict application will always achieve the best biodiversity outcome when applied across Australia. As such, we suggest that a discretionary mechanism be included under the *EPBC Act 1999*, which allows the Minister to override the rules in certain circumstances.

For example, the *EBPC Act 1999* could specify that:

- If the Minister is of the opinion that a better outcome can be achieved through a minor variation of the rules relating to high conservation value areas and offsets, he/she can refer the strategic assessment to an expert panel.
- The expert panel should be required to assess whether a better outcome is likely to be achieved without strict application of rules relating to high conservation value areas and offsets.

[250] Gibbons P and Lindenmayer D (2007) 'Offsets for land clearing: No net loss of the tail wagging the dog'? *Ecological Management and Restoration* 8:26-31.

[251] Gibbons P and Lindenmayer D (2007) 'Offsets for land clearing: No net loss of the tail wagging the dog'? *Ecological Management and Restoration* 8:26-31.

- The expert panel may seek public submissions and should make recommendations in a report to the Minister, which should be made publicly available.
- The Minister should be required to consider the expert panel's report when making a decision, and should publish reasons for the decision.

We favour the use of an expert panel over government review due to the ecological complexity of landscape-scale assessment processes and because an expert panel is likely to be perceived as being more independent.

We feel that the above model may improve the current strategic assessment process because it clearly defines the 'overall improve or maintain test', high conservation value areas, and offset rules. In addition, the model recognises that it is unlikely to be possible to define a strict set of rules that will always achieve the best biodiversity outcome, and as such, it attempts to establish a defensible process for applying Ministerial discretion.

As noted, the ability to undertake landscape-scale assessments such as strategic assessment to ensure the protection of biodiversity is currently limited and subject to much uncertainty. While we should aim to maintain and protect biodiversity processes, this in particular, is a new and undeveloped concept. However, there is a significant need to better evaluate the biodiversity outcomes of land-use plans. As noted, the key purpose of conservation planning is to ensure the persistence of species.[252] As for the evaluation of the NRS (see section 5.2), it appears to us that any evaluation of land-use plans needs to not only include consideration of protecting pre-defined high conservation value areas, but also to evaluate the plan in terms of how well it ensures the persistence of a range of species, including threatened species potentially impacted by the plan. As noted, we understand that we have tools available that can do this, and which can also take into account climate change. Such tools can be used to evaluate different land-use planning options in terms of species persistence.

Recommendations: landscape-scale assessment

A suggested model for landscape-scale assessment is as follows:

- Before approving a strategic assessment under the *EPBC Act 1999*, the Minister must be satisfied on reasonable grounds that the policy, plan or program will meet the 'overall improve or maintain' test.
- In deciding whether the 'overall improve or maintain' test has been met under the *EPBC Act 1999*, the Minister must be satisfied that the following criteria are met –
  - Areas of high conservation value for listed threatened species and ecological communities are protected.
  - Any loss of other areas of less value for listed threatened species and ecological communities is offset in accordance with offset rules.
- Notwithstanding the above, if the Minister is of the opinion that a better outcome can be achieved through a minor variation of the rules relating to high conservation value areas and offsets under the *EPBC Act 1999*, he/she can refer the strategic assessment to an expert panel.

[252] Margules C and Pressey B (2000) 'Systematic conservation planning' *Nature* 405: 243-253.

- The expert panel should be required under the *EPBC Act 1999* to assess whether a better outcome is likely to be achieved without strict application of rules relating to high conservation value areas and offsets.
- The expert panel may seek public submissions and should make recommendations in a report to the Minister, which should be made publicly available under the *EPBC Act 1999*.
- The Minister should be required under the *EBPC Act 1999* to consider the expert panel's report when making a decision, and should publish reasons for the decision.

(b) Bioregional planning

What is the tool?

Bioregional plans are another landscape scale planning tool available to the Australian government under the *EPBC Act 1999.*[253] The Minister may prepare a bioregional plan for a bioregion that is within a Commonwealth area, or may cooperate with a State or State agency or any other person in the preparation of a bioregional plan for a bioregion that is not wholly within a Commonwealth area. The bioregional plan may include provisions relating to biodiversity and its conservation status, important economic and social values, heritage values of places, objectives relating to biodiversity and other values, priorities, strategies and actions to achieve the objectives, mechanisms for community involvement in implementation of the plan and measures for monitoring and reviewing the plan.

Once a bioregional plan is made, the Minister must take it into account when making any decision under the *EPBC Act 1999* to which the plan is relevant.[254]

How is it currently working?

No bioregional plans for terrestrial bioregions have been made under this section of the *EPBC Act 1999*. There are a number of marine bioregional plans in various stages of completion.

Will it conserve biodiversity under climate change?

Bioregional plans have the capacity to include the scientific principles important for the protection of terrestrial biodiversity under climate change, however they have only limited influence because they must merely be considered as one of a number of factors by the Minister when making decisions under the *EPBC Act 1999*. This means that even if a bioregional plan provides strong statements and establishes priorities to enable the adaptation of biodiversity to climate change, these may not be translated to actual on ground protection and implementation through the *EPBC Act 1999*.

Recommendations: bioregional plans

- Enabling the adaptation of biodiversity to climate change should form a key component of any bioregional plans made.

[253] *Environmental Protection and Biodiversity Conservation Act 1999* s 176

[254] *Environment Protection and Biodiversity Conservation Act 1999* s176

.7 Site-scale assessment

What is the tool?

Under the *EPBC Act 1999*, a person must not take an action that has, will have or is likely to have a significant impact on a matter of national environmental significance without approval from the Minister.[255] Matters of national environmental significance include threatened species and ecological communities listed under the *EPBC Act 1999*, migratory species, ramsar wetlands and heritage areas.[256] It is the responsibility of the proponent to refer any action that they think may be, or is a controlled action to the Minister, and for him to determine whether or not the action requires Commonwealth approval i.e. whether or not the action is a controlled action.[257]

If the action is controlled, the Minister may decide on the appropriate level of environmental assessment.[258] After considering *inter alia* the relevant environmental assessment documentation, community and stakeholder comment and social and economic factors the Minister may give approval to undertake the action and may include conditions to protect, repair or mitigate damage to a matter of national environmental significance.[259]

How is it currently working?

There are a number of problems with the current site-scale assessment process, which affects its ability to protect biodiversity.

First, the difficultly in assessing 'significant impact' due to a lack of information about the existing state of the environment, the difficulty in predicting impacts in complex ecological systems, and the uncertainty often surrounding the effectiveness of mitigation measures.

Second, the inability of the process to properly consider cumulative impacts of developments (e.g. it will always be hard to conclude that a development that clears only a small amount of habitat for a species compared to that remaining is likely to have a 'significant impact' on that species).

Third, inconsistent and inadequate assessments, which mean that decision-makers often have incomplete information on the biodiversity to be impacted.

Fourth, the ineffectiveness and lack of monitoring and enforcement of conditions placed on developments to mitigate impacts on biodiversity.

Finally, the wide discretion that decision-makers have in approving developments (e.g. approval can be given no matter how significant the impacts on threatened species are, based on social or economic grounds) and the reluctance of decision-makers to refuse developments on biodiversity grounds.

---

[255] *Environmental Protection and Biodiversity Conservation Act 1999* ss 67, 67A

[256] *Environmental Protection and Biodiversity Conservation Act 1999* Part 3

[257] *Environmental Protection and Biodiversity Conservation Act 1999* s 68

[258] *Environmental Protection and Biodiversity Conservation Act 1999* s87

[259] *Environmental Protection and Biodiversity Conservation Act 1999* ss 133, 134

How will it work under climate change?

Site-scale assessment of the impacts on biodiversity will remain important under climate change because it provides a mechanism to ensure that sites that are currently important for biodiversity (e.g. because they contain large populations) are adequately protected. Common sense says that protecting sites important for biodiversity now will minimise the impacts of climate change on biodiversity in the future. However, site-scale assessment may become less important relative to landscape-scale assessment under climate change for two main reasons:

- Processes important for the protection of biodiversity under climate change, such as connectivity, can only be properly considered at the landscape-scale.
- Sites that are currently important to a given species may become less important to that species in the future under climate change.

Nevertheless, as noted, there are risks associated with a landscape-scale approach for biodiversity, in terms of high levels of uncertainty. In contrast, site-scale assessment is a much more certain process, and this adds weight to the argument that site-scale assessment will remain relevant under climate change. However, the problems with the site based assessment process identified above will also apply under climate change, with the addition of the following points.

First, the focus of the assessment process is threatened species. While EIAs usually also assess impacts on non-listed species and ecological communities, the focus of assessment and decision-making is on threatened species. As noted, a focus on threatened species may not be the best way to minimise species extinctions under climate change.

Second, the assessment process does not explicitly require decision-makers to consider whether a development site is likely to be important for biodiversity under climate change (as a potential habitat corridor or buffer area, etc). Again, while EIAs usually consider the connectivity value of a development site, if threatened species are not present, then the importance of such areas under climate change will often not be adequately considered.

Recommendations: site scale assessment

- A greater focus should be given to landscape scale assessment as opposed to site scale assessment, however site scale assessment will remain relevant.
- The site based assessment process should be amended to require the Minister to consider whether a site will be important for biodiversity under climate change.

.8 Mechanisms for conservation on private land

What is the tool?

Governments around Australia are increasingly recognising that a landscape approach to biodiversity conservation is necessary; one that that traverses all tenures. No longer can ecologically sustainable development simply involve locking up certain land – through government acquisition in protected areas and developing land outside these areas. Significant amounts of land of high conservation potential across Australia are found on private property. For example, in Victoria 15 per cent of the State’s threatened vegetation types are reliant solely on private land for their survival while another 35 per cent of threatened vegetation types occur largely on private land.[260]

Conservation on private land is a suite of tools in itself, including land which is designated as part of the NRS. Many would argue at a definitional level, but private conservation initiatives include:

- Conservation agreements in perpetuity on whole or part of the land;[261]
- Acquisition programs by philanthropical or Trust bodies that may see the land join the NRS;[262]
- Assistance to purchase land for conservation;[263]
- Technical assistance in managing land for conservation;[264]
- Stewardship payments for the management of land for conservation;[265] and
- Tax incentives.[266]

The Australian government plays a major role funding conservation programs through Caring for our Country but most private conservation programs operate under state legislation and are implemented at a regional level.

How is it currently working?

Conservation on private land has always operated as a supplement to government efforts to protect biodiversity:

> *'except in those limited circumstances where the public interest in protecting biodiversity and private interest substantially coincide, and where biodiversity loss is reversible, voluntary mechanisms should be used to build a biodiversity conservation ethic and to supplement other instruments. In virtually all cases they need to be supported by mechanisms that ensure dependability and recognize the need for precaution to avoid irreversible loss.'*[267]

---

[260] Commonwealth State of the Environment Report 2006 at: http://www.environment.gov.au/soe/2006/publications/drs/indicator/111/index.html

[261] See, for example, *Environment Protection and Biodiversity Conservation Act 1999* s 305;

[262] See, for example, the Australian Bush Heritage Fund. Found at: http://www.bushheritage.org.au/ (17 February 2009).

[263] The Natural Heritage Trust National Reserve System Program facilitates the establishment of Private Protected Areas, providing up to two thirds of the purchase price to assist voluntary land purchase in exchange for permanent protection of the land.

[264] Many schemes provide this. One such program is Land for Wildlife, which operates across Australia – for example, see: http://www.dse.vic.gov.au/DSE/nrenpa.nsf/LinkView/34933B99F789EF0E4A25677800115944BA15AEEDADB3CA6C4A2567D600824A6C

[265] Section 305 (1)(e) of the *EPBC Act 1999* provides that conservation agreements may contain terms requiring the Commonwealth to provide financial, technical or other assistance to a person bound by the agreement;.

[266] See, for example, *Income Tax Assessment Act 1997* s 31.5.

[267] Young MD, Gunningham N, Elix J, Lambert J, Howard B, Grabosky P and McCrone E (1996) *Reimbursing the Future: An evaluation of motivational, voluntary, price-based, property-right, and*

The take-up of such programs at a Federal level has been limited, although the situation seems to have improved in recent years with greater government attention to facilitating and promoting private conservation initiatives. However, the take up still remains greater at a state level. For example, there are only 12 conservation agreements finalised under the *EPBC Act 1999*.[268] In contrast, there are around 200 voluntary conservation agreements finalised in NSW.

It appears that the up-take of private land schemes has been limited by the twin requirements of generally having to protect land in perpetuity and needing to have land of high biodiversity value, in order to attract funding, technical assistance, and tax benefits. 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 up-take (e.g. non-binding agreements that are easy to revoke).

As a result, many landholders appear to be adopting a 'wait and see' approach.[269] A number of new schemes have recently been developed (e.g. BioBanking in NSW) 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.

Philanthropic organisations operating on a national scale have been quite successful. For example, Bush Heritage Australia (a national non-profit organisation that protects Australia's unique animals, plants and their habitats by acquiring and managing land of outstanding conservation value) owns and manages 31 reserves throughout Australia covering over 946,276 hectares in six states.[270]

How will it work under climate change?

The protection of biodiversity on private land will be a vital strategy to protect biodiversity under climate change. As noted, combating the impacts of climate change will generally require a 'softening' of the matrix, increasing connectivity across landscapes, creation of buffers around sensitive areas, and the protection of a diversity of habitat types. All these strategies will require increasing the protection and management of biodiversity on private land.

As noted, there are a number of schemes established at the state and Federal levels for the protection of biodiversity on private land, which taken together, appear to provide a flexible framework, however we make the following points in relation to private land conservation under climate change:

First, there is a clear need for the level of up-take of private land conservation schemes to increase significantly under climate change. This will require the Federal and State governments to address barriers to up-take, which are likely to

---

regulatory incentives for the conservation of biodiversity at p 145. Available online at http://www.environment.gov.au/biodiversity/publications/series/paper9/index.html

[268] http://www.environment.gov.au/epbc/about/conservation-agreements.html#list

[269] See 'Background Briefing – 'Privatising Nature', 27 July, 2008 ABC Radio at: www.abc.net.au/rn/backgroundbriefing/stories/2008/2310990.htm

[270] http://www.bushheritage.org.au/ (17 February 2009).

include a lack of appropriate incentives such as funding and tax benefits, and the in-perpetuity nature of some agreements. Recent schemes such as Biobanking in NSW, which leverage investment from developers, may be an important future source of funding. However, it must be recognised that Biobanking (and in some cases the Property Vegetation Plan process under the NSW *Native Vegetation Act 2003*) is an offset scheme, which, as opposed to other schemes, only generates funding in exchange for a loss of biodiversity elsewhere.

Second, there is likely to be a need to ensure greater co-ordination of private land conservation schemes to ensure that conservation investment on private land through the schemes is strategically targeted. The various schemes operate under a different set of objectives and rules. For example, the 'Caring for our Country' program funds conservation activities under a different set of objectives to NSW Catchment Management Authorities (CMAs).[271] Similarly, Biobanking in NSW, which operates under a specific set of rules, is likely to target investment on different types of land to other schemes operating under different objectives. While having different objectives is appropriate, it may result in areas important for the protection of biodiversity under climate change not being targeted for conservation investment. 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.

Third, climate change is likely to require significant investment in the restoration of degraded areas. As such, there is likely to be a key role for private land conservation schemes, such as Biobanking agreements, Property Vegetation Plans, and wildlife refuge agreements provided for under NSW legislation, which allow for the protection and management of land that is not necessarily of high biodiversity value currently, but that with restoration, is likely to be important for biodiversity under climate change (e.g. potential habitat corridors or buffer zones in poor condition). This also requires significant investment in large scale revegetation programs, with the Australian government well placed to do this.

Fourth, there may be a key role for more flexible schemes, such as wildlife refuge agreements provided for under NSW legislation, in the short-term. 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. In addition, because wildlife refuges can be declared over multiple-use land, they provide an appropriate investment mechanism to improve the quality of the 'matrix'. As noted, the maintenance of a structurally complex matrix is particularly important where habitat patches are small or poorly connected, which is common in highly cleared agricultural areas.[272]

Finally, clearly it will be vital to ensure that legislation provides strong protection for areas of high biodiversity value on private land. For example, the *Native Vegetation Act 2003* in NSW has been successful in ending broad-scale land clearing in rural areas, and in urban areas, Biobanking appears to be more protective of biodiversity than the current Assessment of Significance/SIS process. These initiatives are clearly a step in the right direction, however few

[271] Natural Resources Commission (2008) 'Progress report on the effective implementation of Catchment Action Plans', NRC, Sydney.

[272] Fischer J, Lindenmayer D and Manning A (2006) 'Biodiversity, ecosystem function, and resilience: ten guiding principles for commodity production landscapes' *Frontiers in Ecology and Environment* 4(2): 80-86.

other states have this level of legislative protection for native vegetation. There is therefore a clear need to ensure that land clearing controls in both rural and urban areas are further tightened wherever possible. Introducing a land clearing trigger under the *EPBC Act 1999* would be a way for the Australian government to take a leadership role in protecting native vegetation on a national scale.

Recommendations: conservation on private land

- Financial and bureaucratic barriers that impede the take-up of conservation initiatives should be identified and removed.
- The objectives and rules of the different schemes should be better co-ordinated/aligned so that conservation efforts are more effectively targeted.
- Greater incentives should be provided for the restoration of land, including for the conservation of land which is not of high conservation value.
- An equal focus should be given operationally to more flexible schemes, such as wildlife refuges to improve the range of options for private conservation.
- A native vegetation trigger should be introduced under the EPBC Act to enable the Australian government to take a lead role in stopping broadscale clearing of native vegetation across Australia.

.9 "External" influences

(a) Institutional framework

A common feature of biodiversity conservation and management is that it is beset by institutional frameworks that foster inefficiencies and promote an uncoordinated approach. Sometimes this will be due to the fact that biodiversity conservation imperatives sit outside development objectives;[273] other times it will be due to restructures[274] or the vesting of responsibilities for biodiversity conservation in different agencies (for example, terrestial and marine).[275] In the context of biodiversity conservation, the establishment of the Commonwealth Department of Climate Change and other like agencies may ultimately do more harm than good, as their gatekeeper role may inhibit the take-up of climate change initiatives by the NSW Government as it may now rely on the Commonwealth to take the lead on biodiversity conservation.

---

[273] Secretariat of the Convention on Biological Diversity (2003) Interlinkages between biological diversity and climate change. Advice on the integration of biodiversity considerations into the implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol Montreal, SCBD (CBD Technical Series no. 10) at p 9. It further noted a similar problem at the international level:

> In addition, there is a lack of coordination among the multilateral environmental agreements, specifically among the mitigation and adaptation activities undertaken by Parties to the UNFCCC and its Kyoto Protocol, and activities to conserve and sustainably manage ecosystems undertaken by Parties to the Convention on Biological Diversity (at p 9).

[274] As the South Gippsland Conservation Society has noted in Victoria: "Over the past 20 years we have seen departments dealing with natural resources turned upside down, amalgamated, de-amalgamated, tweaked and down-sized": see EDO Victoria (2007) *Land and Biodiversity – A Call for Action: An analysis of submissions to the State Government's consultation paper 'Land and Biodiversity at a Time of Climate Change'* at p 20.

[275] In NSW, marine species dealt with under the (NSW) *Fisheries Management Act 1994* and land-based species under the (NSW) *Threatened Species Conservation Act 1995*. This is an inefficiency in itself, but is exacerbated by the fact that one is a resource allocation agency and the other a conservation agency.

As Bates has noted:

> *biodiversity protection is affected by, and in fact relies upon, discretionary exercises of power by virtually every statutory or government authority in Australia; and that responsibility for biodiversity protection is legally divided among, or conferred upon, many of these authorities creating a complex regulatory web that is uncertain in its application, inefficient in its approach, and ineffectual in adequately protecting biodiversity. Neither the legislation, nor apparently government policy, displays any coordinated or "whole-of-government" approach to biodiversity protection; legislative functions appear to have been conferred upon government agencies in an ad hoc manner without any clear strategic direction for promoting biodiversity conservation.*[276]

(b) Resourcing issues

Both adaptation and biodiversity conservation are poor cousins in their respective fields of climate change and general environmental issues. There are a number of points which flow from this.

First, as McDonald has noted, "there has been remarkably little attention given to the need for the best means by which to adapt to….inevitable impacts".[277] This lack of attention is, in turn, reflected in a lack of funding for adaptation. However, money is starting to flow, at least for research purposes.[278]

Second, biodiversity conservation has historically been under resourced, leading to problems of implementation[279] – witness the disparity between the conservation tools available under the various legislative schemes and their take-up (as discussed above). As noted, the Commonwelath has stepped back from making mechanisms such as recovery plans mandatory and moved to a discretionary recovery planning approach, largely due to a failure to meet the statutory requirements.

Third, climate 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, cylonic activity and extreme weather events and enforcement costs regarding illegal fishing.[280] Other costs will relate directly to biodiversity conservation - research, monitoring and intensive management and ex situ initiatives.[281]

---

[276] Bates G (2006) *Environmental Law in Australia* 6th ed, LexisNexis, Butterworths, Australia at p 435.

[277] McDonald J (2007) "The adaptation imperative: managing the legal risks of climate change impacts" in Bonyhady T and Christoff P (2007) *Climate Law in Australia* Federation Press, Sydney at p 124.

[278] See, for example, the Ministerial agreement to fund a set of priority action areas under the Action Plan made in 2006 (as noted in Mallett K (2007) "The Australian National Biodiversity and Climate Change Action Plan" in *Emerging Issues for Biodiversity Conservation in a Changing Climate* Abstracts of Poster Presentations at the 12th Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity 2–6 July 2007 in Paris, France).

[279] EDO Victoria (2007) Land and Biodiversity – A Call for Action: An analysis of submissions to the State Government's consultation paper 'Land and Biodiversity at a Time of Climate Change' at p 16.

[280] Hyder Consulting (2008) *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts at pp 52, 63, 81, 197, 215, 226, 235 and 244.

Fourth, resources for adaptation for the purpose of biodiversity conservation will have to compete for resources with other sectors, including within the 'adaptation budget', such as adaptation strategies around human settlements. For example, the report from the Working Group established by the Prime Minister focussed on a very narrow range of biodiversity actions, revolving around iconic sites.[282]

Finally, resources for biodiversity conservation may face decline if tourism dollars decline. For example, Kakadu is central to tourism in the Northern Territory. In 2006-07, tourism contributed an estimated $615.7 million, or 6.7% to the Northern Territory economy; 1.38 million people visited, spending over $1.8 billion.[283] Climate change projections indicate it will become a less, or much less, hospitable place to visit, which will inevitably effect income streams to the Australian economy.[284]

(c) Pressure from other sectors

Biodiversity conservation has always faced pressures from other sectors, well beyond resourcing issues. Development imperatives, including mining, and coastal development, have had adverse impacts on biodiversity conservation and driven the crisis we now face.

Climate change is likely to exacerbate these pressures. Adaptation measures themselves have the capacity to further deleteriously affect biodiversity conservation. For example, the building of sea walls will affect coastal ecosystems and impact on habitat while 'planned retreat' policies may impinge on protected areas, much of which lies near the coast.[285] The north of Australia has already been identified by some as a prime spot for agriculture under climate change.

Recommendations: 'external' influences

- Funding for biodiversity conservation should be increased to allow for the effective utilisation of statutory conservation tools.
- The conservation of biodiversity must remain a fundamental principle in all adaptation and mitigation responses to climate change.

---

[281] Hyder Consulting (2008) *The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report*, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts at pp xix, 92, 182, 189, 235 and 244.

[282] PMSEIC Independent Working Group 2007, *Climate Change in Australia: Regional Impacts and Adaptation – Managing the Risk for Australia*, Report Prepared for the Prime Minister's Science, Engineering and Innovation Council, Canberra at pp 3 and 25-27.

[283] Tourism NT *NT Tourism Industry* Available online at http://www.tourismnt.com.au/nt/nttc/about/nt_tourism.html [Date accessed 1/9/09]

[284] Hyder Consulting (2008) The Impacts And Management Implications Of Climate Change For The Australian Government's Protected Areas: Final Report, Canberra, ACT: Dept Of The Environment, Water, Heritage And The Arts at pp 64-82.

[285] See "Biodiversity-Climate interactions: adaptation, mitigation and human livelihoods" Summary of an international meeting held at the Royal Society 12-13 June 2007; Secretariat of the Convention on Biological Diversity (2003). Interlinkages between biological diversity and climate change. Advice on the integration of biodiversity considerations into the implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol.Montreal, SCBD, 154p. (CBD Technical Series no. 10) at p 8 and Korn H, Ntayombya P, Berghäll O, Cotter J, Lamb R, Ruark G, Thompson I pp 48-87 *Climate Change Mitigation And Adaptation Options: Links To, And Impacts On, Biodiversity*, pp 48-87 at p 78.

Appendix – roundtable discussion

The discussion points are listed below in the order they were discussed at the roundtable.

General

Discussion points

Climate change will significantly increase uncertainty for conservation management. In this context:

- Are the available tools the right ones to address the impacts of climate change on biodiversity or do we need fundamentally new tools and approaches?

  (i.e. is this about doing what we have always been trying to do, but making sure we do it better, or is it more than this?).
- Does the relative importance of the various conservation management tools available at a NSW and Federal level change under climate change?

  (i.e. will some tools become more important than others)?

Summary of discussion

- The range of tools that we have is probably adequate, but we may need to revisit why/how we use them. The relative importance of each may change.
- Legislation is not specific enough about how each tool should be used and what decision-makers have to achieve with each tool.
- A key issue with the existing tools is the lack of effective integration between them. Integration will be vitally important under climate change.
- Focusing on threatened species may not be appropriate. We need to broaden our approach to biodiversity conservation.
- We should focus on threat abatement over recovery actions. Threat plans will become more important and will give greater 'bang for buck', although recovery plans will remain important if we want to save specific species.
- Landscape-scale planning and assessment will become more important relative to site-scale assessment.
- We should not focus on connectivity at expense of other strategies. Connectivity at a regional scale will be more important than at a larger scale.
- Restoration at a landscape-scale in areas that provide potential future habitat for species under climate change will be important.

Legislative objectives

Discussion points

- How important is it to change current conservation objectives to reflect the realities of climate change?
- To what extent do current objectives hinder other conservation management tools that attempt to address the impacts of climate change?
- If current conservation objectives should be changed, what are appropriate new objectives and how should these be framed in legislation?

Summary of discussion

Note: the lawyers and the scientists had a very different understanding of the definition and meaning of the term 'objectives', 'goals', 'targets', etc.

- Objectives are important and should be changed to reflect the realities of climate change in order to ensure that we prioritise the right things.
- Legislative objectives on their own don't always mean much. There is a need to operationalise objectives through other legislative provisions.
- 'Resilient' ecosystems may not be the ultimate objective, but rather a means of achieving an objective.

Listing of threatened species

Discussion points

- What is the one thing you would change about this conservation management tool to better protect biodiversity under climate change?
- Should legislation enable listings to include species that are not currently threatened, but that are likely to become threatened under climate change?
- Should legislation enable listings to include 'key functional groups'? What might be some of the issues or difficulties associated with this approach?

Summary of discussion

- We need to prioritise the listing process (the consideration of nominations) to give scientific committees the extra capacity to focus on the right areas.
- Threatened species lists are very bias towards vertebrates and plants.
- There is a need to ensure that species that play a key role in ecosystem function are protected, in particular, their abundance levels (even if common).
- Being able to list key functional species (even if not threatened) in order to protect abundance levels will have broad benefits for biodiversity in general.
- Examples of key functional species not listed and that will be important under climate change (as dispersers) are emus and some flying foxes.
- Focusing on threatened species will remain useful because it provides a mechanism to protect a diversity of habitat types (i.e. it is likely to protect rare habitat types).
- Listing of ecological communities is important (broad benefits to biodiversity in general) and listing of populations is important.

Recovery and threat abatement planning

Discussion points

- Does the importance of prioritisation as a conservation management tool increase under climate change? If prioritisation between species is important, how should it be undertaken?
- Is the recent emphasis on the more generic and less resource intensive 'recovery strategies' (over 'recovery plans') and threat abatement strategies (over 'threat abatement plans' appropriate?
- Does the importance of threat abatement planning as a conservation management tool change relative to other tools under climate change (e.g. should we focus more on threat abatement over recovery planning)?

Summary of discussion

- Threat abatement and threat plans should be prioritised over recovery plans because they usually have broad benefits for many species, not just one.
- Recovery plans should be tighter, shorter, and more focused on outcomes and less on species biology, etc, which should be covered in the listing advice.
- We may want to focus more on regional recovery plans, although regional plans tend to loose their focus and so are not always effective.
- A possible model could be to prepare a detailed recovery plan for one species in each functional group and use that as a template for the preparation of much shorter recovery plans for the other species in that group.
- Recovery plans should play a key role in ensuring the on-ground protection of existing populations of species (e.g. from development).

Critical habitat

Discussion points

- What is the one thing you would change about this conservation management tool to better protect biodiversity under climate change?
- Is there a greater role for critical habitat in protecting land outside the protected area system important for biodiversity under climate change, such as habitat corridors, future climate refuges, buffer zones, etc?
- Should the criteria for listing critical habitat be expanded to allow the listing of areas that are likely to be required by species in the future under climate change (e.g. refuges), even if they are not currently used by that species?

Summary of discussion

- The idea of specific habitat associated with a given species under climate change will become problematic as species move. Also, it will be difficult to predict what habitat is likely to be critical for species under climate change.
- Critical habitat is still a useful tool because it is likely to protect a diversity of habitat types (i.e. likely to protect rare habitat types).
- By protecting a diversity of habitat types, you are also protecting the underlying differences in abiotic variables, which means you are probably also capturing a diversity of habitat types in the future (under climate change).

- Recovery plans should play a key role in ensuring the on-ground protection of existing populations of species (e.g. from development).

Land-use planning, landscape scale assessment, and site-scale assessment

Discussion points

- Does the importance of landscape-scale assessment as a conservation management tool change relative to other tools under climate change (e.g. should we focus more on landscape assessment over site-scale assessment)?
- Is it possible to identify 'red flag' areas on a landscape-scale (as has been done under Biobanking on a site-scale)? Can this be done to adequately account for climate change?
- Should site-scale assessment processes be modified to include a requirement to consider impacts on areas likely to be important for biodiversity under climate change? What are some the difficulties in doing this?
- Should offsetting policies associated with site-scale assessment be modified to encourage offsetting in areas likely to be important for biodiversity under climate change? What are some the difficulties in doing this?

Summary of discussion

- Land-use planning is the only way to effectively deal with cumulative impacts.
- There is a significant need to integrate land-use planning (undertaken by Councils) with investment planning (undertaken by CMAs).
- Landscape-scale assessment will become more important compared to site-scale assessment. However, landscape-scale assessment is a difficult process subject to a lack of knowledge and significant uncertainty.
- One approach to landscape planning could be to establish precautionary 'red flag' areas where no development is allowed except where developers can prove, via site-scale assessment, that development would be acceptable.
- Climate change must be accompanied by much tighter controls on land-clearing (e.g. red flag areas will need to be reconsidered and tightened up).
- Offsetting as a concept is very problematic and normally results in a net loss of vegetation. The principles currently underpinning offsets may become more problematic/less valid under climate change. Climate change will affect the value you give to a clearing site and the value you give to an offset site.

National Reserve System

Discussion points

- Is the NRS framework a robust strategy to address the impacts of climate change on biodiversity, but particularly in relation to protected areas?
- Are active and/or passive adaptive management appropriate management frameworks to address the impacts of climate change on biodiversity?
- To what extent does the current management framework facilitate or hinder adaptive management? If adaptive management is being hindered, what are the key reasons and what changes need to be made to address this issue?

Summary of discussion

- There is a need to redefine the objective of the NRS (why were doing it), but the framework generally provides a robust strategy under climate change.
- The NRS should be about protecting a diversity of habitat types to provide habitat for the widest possible range of species to come and go. It should no longer be about protecting a specific species within a specific area.
- The key issue with the NRS is implementation. This needs to be significantly ramped up if the NRS framework is to work under climate change.
- Management is a key problem with the NRS due to a lack of resources.
- Adaptive management is very important and should be implemented.

Conservation on private land

Discussion points

- Does the importance of conservation on private land as a conservation management tool change relative to other tools under climate change (e.g. should we focus more on private land over public land conservation)?
- How important are the 'softer' private land conservation mechanisms (e.g. non-perpetuity or non-legally binding agreements) in the mix of mechanisms?

Summary of discussion

- Private land will play a key role in terms of increasing connectivity and providing adequate buffers around protected areas.
- There may be more value in investing in buffers than there is in investing in protecting isolated areas.
- There is a significant need for revegetation/restoration on private land. Private conservation mechanisms should drive revegetation/restoration.
- CMAs prioritise investments on private land in different ways. Most investments are prioritised around threatened species.

Additional discussion at the end

- Legislative objectives should remain as aspirational objectives.
- There is a need to better integrate science into Catchment Action Plans in terms of informing priorities, setting targets, and measuring outcomes.
- Regional plans such as Catchment Action Plans need to be able to predict how climate change will change the nature of existing threats (e.g. fire regimes, land-use changes) and begin to address these changing threats.
- Climate change mitigation projects have the potential to impact biodiversity (e.g. tree planting schemes and rivers) and this needs to be addressed.
- The ability to protect biodiversity under climate change will be significantly influenced by other legislative regimes (e.g. water management).
- Because of the uncertainty associated with climate change, we should generally take the approach of trying all broad strategies to see what works best, within an adaptive management framework.

- However, we can be more certain that some broad strategies will work better than others. We should prioritise these over the others first, and then test the others within an adaptive management framework.