Climate change and the legal framework for biodiversity protection in NSW: 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 NSW. 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 in NSW 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 State-wide debate on the appropriateness of our current approach to biodiversity conservation under climate change.
- Ensure that the NSW Scientific Committee maintains its independence from the NSW government and plays a key role in informing decisions.

Protected areas: Establishment

- 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 and management under climate change.

Protected areas: Management

- 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 *NPW Act 1974* for all types of protected areas.
- Management plans under the *NPW Act 1974* should be required to be reviewed and updated on a regular basis.
- 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 *TSC Act 1995*.
- 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 *TSC Act 1995*.
- The definition of 'indigenous' under the *TSC Act 1995* 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 *TSC Act 1995* should be undertaken with a view to ensuring their efficacy under climate change.
- In conjunction with a robust community nomination process, the *TSC Act 1995* should be amended to allow the NSW Scientific Committee to establish 'priority themes' for the assessment of nominations.
- The *TSC Act 1995* should be amended to allow the NSW Scientific Committee to establish prioritisation criteria that the Committee must consider when prioritising nominations.

Critical habitat

- The definition of critical habitat under the *TSC Act 1995* 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).

Priorities Action Statement

- A framework for prioritisation between listed species should be developed under the *TSC Act 1995*, 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 a 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

- Recovery plans under the *TSC Act 1995* should be made shorter, simpler, and be more tightly focused on recovery actions and outcomes.
- A greater focus should be given operationally under the *TSC Act 1995* to the more generic recovery strategies over recovery plans, as provided for in the Priorities Action Statement.
- Recovery plans under the *TSC Act 1995* should facilitate adaptive management and be more flexible and responsive to change and uncertainty.
- A greater focus should be given operationally under the *TSC Act 1995* to threat abatement planning over recovery planning.
- A greater focus should be given operationally under the *TSC Act 1995* to multi-species recovery plans over single-species plans only where species can be appropriately grouped based on threat similarity using robust approaches.

CMAs

- Investment priorities under the *CMA Act 2003* should be developed through a statutory requirement to take into account climate change impacts.
- CMAs need to use appropriate decision-support tools for prioritisation and environmental decision-making.
- Increased funding and resources need to be made available to ensure that CMA monitoring on natural resource condition and trends is improved.
- Land-use planning undertaken by Councils should be better integrated with investment planning undertaken by CMAs through requiring Councils under the *EP&A Act 1979* to take into account CMA plans.
- CMAs should be given greater flexibility under the *CMA Act 2003* over when they spend their investment budgets by increasing the period over which funding must be spent, to ensure investments are more effective.

Land-use planning

- Land-use plans such as LEPs should contain a legal test under the *EP&A Act 1979* that requires a decision-maker to be satisfied that the land-use plan as a whole adequately protects biodiversity, including under climate change.
- Land-use planning undertaken by Councils should be better integrated with investment planning undertaken by CMAs through requiring Councils under the *EP&A Act 1979* to take into account CMA plans (as noted above).

Landscape-scale assessment

- Before certifying an EPI under the *TSC Act 1995*, the Minister must be satisfied on reasonable grounds that the EPI will meet the 'overall improve or maintain' test.
- In deciding whether the 'overall improve or maintain' test has been met under the *TSC Act 1995*, 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 *TSC Act 1995*, he/she can refer the biocertification assessment to an expert panel.
- The expert panel should be required under the *TSC Act 1995* 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 *TSC Act 1995*.
- The Minister should be required under the *TSC Act 1995* to consider the expert panel's report when making a decision, and should publish reasons for the decision.

Site-scale assessment

- Biobanking should be made compulsory subject to robust evaluation and review. Given that Biobanking is not yet underway, the statutory two year review of the scheme is unlikely to allow enough time for proper evaluation.
- Regular review and further tightening of the 'red flag rules' should occur to ensure that Biobanking becomes more protective of biodiversity over time, including areas important for biodiversity under climate change.
- 'Priority areas' for offsetting within regions should be identified using scientifically defensible approaches to enable future modification of the assessment methodology to encourage offsets within priority areas.

Land clearing controls

- Regular review and further tightening of the 'red flag rules' should occur to ensure that the *NV Act 2003* becomes more protective of biodiversity over time, including areas important for biodiversity under climate change.
- 'Priority areas' for offsetting within regions should be identified using scientifically defensible approaches to enable future modification of the *NV Act 2003* assessment methodologies to encourage offsets within priority areas.

Conservation on private land

- Financial and bureaucratic barriers that impede the take-up of conservation initiatives should be identified and removed.

- Incentives should be structured so that conservation effort is targeted in areas of greater strategic need.
- 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.

'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.

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1. Introduction

1.1 The issue

We are already failing to adequately address the decline of biodiversity in NSW 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 NSW.

Our current approach to biodiversity conservation in NSW (and 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.

1.2 The process

This paper begins the process of evaluating whether the current legal framework for the protection of biodiversity in NSW 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 that affects biodiversity in NSW. 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.

- Key *statutory* tools for the protection of biodiversity in NSW (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 Department of Environment and Climate Change	Paul Adam University of New South Wales
Gerry Bates University of Sydney	Chris Dickman University of Sydney
Michael Dunlop CSIRO Sustainable Ecosystems	Brendan Wintle University of Melbourne
Martin Fallding Land & Environment Planning	Sarah Bekessey Royal Melbourne Institute of Technology
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 NSW government.

1.3 The structure

The paper is structured as follows:

- Section 2 – This section briefly describes the predicted impacts of climate change on biodiversity.

- Category 2 – Legislation that has significant application to biodiversity protection, but that is not specifically designed to protect biodiversity (e.g. planning laws).
- 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 3 – This section briefly describes how species have adapted to climate change in the past.
- Section 4 – This section identifies some general scientific principles for the protection of biodiversity under climate change.
- Section 5 – This section:
    - Describes each statutory conservation tool.
    - Briefly evaluates how well each statutory conservation tool is currently working in terms of protecting biodiversity.
    - 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 NSW government needs to consider in relation to each statutory conservation tool.

2. 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

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]

The most vulnerable species will be those with long generation times, low mobility, small or isolated ranges, and low genetic variation.[11] Species that are already vulnerable due to restricted population size or specific habitat requirements will be particularly prone to extinction.[12]

Some ecosystems are also considered to be particularly vulnerable to climate change, including alpine ecosystems, coral reefs, and mangrove systems.[13]

3. How will species adapt to climate change?

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

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, 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] 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.

[12] 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).

[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).

[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*

- 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]

4. 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.

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.

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.

4.1 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 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

[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.

[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.

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.

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

[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.

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]

4.3 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]

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

[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.

[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.

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]

4.4 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).
- The fact that suitable habitat connectivity will vary between different species.

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[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.

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]

4.5 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]

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[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

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[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]

4.6 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]

4.7 Increase the focus on protecting ecosystem functions

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[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

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[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]

4.8 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.

4.9 Prioritise conservation actions

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[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).

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[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]

4.10 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.

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[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]

5. Current legislative framework

The legislative tools in NSW 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.
- Catchment Management Authorities.
- Land-use planning and landscape-scale assessment.
- Site-scale assessment in urban areas.
- Land clearing controls in rural areas.
- Mechanisms for conservation on private land.

5.1 Legislative objectives

What is the tool?

Three pieces of legislation in NSW have the conservation of terrestrial biodiversity as a key objective, consistent with international obligations.[98] These are:

The *National Parks and Wildlife Act 1974* (*NPW Act 1974*), which aims to ensure the:[99]

> *Conservation of nature, including, but not limited to, the conservation of:*
>
> - *habitat, ecosystems and ecosystem processes, and*
> - *biological diversity at the community, species and genetic levels, and*
> - *landforms of significance, including geological features and processes, and*
> - *landscapes and natural features of significance including wilderness and wild rivers.*

The *Threatened Species Conservation Act 1995* (*TSC Act 1995*), which aims to:[100]

> *Conserve biodiversity and promote ecologically sustainable development, and*
>
> *Prevent the extinction and promote the recovery of threatened species, populations and ecological communities, and*
>
> *Protect the critical habitat of those threatened species, populations and ecological communities that are endangered, and*
>
> *Eliminate or manage certain processes that threaten the survival or evolutionary development of threatened species, populations and ecological communities*.

The *Environmental Planning and Assessment Act 1979* (EP&A Act 1979), which aims to ensure the:[101]

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[98] Convention on Biological Diversity 199r, article 1.

[99] (NSW) *National Parks and Wildlife Act 1974* s 21.

[100] (NSW) *Threatened Species Conservation Act 1975* s 3.

[101] (NSW) *Environmental Planning and Assessment Act 1979* s 5.

> *Protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.*

Current overarching conservation goals and legislative objectives generally aim to maintain the status quo – they seek to protect all species from extinction and to prevent change to biodiversity – to keep all things as and where they are. For example, we generally try to protect specific populations in specific locations at current or viable abundances and protect the current composition of ecological communities in specific locations.[102] As Dunlop and Brown state:

> *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. This intent is not always explicit: the intent to preserve biodiversity 'as is' is often embedded in conservation aspirations, practice and formal processes, despite high-level statements in some programs of the objective to enable natural processes to occur.*

How is it currently working?

It is clear that NSW is falling well short of its legislated objectives to protect biodiversity. At least 80 species of flora and fauna – both marine and terrestrial - have become extinct in NSW in the past 200 years.[103] A further 1035 species, populations and ecological communities are listed as 'vulnerable', 'endangered' or 'critically endangered' under the *TSC Act 1995*.[104] This list is growing despite the existence of legislative objectives to protect biodiversity for over 30 years.

As the NSW State of the Environment (SoE) report 2006 states:[105]

> *The diversity of terrestrial species in NSW remains under threat and response mechanisms to protect them have not yet reversed this trend…*[since the last reporting period] *the number of species listed as threatened has increased by 47, and there are an additional 25 threatened populations and communities…The distribution and abundance of many species not listed as threatened continues to decline due to habitat destruction and other pressures.*

The SoE report also notes that even where pressures on species are reduced, due to lag effects, it may take years for the full impacts to become evident, particularly for threats such as habitat fragmentation and climate change.

Will it conserve biodiversity under climate change?

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[102] 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.

[103] Part 4, Schedule 1, *Threatened Species Conservation Act 1995*, Schedule 4, *Fisheries Management Act 1974*.

[104] NSW Department of Environment and Climate Change threatened species profile at: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx.

[105] NSW Department of Environment and Climate Change State of the Environment Report 2006 at: http://www.environment.nsw.gov.au/soe/soe2006/chapter6/.

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.[106] A recent report commissioned by the Australian government was blunt in its assessment:

> *The current goal of preventing change to species and ecosystems is impossible to achieve under climate change.*[107]

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'.*[108]

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 NSW. 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 NSW, 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 NSW 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.

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[106] 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.

[107] 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.

[108] 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.

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 in the long-term (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').[109]

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 NSW. 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 and State-wide 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

[109] 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.

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 a statutorily-required biodiversity strategy such as the 'NSW Biodiversity Strategy', which must be prepared and reviewed every five years under the *TSC Act* 1995, 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 in NSW and so they should be reviewed in synchronicity with such reviews.

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 NSW Scientific Committee, 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 NSW 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 State-wide debate on the appropriateness of our current approach to biodiversity conservation under climate change.
- Ensure that the NSW Scientific Committee maintains its independence from the NSW government and plays a key role in informing decisions.

5.2 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.[110] The Preamble to the *Convention on Biological Diversity* 1992 acknowledges:

> *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.*[111]

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:[112]

- *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.[113]

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:[114]

- 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).

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[110] 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. "

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

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

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

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

- 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).

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).[115]

Establishment of protected areas

In NSW, protected areas are established on public land under the *NPW Act 1974*. The Director-General is responsible for investigating proposals for reservations and dedications.[116] The Act provides for the establishment of a range of protected areas, including national parks, nature reserves, and state conservation areas. The proclamation for certain types of protected areas, including national parks and nature reserves, must be laid before the NSW Parliament.[117] In addition, the concurrence of certain Ministers must be obtained.[118] Reservation of national parks and nature reserves can only be revoked by an Act of Parliament.[119]

The *Wilderness Act 1987* provides for the establishment of wilderness areas, which are generally areas that have not been substantially modified by humans and that are of a sufficient size to be maintained in an unmodified state. Wilderness areas can be declared within existing protected areas, as well as on private land that is subject to a conservation agreement.[120] The Director is responsible for investigating proposals for wilderness declarations.[121] Declarations can only be revoked by an Act of Parliament.[122]

The *NPW Act 1974* and the *Wilderness Act 1987* place a range of restrictions on the use of land, including relating to mining, logging, and tourism development. There are tighter restrictions on the use of land in wilderness areas.

On private land, protected areas can be established under a range of private conservation mechanisms, including conservation agreements (see section 5.10). As noted, some of these areas may be counted as part of the NRS.

The NSW Department of Environment and Climate Change (DECC) has recently prepared the *New South Wales National Parks Establishment Plan*, which sets out the priorities for additions to the NSW protected area system in each IBRA region over the next 10 years. The plan contains a number of broad priorities, including

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

[116] (NSW) *National Parks and Wildlife Act 1974 s7*

[117] (NSW) *National Parks and Wildlife Act 1974 s35, s47D, s47R*

[118] (NSW) *National Parks and Wildlife Act 1974 s30C, 30D*

[119] (NSW) *National Parks and Wildlife Act 1974 s37, 47L, 52, 58M*

[120] (NSW) *Wilderness Act 1987 s8*

[121] (NSW) *Wilderness Act 1987 s5, s6*

[122] (NSW) *Wilderness Act 1987 s8*

protecting unrepresented ecosystems, landscape corridors likely to be important under climate change, and areas important for managing existing protected areas, such as buffer zones.[123] The plan recognizes that the ability to meet the CAR goals across NSW will vary between IBRA regions, depending primarily on the extent of clearing. The plan states that in areas where over 70% of native vegetation remains, the CAR goals remain achievable, and DECC will continue to seek to reserve land under the *NPW Act 1974*. However, in areas where less than 30% of native vegetation remains, the plan states that the CAR goals are not achievable. In these areas, the primary strategy will be the protection of land under private conservation mechanisms.[124]

Management of protected areas

Under the *NPW Act 1974*, the Director-General is responsible for the management of most types of protected areas, including national parks and nature reserves.[125] The Act provides that management plans must be prepared 'as soon as practicable' for national parks and nature reserves, while plans for other types of protected areas are optional. Extensive procedural steps, including consultation with various advisory bodies and public exhibition, are required before a plan can be made.[126] The Act sets out a number of matters that must be considered in preparing a management plan. These include the general management principles set out for each type of protected area under the Act, the conservation of biodiversity, including the maintenance of habitat and populations of threatened species, the maintenance of natural processes, and fire management.[127] The Minister may amend or replace a plan of management 'from time to time'.[128] Where this occurs, the plan is subject to the same procedural steps required in making the original plan.[129] Management plans are legally binding: the management of a protected area must be undertaken in accordance with the plan.[130] Anyone can bring Court proceedings to enforce a management plan.[131]

How is it currently working?

Establishment of protected areas

Historically, protected areas have generally been established on unproductive land unsuitable for other purposes such as agriculture and development,[132]

[123] Department of Environment and Climate Change (2008) *New South Wales National Parks Establishment Plan 2008: Directions for building a diverse and resilient system of parks and reserves under the National Parks and Wildlife Act*, DECC, Sydney.

[124] Department of Environment and Climate Change (2008) *New South Wales National Parks Establishment Plan 2008: Directions for building a diverse and resilient system of parks and reserves under the National Parks and Wildlife Act*, DECC, Sydney.

[125] (NSW) *National Parks and Wildlife Act 1974 s8*

[126] (NSW) *National Parks and Wildlife Act 1974*, s73A.

[127] (NSW) *National Parks and Wildlife Act 1974* s 72AA.

[128] (NSW) *National Parks and Wildlife Act 1974* s 73B.

[129] (NSW) *National Parks and Wildlife Act 1974* s 73B.

[130] (NSW) *National Parks and Wildlife Act 1974* s 81(4).

[131] (NSW) *National Parks and Wildlife Act 1974* s 176A.

[132] Pressey R, Hager T, Ryan K, Schwarz J, Wall S, Ferrier S and Creaser P (2000) 'Using abiotic data for conservation assessments over extensive regions: quantitative methods applied across New South Wales, Australia' *Biological Conservation* 69, 55-82.

meaning that protected areas tend to be 'residual' to human requirements.[133] This is reflected in progress towards meeting the CAR goals.

A review of the NRS 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.*[134]

A more recent report by Dunlop and Brown for the Australian government agrees:

> *At present the effectiveness of the NRS is limited as habitat in many regions is very poorly represented.*[135]

In NSW at January 2006, the land reserved under the *NPW Act 1974* comprised 751 protected areas and a total of 6,477,018 hectares (ha), which represented 8.08% of the State. Much land has been added to the NSW protected area system recently. Since 1995, about 2.5 million ha has been added.[136]

Progress towards meeting the CAR goals in NSW varies considerably between IBRA bioregions, and in general, is more advanced in the east of the State than the west. Of the 18 IBRA regions in NSW, 11 have less than 50% of their regional ecosystems contained in the protected area system (comprehensiveness goal), while of the 129 IBRA sub-regions in NSW, 79 have less than 50% of their regional ecosystems protected (representativeness goal).[137] A few IBRA regions such as the Australian Alps have met 100% of their comprehensiveness and representativeness targets, while other regions, particularly those in the Far and Central Western regions, fall well short. For example, of the 213 vegetation communities identified as occurring in the Far and Central Western regions, almost two-thirds have less than 5% of their pre-European extent contained in protected areas.[138] In terms of the adequacy goal, Dunlop and Brown have noted that the goal is poorly defined from an operational perspective (although they note that a new framework for assessing adequacy is currently being developed). As such, it is currently difficult to measure progress towards meeting the goal.[139]

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[133] 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

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

[135] 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.

[136] Department of the Environment and Climate Change State of the Environment Report 2006 www.environment.nsw.gov.au/soe/soe2006/chapter6/chp_6.3.htm

[137] Department of Environment and Climate Change (2008) *New South Wales National Parks Establishment Plan 2008: Directions for building a diverse and resilient system of parks and reserves under the National Parks and Wildlife Act*, DECC, Sydney.

[138] Department of Environment and Climate Change (2008) *New South Wales National Parks Establishment Plan 2008: Directions for building a diverse and resilient system of parks and reserves under the National Parks and Wildlife Act*, DECC, Sydney.

[139] 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.

Management of protected areas

In terms of management of protected areas, the most recent 'State of the Parks' report[140] identifies that out of 639 protected areas established at 2004, only 195 (56 percent) had approved management plans in place, 122 had draft plans, 136 had plans in preparation, and plans for 186 protected areas had not yet commenced. In terms of ancillary plans (these are more detailed plans prepared to complement the primary management plan, such as for pest and weed control, fire management, threat abatement, and threatened species recovery), the report identified that about 90 percent of protected areas had at least one ancillary plan in place. The most common plans prepared were for pest and weed management (413 protected areas) and fire management (366 protected areas). The implementation of management plans is progressing adequately in only 12 percent of protected areas and inadequate implementation is actually having a detrimental impact on park values in 22 percent of protected areas. In addition, information on the natural values of protected areas is only sufficient to guide planning and management-decisions for all values in 16 percent of protected areas, while information gaps occur for some or all values in the remaining parks.

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,[141] there is general agreement that the NRS provides a robust framework to combat the impacts of climate change.[142] The CAR goals are based on sampling the diversity of ecosystem types (comprehensiveness) and the diversity within ecosystem types (representativeness) across their geographic ranges.[143] 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.[144] 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

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[140] Department of Environment and Climate Change (2004) *State of the Parks 2004*, DECC, Sydney.

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

[142] 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.

[143] 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.

[144] 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.

report, the Australian government recently announced $180m for the NRS, specifically in light of the challenges posed by climate change.[145]

A key issue in relation to the current prioritisation process under the NRS framework is that it does not appear to consider 'threats' in determining what land should be protected.[146] Given that protected areas are often 'residual' to human requirements, it appears to us that threat is an important consideration in this 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.[147] As Pressey puts it: [148]

> *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.[149]

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.[150] 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.[151]

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

[146] 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

[147] 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.

[148] 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

[149] 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.

[150] 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.

[151] 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.

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.[152] The first three of these are commonly advocated by scientists.[153] Indeed, the connectivity approach is gaining much currency in Australia at present (e.g. the Great Eastern Ranges Initiative, and see also the DECC Adaptation Strategy).[154] 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)[155] 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

To date, climate change has not significantly influenced the preparation of management plans for protected areas. The Australian government recently commissioned two major reports into the management of protected areas under climate change. Both reports raise profound issues for management and demonstrate that climate change has rarely been considered adequately to date.[156] For example, one report found that:

> *Existing management strategies may no longer be appropriate under changed climatic conditions and may therefore require review.*[157]

A brief desktop review of approved or draft management plans prepared under the *NPW Act 1974* in NSW shows that only 15 of the approximately 135 plans mentioned climate change.[158] Of the 15, some are informational only, noting the

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[152] 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.

[153] 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.

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

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

[156] 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.

[157] 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.

[158] There are actually 155 plans on the DECC website but 19 could either not be accessed or were seen as inapplicable (such as the Kosciuszko National Park – draft plan for managing human waste).

likely impacts of climate change and setting out the legal position (e.g. that climate change is a key threatening process).[159] Others prioritise management actions with an emerging theme being a 'climate change trifecta' of:[160]

- Continuing existing fire, pest and weed management programs to increase the ability of native species to cope with climate change.
- Liaising with neighbours, Landcare groups and government agencies to encourage retention and expansion of native vegetation.
- Encouraging research into appropriate indicator species.

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:[161]

- 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).[162] While many scientists argue that addressing existing threats is a key strategy to combat the impacts of climate change[163], 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 more on modelling and monitoring. In addition, the effectiveness of current management strategies will become more uncertain.[164]

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[159] See the Whalan Whalan State Conservation Area – draft plan of management; Clarence Estuary Nature Reserve - draft plan of management; Little Pimlico Island Nature Reserve - draft plan of management; Tweed Estuary Nature Reserve - draft plan of management.

[160] See Barrington Tops National Park, Mount Royal National Park and the Barrington Tops State Conservation Area – draft plan of management; Jerrawangala National Park - draft plan of management; Meeting Place Precinct - draft conservation management plan; Parma Creek Nature Reserve - draft plan of management; Wallingat National Park - draft plan of management; Wee Jasper Nature Reserve - draft plan of management; Wereboldera State Conservation Plan - draft plan of management; Lord Howe Biodiversity Management Plan (adopted).

[161] 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.

[162] 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.

[163] 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.

[164] 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.

Increasing uncertainty in relation to the management of protected areas under climate change strongly suggests the need to apply decision-theory frameworks to decision-making process in management and adaptive management frameworks to the implementation of management strategies, both of which deal explicitly with uncertainty (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.[165] 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:[166]

- 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 *NPW Act 1974*. 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 (plans are legally binding) 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 NSW 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.

There will also be a greater need under climate change to ensure that management plans are reviewed and updated on a regular basis. As noted, under the *NPW Act 1974*, management there is no requirement to review management plans regularly. Despite the fact that resources for the preparation of plans are clearly inadequate, there may be a need to reconsider this provision. There will also be a need to ensure that management plans remain flexible and do not foreclose on opportunities to implement the more unusual or radical management strategies (e.g. translocation in specific circumstances).

Recommendations: protected areas

Establishment of protected areas

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

[166] 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.

- 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 and management 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 *NPW Act 1974* for all types of protected areas.
- Management plans under the *NPW Act 1974* should be required to be reviewed and updated on a regular basis.
- Funding for protected area management should be increased to allow for the effective implementation of adaptive management frameworks.

5.3 Listing of threatened species, etc

What is the tool?

The *TSC Act 1995* establishes the process for listing terrestrial species in NSW. The Act provides for the listing of species, populations, and ecological communities under the categories of 'vulnerable', 'endangered', or 'critically endangered'.[167]

Decisions to list species, etc are made by the NSW Scientific Committee established under the Act in accordance with criteria prescribed by the TSC Regulation.[168] Under the regulation, the Scientific Committee must consider a range of criteria, including whether a species has undergone a reduction in population size, or has a restricted distribution, or has few mature individuals remaining.[169]

The listing process involves seeking nominations for listing from the public. The Scientific Committee may also make a determination on its own initiative or following a request of the Minister or the Natural Resources Commission.[170]

Under the *TSC Act 1995*, the Scientific Committee must determine priorities for its consideration of nominations every 12 months. In determining the priorities, the committee must have regard to any matters the committee considers

[167] (NSW) *Threatened Species Conservation Act 1995* ss 10, 11, 12

[168] (NSW) *Threatened Species Conservation Regulation 2002, Part 3, Division 1*

[169] (NSW) *Threatened Species Conservation Regulation 2002, Part 3, Division 1*

[170] (NSW) *Threatened Species Conservation Regulation 2002* s 18

relevant, including taxonomic distinctiveness and degree or immediacy of threat.[171]

The decision to list a species, etc in NSW is made by a scientific committee (not the Minister) and solely on the basis of scientific considerations (based on an analysis of the risk of extinction) and not on any social or economic considerations.[172]

The listing process triggers a number of legislative protection mechanisms, including:[173]

- Permits and licences.
- Impact assessment and approvals in urban areas.
- Land clearing controls in rural areas.
- Recovery plans.
- Key threatening processes.
- Threat abatement plans.
- Declarations of critical habitat.
- Interim protection orders.
- A range of offences.
- A range of duties and functions.

In addition, threatened species lists are used to allocate resources for recovery and threat abatement actions, design protected area systems, constrain development, and report on the state of the environment.[174]

How is it currently working?

Threatened species lists are a key component of the protection of biodiversity in NSW. In particular, for lands outside the protected area system, the trigger for legislative protection mechanisms has historically been dependent on, and in some cases may still depend on, the presence of threatened species.[175] As such, the lists are one of the few tools available to government agencies and the public to limit the adverse impacts of development on the environment.[176]

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[171] (NSW) *Threatened Species Conservation Regulation 2002* s 21

[172] See s 194Q of the EPBC Act, which provides that the Federal Environment Minister must consider the social and economic implications of listing a species or ecological community.

[173] Environmental Defender's Office (NSW) (2005) *Environmental Law Toolkit* – NSW 5th edition, Federation Press, Sydney.

[174] 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.

[175] This is particularly the case for urban areas, where (until the recent Biobanking legislation), protection relied almost solely on threatened species. In rural areas, the assessment methodology that operationalises the land clearing controls under the NV Act protects non-listed vegetation types in certain circumstances, but threatened species and their habitats remain a key focus.

[176] 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.

Currently, there are over 830 species, 30 populations, and 70 endangered ecological communities listed as threatened under the *TSC Act 1995* in NSW, with 75 species presumed extinct.[177] The 2006 NSW State of the Environment report states that between 2002 and 2006, the list has 'grown considerably', with 45 species added to the endangered list and six to the vulnerable list. The report concludes that the trend in the number of species, etc listed is 'deteriorating'.[178]

It should also 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.[179] 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.[180] Due to this bias, as well as time lags and lack of knowledge, many species at risk of extinction may not be currently listed.[181]

There are a number of problems with focusing on threatened species as a basis for biodiversity protection, which have been much discussed.[182] 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 NSW 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.[183]

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.

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[177] Department of Environment and Climate Change (2006) 'Introducing the Threatened Species Priorities Action Statement (PAS), DECC, Sydney.

[178] NSW State of the Environment Report 2006: www.environment.nsw.gov.au/soe/soe2006/chapter6/chp_6.3.htm

[179] 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.

[180] 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.

[181] 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

[182] 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.

[183] 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.

Related to this point, a focus on threatened species may direct attention away from resourcing other strategies to protect biodiversity under climate change.[184]

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.[185]

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 TSC 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'.[186]

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.*[187]

This point also applies to the listing of populations, where the *TSC Act 1995* requires that a population be restricted to a particular area. If the population migrates away from that particular area in response to climate change, then it may no longer be afforded protection under the Act.[188]

Fifth, the ability to list populations is an important aspect of the *TSC Act 1995* [189] because it adds flexibility to the Act, 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 provides a mechanism to protect advancing populations as they migrate across NSW in response to climate change, even though the species itself would not qualify for listing.

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[184] 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.

[185] 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.

[186] 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.

[187] 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.

[188] 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.

[189] We note that this is not provided for under the *Environment Protection and Biodiversity Conservation Act 1999*.

Sixth, for a species to be eligible for listing under the *TSC Act 1995*, it must be 'indigenous' to NSW, which is defined as being present in NSW in 1770. This definition may become problematic if our overarching goal is to facilitate natural adaptation under climate change. For example, a species previously restricted to Victoria may move into NSW in response to climate change and establish small populations. Under the current definition of indigenous, this species would not be eligible for listing under the *TSC Act 1995*, despite its tenuous hold in NSW.[190]

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(a).

In terms of the first point, as noted, *TSC Act 1995*requires that the NSW Scientific Committee determine priorities for its consideration of nominations every 12 months. We understand that the committee accepts all nominations in any given year and at any time of the year and then prioritises its assessment of all nominations received in accordance with three factors: the degree of threat; the immediacy of threat; and taxonomic distinctiveness.[191]

However, ultimately, the NSW Scientific Committee assesses all nominations it receives. Then, when the committee has capacity, it develops its own nominations in consideration of various prioritisation factors, including:[192]

- Species, etc that are suspected to be facing imminent risk of extinction and that would benefit from regulation and implementation of recovery action.
- Taxa that are not known to occur within secure habitats such as conservation reserves and land subjected to formalised conservation agreements.
- Species for which implementation of recovery action will deliver broader conservation benefits.
- Threatening processes, in particular invasive species.
- Species and ecological communities that are vulnerable to climate change.

As climate change is likely to increase the extinction risk of many species, we believe there is a key role for the NSW 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 *TSC Act 1995* that allows prioritisation of nominations will remain important, as it gives the committee the ability to create capacity to make

[190] 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.

[191] Personal communication, Dr Richard Major, Chairperson, NSW Scientific Committee (19/05/2009).

[192] Personal communication, Dr Richard Major, Chairperson, NSW Scientific Committee (19/05/2009).

its own nominations and the flexibility to do this in the areas of greatest need. However, the Act does not currently specify any prioritisation criteria that the committee must consider, or require that the informal criteria currently used by the committee are made publicly available. As more species 'line up' for listing, it will become more important for the prioritisation process to be made transparent.

In addition, it may be appropriate to allow the NSW Scientific Committee to establish 'priority themes' to encourage nominations in areas of greatest need.[193] However, there is a risk that this process will discourage public participation in the nomination process because the corollary to a priority theme is that nominations outside the theme have a low priority.[194] In addition, the public may perceive that a species under immediate threat of extinction (e.g. due to a development) will not be prioritised over a species that meets the current theme. If priority themes were to be established, the theme should only be one of a number of criteria used to prioritise nominations, including 'immediacy of threat'.

Recommendations: lists

- The listing of species that play a key role in ecosystem function ('key functional species') should be enabled under the *TSC Act 1995*.
- 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 *TSC Act 1995*.
- The definition of 'indigenous' under the *TSC Act 1995* 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 *TSC Act 1995* should be undertaken with a view to ensuring their efficacy under climate change.
- In conjunction with a robust community nomination process, the *TSC Act 1995* should be amended to allow the NSW Scientific Committee to establish 'priority themes' for the assessment of nominations.
- The *TSC Act 1995* should be amended to allow the NSW Scientific Committee to establish prioritisation criteria that the Committee must consider when prioritising nominations.

5.4 Critical habitat

What is the tool?

The *TSC Act 1995* provides for the listing of 'critical habitat'. The Act defines critical habitat as 'habitat critical to the survival of an endangered species, population or ecological community or a critically endangered species or ecological community' (i.e. not a vulnerable species, etc).[195]

The Director-General is responsible for identifying critical habitat, and must consult with the NSW Scientific Committee and have regard to any advice received.[196] However, the decision to list critical habitat is made by the Minister,

[193] This occurs under the *Environment Protection and Biodiversity Conservation Act 1999*.

[194] Personal communication, Dr Richard Major, Chairperson, NSW Scientific Committee (19/05/2009).

[195] (NSW) *Threatened Species Conservation Act 1995* s 37.

[196] (NSW) *Threatened Species Conservation Act 1995* ss 38, 39

who must have regard to the likely social and economic consequences of a declaration and the likely consequences for landholders.[197]

The declaration of critical habitat has the following key implications:

- A Species Impact Statement must be prepared to assess the impacts of developments under Part 4 or Part 5 of the EP&A Act that are proposed on land that is critical habitat.
- The concurrence of the Director-General is generally required for developments determined under Part 4 or Part 5 of the EP&A Act that are proposed on land that is critical habitat.
- Public authorities must have regard to the existence of critical habitat that occurs on land that they own or control in relation to the use of that land and in exercising their functions over any land that contains critical habitat.[198]
- In preparing a draft Local Environment Plan, Councils must consult with the Director-General if in the opinion of Council the draft plan may affect land that is critical habitat.

How is it currently working?

Critical habitat has been rarely used as a conservation tool in NSW. There are currently only four areas declared as critical habitat under the *TSC Act 1995*: the Wollemi Pine, the Gould's Petrel, Little Penguin population in Sydney Harbour, and the Mitchell's Rainforest Snail.[199]

Under each declaration, the area declared as critical habitat ranges from tens of ha (Little Penguin and Gould's Petrel) to 5,000 ha (the Wollemi Pine). In all cases except for the Little Penguin, areas of critical habitat have been declared entirely within existing protected areas (e.g. nature reserves declared under the *NPW Act 1974*). Part of the Little Penguin critical habitat occurs within Sydney Harbour National Park, and the remaining areas also appear to be public land.

There are likely to be a number of reasons why critical habitat is rarely used as a conservation tool. First, there is uncertainty around the meaning of the term – many people probably believe all habitat of a species is critical to the survival of that species, and there are clearly practical difficulties in making such determinations. Second, governments are traditionally hesitant to make decisions that affect private property rights. Some jurisdictions (e.g. Queensland), explicitly recognise this by requiring compensation in certain circumstances.

A further key limitation on the ability of critical habitat to protect areas important for the survival of threatened species, etc, is that a declaration largely only introduces procedural requirements and does not guarantee the protection of that habitat. In addition, the protection mechanisms provided by declarations of critical habitat do not apply to the assessment of the largest developments in NSW, which are assessed under Part 3A of the EP&A Act.

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[197] (NSW) *Threatened Species Conservation Act 1995* s 44.

[198] (NSW) *Threatened Species Conservation Act 1995* s 50.

[199] See Department of Environment and Climate Change at: http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm

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 (through requirements for additional assessment and concurrence) to areas important for the survival of 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'.[200]

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 'Eastern Suburbs Banksia Scrub' (the buffer) be declared as part of the critical habitat for Eastern Suburbs Banksia Scrub? We note that critical habitat for the Wollemi Pine includes 'buffer areas', but it is unclear whether those areas comprise habitat for the pine.[201] 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 *TSC Act 1995* 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).

5.5 Recovery planning and threat abatement planning

(a) Priorities Action Statement

What is the tool?

In 2004, amendments were made to the *TSC Act 1995* to provide for the 'Priorities Action Statement' (PAS). The key aim of the PAS is to prioritise

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

[201] See Department of Environment and Climate Change (2006) 'Critical Habitat determination for the Wollemi Pine (Wollemia nobilis) Araucariaceae - A determination under Part 3 of the Threatened Species Conservation Act 1995'. DECC, Sydney.

recovery and threat abatement strategies and actions for the protection of threatened species.

Prior to the PAS, the preparation of recovery plans was mandatory. A reason for its introduction was to address the gap between the number of threatened species requiring recovery plans (over 900) and the number of plans actually prepared (about 60).

Under the *TSC Act 1995*, the PAS must set out the recovery and threat abatement strategies to promote the recovery of each threatened species, etc and to manage each key threatening process. It must also establish relative priorities for the implementation of recovery and threat abatement strategies, establish performance indicators to enable reporting on achievements, and set out timetables for implementation and achievement.[202]

The PAS identifies 36 recovery and threat abatement strategies, and each of these strategies has more specific 'priority actions' associated with them, which cover things such as surveys to clarify the distribution of a species, weed and pest management programs, research, community education programs, etc.[203]

While DECC is ultimately responsible for implementing the PAS, recovery and threat abatement strategies are to be implemented by DECC, Catchment Management Authorities, Councils, and other land managers.[204]

How is it currently working?

In theory, the PAS represents a 'triage' or prioritisation process. It aims to prioritise strategies and actions for species recovery and threat abatement. As noted, scientists have long argued for the need to allocate limited conservation budgets in the most efficient way in order to maximise conservation outcomes.

There was a significant need for a formal prioritisation process such as the PAS. As noted, because conservation budgets are limited, prioritisation in relation to threatened species is currently occurring implicitly, based largely on conservation status or intuition. However, there are problems with this approach, as follows:

- It is not transparent. The public do not understand how decisions are made on what species get recovery plans and what species receive funding.
- It is probably not done in the same way each time. It is likely that decisions on what species get funding are influenced by different factors each time.
- It is unlikely to be making the best use of available resources, which means that we may not be maximising conservation outcomes.

As McIntyre et al[205] argue we are currently practising a distorted form of triage, which in practice permits extinction to continue in certain groups of taxa, regardless of intentions to save all species.

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[202] (NSW) *Threatened Species Conservation Act 1995* s 90A.

[203] See Department of the Environment and Climate Change at: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_recovery_new.aspx

[204] Department of Environment and Climate Change (2006) 'Introducing the Threatened Species Priorities Action Statement (PAS), DECC, Sydney.

[205] McIntyre S, Barrett G, Kitching R and Recher H (1992) 'Species triage – seeing beyond wounded rhinos' *Conservation Biology* 6(4): 604-606.

We note that the New Zealand government has already begun making prioritisation decisions within a transparent and accountable framework.[206]

The PAS was introduced in an attempt to address such issues. However, in our view, there are a number of problems with the PAS, which we have previously identified. In summary, these include:[207]

- The PAS does not prioritise strategies and priority actions between species. It does not introduce a transparent method for allocating limited resources between species – it merely lists what actions apply to each species.
- The basis for the prioritisation of strategies and priority actions is unclear. DECC states that priorities were determined based on expert input, however, it is not clear what criteria were used to determine relative priorities.[208]
- The PAS does not clearly identify responsibilities for the implementation of strategies and priority actions or provide an assessment of the capacity of government agencies and others to implement the strategies and actions.
- The PAS does not identify the locations for the implementation of strategies and priority actions. This makes it difficult to identify priority areas or regions where actions would have the greatest impact.

The key problem with the PAS is that it does not prioritise strategies and actions *between* species. The PAS currently identifies 4,255 priority actions that are classified as 'high priority, which apply to 755 threatened species.[209] Clearly, governments do not have the resources to implement this number of high priority actions against each species and within the timeframes contemplated by the PAS.

The PAS was supposed to be reviewed every three years with input from the Natural Resources Commission, the NSW Scientific Committee, the Social and Economic Advisory Council, the Biological Diversity Advisory Council, and other government agencies. However, this has not yet occurred.

Will it conserve biodiversity under climate change?

As noted, climate change is likely to increase the extinction risk of many species, which will further exacerbate the problem of limited conservation budgets. There is a clear need to establish a transparent, repeatable, and defensible prioritisation process for the protection of threatened species under climate change. Although the idea of the PAS is consistent with what is needed, because of the problems noted above, we do not believe the PAS currently achieves these things.

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[206] 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.*

[207] See EDO submission on Threatened Species Priority Action Statement at: http://www.edo.org.au/edonsw/site/policy.php; See also Joseph L, Watson J, Possingham H (2009) 'The New South Wales Priorities Action Statement and opportunities for maximizing return on investment for conservation' *Ecological Management and Restoration* 10 S143-144.

[208] Department of Environment and Climate Change (2006) 'Introducing the Threatened Species Priorities Action Statement (PAS), DECC, Sydney.

[209] See Department of the Environment and Climate Change at: http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_recovery_new.aspx

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).[210]

We are aware of various other prioritisation processes, including 'Back on Track' used in Queensland, the Project Prioritisation Protocol[211] used in New Zealand, and a further approach recently outlined by Briggs.[212] Determining the best prioritisation approach to use is a difficult technical question requiring expert input. However, we make the following general comments:

First, 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 the amount of money allocated to these activities.[213] 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.

Second, any prioritisation process needs to clearly establish the objective of the process and a timeframe over which the objective should be achieved.[214] 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?[215] 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).[216] 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).

Third, as noted, many prioritisation processes only take into account species value, which is usually defined by the conservation status of a species. However,

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[210] 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.

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

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

[213] 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'.

[214] 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

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

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

Joseph et al[217] 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.

Fourth, 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).

Recommendations: Priorities Action Statement

- A framework for prioritisation between listed species should be developed under the *TSC Act 1995*, 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.

(b) Recovery planning

What is the tool?

Under the *TSC Act 1995*, the Director-General has discretion as to whether to prepare a recovery plan for threatened species, populations, and ecological communities.[218] As noted, the preparation of recovery plans was mandatory until amendments were made to the *TSC Act 1995* introducing the PAS. Priorities for recovery plans in NSW are now to be determined in accordance with the PAS.[219]

The PAS identifies that recovery plans will continue to be prepared for threatened species that are iconic, or have complex conservation issues involving a suite of management actions, or require the input of multiple stakeholders. The PAS provides for the preparation of three types of plans:

- Single-species plans – these are most appropriate for species that have specific habitat requirements and threats.
- Multi-species plans – these are most appropriate for species of the same taxonomic group or geographic region that share common threats.
- Regional-wide plans – these are suitable for broadly distributed species, where the threatening processes vary in type and severity across their range.

[217] Joseph L.N. et al (2009) (in press) 'Optimal allocation of resources among threatened species: a Project Prioritization Protocol' *Conservation Biology.*
[218] (NSW) *Threatened Species Conservation Act 1995* s 56.

[219] (NSW) *Threatened Species Conservation Act 1995* s 58.

Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, threatened species, etc. In determining what measures to include in a recovery plan, the Director-General must have regard to the objects of the *TSC Act 1995*, the likely social and economic consequences of the plan, and the most efficient use of resources.[220]

The preparation of a recovery plan has the following implications:

- Decision-makers must not make decisions that are inconsistent with the provisions of a recovery plan.[221] However, if the implementation of a plan affects a statutory discretion, the plan does not operate to exclude the discretion. In these cases, the plan must merely be taken into account.[222]
- In deciding whether a development is likely to have a significant impact on a threatened species, etc, a decision-maker must consider whether the development is consistent with the objectives or actions of a recovery plan.[223]
- Ministers and public authorities must take any action available to them to implement those measures in a recovery plan that they are responsible for.[224]

In addition, the preparation of a recovery plan is an important step in gaining funding for recovery actions, although the preparation of a plan does not necessarily mean that funding for implementation will follow.

How is it currently working?

Currently, 82 recovery plans for endangered species and 15 plans for vulnerable species have been finalised under the *TSC Act 1995*. A further 28 plans are in preparation or pending finalisation, again, all applying to threatened species. No recovery plans have yet been finalised for threatened ecological communities. [225]

Recovery planning is a key mechanism for ensuring the long-term survival of threatened species in NSW. However, there are few examples globally where recovery plans have improved the conservation status of threatened species.[226] Despite this, recovery planning is still generally seen to have been successful in NSW. For example, the NSW State of the Environment Report 2006 states:[227]

> *Recovery plans have been effective in assisting the long-term survival of many priority species. For example, recovery actions for the little tern*

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[220] (NSW) *Threatened Species Conservation Act 1995* s 69.

[221] (NSW) *Threatened Species Conservation Act 1995* s 69.

[222] (NSW) *Threatened Species Conservation Act 1995* s 69.

[223] (NSW) *Environmental Planning and Assessment Act* s 5A.

[224] (NSW) *Threatened Species Conservation Act 1995* s 69.

[225] See Department of the Environment and Climate Change at: www.environment.nsw.gov.au/threatenedspecies/RecoveryPlanning.htm

[226] 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.

[227] 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.

> *have successfully increased their numbers in NSW, while the number of breeding pairs for Gould's petrel recovered to over 900 in 2004–05.*

Notwithstanding this view, however, there are a number of problems with the recovery planning process, as follows:

First, demand far outstrips supply. As noted, as a result, the NSW government introduced the PAS. As the Environment Minister stated in 2004:

> *Under the current system, a recovery plan must be prepared for every threatened species. For current listings alone, this could amount to over 900 plans. To date around 60 recovery plans and two threat abatement plans have been approved. Those figures indicate that this particular process has become an ineffective way of achieving recovery for threatened species. It was effective when we knew of 80 threatened species, but it cannot be effective when we know of 900…*[228]

Second, recovery plans are expensive and resource intensive to prepare. Over 10 years ago, recovery plans were estimated to cost about $100,000 for animals and $50,000 for plants.[229] No doubt they cost more today. Even on these costings, the preparation of recovery plans for all species under the *TSC Act 1995* would comprise an overwhelming component of any government agency budget. Part of the high costs appears to be associated with the fact that recovery plans attempt to be comprehensive statements about a species' biology and ecology.

Third, and related to the second point, the high cost of preparing recovery plans and the significant resources required diverts resources away from on-ground actions.[230] The on-ground implementation of recovery actions is significantly under-funded in both NSW and at a Commonwealth level.[231] For example, funding for the successful Gould's Petrel recovery program came through a series of competitive grants. This meant there were long periods of funding uncertainty, which made long-term planning difficult and put previous gains at risk.[232]

Fourth, recovery plans lack 'teeth'. Because the provision under the *TSC Act 1995*, which states that public authorities must not make decisions that are inconsistent with a recovery plan, does not operate to exclude any statutory

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[228] See the Second Reading Speech by the Honorable Bob Debus for the (NSW) *Threatened Species Legislation Amendment Bill 2004* at:
www.parliament.nsw.gov.au/prod/parlment/HansArt.nsf/V3Key/LA20040901002
See also the Second Reading Speech for the (CTH) *Environment And Heritage Legislation Amendment Bill (No. 1) 2006*.

[229] 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.

[230] 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.

[231] 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.

[232] 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.

discretion, this means that in most cases, the decision-maker must merely take the recovery plan into account (for example, where Council is preparing a draft Local Environmental Plan or is deciding whether to approve a development). In addition, there is no guarantee that a Species Impact Statement has to be prepared where a development is inconsistent with a recovery plan.[233] In our experience, recovery plans consistently fail to protect populations of threatened species targeted under the plan from the impacts of development.

Fifth, the effectiveness of recovery plans and recovery actions is rarely monitored and evaluated.[234] In a review of 181 recovery plans in the U.S, on average, only about 50% of actions were monitored.[235] Monitoring is often identified as an important action in plans, but is often assigned a low priority and is rarely funded.[236] 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.[237]

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 three 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 it is likely to increase the need to prioritise recovery actions. A key aspect of any prioritisation process (such as the PAS) will be determining in a transparent and objective way, what species get recovery plans and why. In addition, there appears to be a need to make recovery plans shorter, simpler, and more tightly focused on recovery actions and outcomes.[238] In this regard, the mandatory 'conservation advices' under the EPBC Act may be a useful model. They are much less resource intensive to prepare and must be pragmatic about the potential for recovery actions to make a difference.[239]

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[233] The recovery plan is only one of seven factors that must be considered in determining whether a development will have a significant impact on a threatened species, etc.

[234] 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.

[235] 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.

[236] 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.

[237] 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.

[238] 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.

[239] (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* s266B.

Second, 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,[240] and this is likely to increase under climate change as the nature of threats change in ways that are difficult to predict.[241] 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.[242] As Clark et al stated:

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

Third, 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.[243] 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.

Forth, 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.[244] 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 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-

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[240] 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.

[241] 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.

[242] 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.

[243] 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.

[244] 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.

species plans to be effective, species must be grouped only after proper analysis of the distribution of threats using appropriate tools.[245]

Recommendations: recovery plans

- Recovery plans under the *TSC Act 1995* should be made shorter, simpler, and be more tightly focused on recovery actions and outcomes.
- A greater focus should be given operationally under the *TSC Act 1995* to the more generic recovery strategies over recovery plans, as provided for in the Priorities Action Statement.
- Recovery plans under the *TSC Act 1995* should facilitate adaptive management and be more flexible and responsive to change and uncertainty.
- A greater focus should be given operationally under the *TSC Act 1995* to threat abatement planning over recovery planning.
- A greater focus should be given operationally under the *TSC Act 1995* to multi-species recovery plans over single-species plans only where species can be appropriately grouped based on threat similarity using robust approaches.

(c) Key threatening processes and threat abatement planning

What is the tool?

Under the *TSC Act 1995*, key threatening processes (KTPs) can be listed.[246] KTPs are processes that may adversely affect threatened species, populations or ecological communities, or could cause species, populations, or ecological communities that are not threatened to become threatened.[247] As such, the Act allows for the listing of future threats – threats that are yet to establish, but that are likely to have significant impacts on biodiversity if they do (the listing of Red Imported Fire Ant and Large Earth Bumblebee are examples).[248]

In NSW, the listing of KTPs is also a precondition for a decision by the Minister as to whether to prepare a threat abatement plan (TAP). A TAP is a plan to abate, ameliorate or eliminate the adverse effects of KTPs[249] and must include actions necessary to reduce the impact of a KTP on threatened species, etc.[250] In considering whether to approve a draft TAP, the Minister must have regard to the likely social and economic consequences of the approval of the plan.[251]

As for recovery plans, the preparation of TAPs was mandatory until the PAS was introduced. Priorities for TAPs are now to be determined in accordance with the PAS.[252] The PAS identifies that TAPs will continue to be prepared for each KTP

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

[246] (NSW) *Threatened Species Conservation Act 1995 s 13.*

[247] (NSW) *Threatened Species Conservation Act 1995 s 13.*

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

[249] (NSW) *Threatened Species Conservation Act 1995 s 74.*

[250] (NSW) *Threatened Species Conservation Act 1995 s 77.*

[251] (NSW) *Threatened Species Conservation Act 1995 s 83.*

[252] (NSW) *Threatened Species Conservation Act 1995 s 76.*

where it poses a significant impact on biodiversity or is the main threat to many species, where its impact varies depending on location, or where management requires coordination of several public authorities and stakeholders.[253]

The PAS also introduced 'Statements of Intent'. These are non-statutory statements of policy that outline in general terms how DECC proposes to manage KTPs. A Statement of Intent summarises existing knowledge on a KTP, identifies where it operates, what impacts it is having, and outlines in general terms how DECC proposes to manage it. Statements of Intent are much shorter and less detailed than a TAP, and may act as a precursor to the preparation of a TAP.[254]

The preparation of a TAP has similar implications to recovery plans, as follows:

- Decision-makers must not make decisions that are inconsistent with the provisions of a TAP. However, as for recovery plans, a later provision of the *TSC Act 1995* means that in effect, plans must merely be taken into account.[255]
- In deciding whether a development is likely to have a significant impact on a threatened species, etc, a decision-maker must consider whether the development is consistent with the objectives or actions of a TAP.[256]
- Ministers and public authorities must take any action available to them to implement those measures in a TAP that they are responsible for.[257]

As for recovery plans, the preparation of a TAP is an important step in facilitating funding for threat abatement actions, although the preparation of a plan does not necessarily mean that funding for implementation will follow.

How is it currently working?

There are currently 31 KTPs listed under the *TSC Act 1995*.[258] 'Human-caused climate change' is listed as a KTP. Others include habitat fragmentation, fire frequency, and threats posed by invasive species.[259] These threats have a major impact on threatened species in NSW – land clearing affects 619 listed threatened species, while invasive species affects 657 listed species.[260]

The current list of KTPs under the *TSC Act 1995* is generally representative of the major direct threats to biodiversity in NSW, although many potential threats are

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[253] DECC (2008) 'Statement of Intent 1: Infection of native plants by *Phytophthora cinnamomi*', Sydney; www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas_abatement_strategies.aspx

[254] See Department of Environment and Climate Change at: www.threatenedspecies.environment.nsw.gov.au/tsprofile/pas_abatement_strategies.aspx

[255] (NSW) *Threatened Species Conservation Act 1995 s 86.*

[256] (NSW) *Environmental Planning and Assessment Act* s 5A.

[257] (NSW) *Threatened Species Conservation Act 1995 s 86.*

[258] See Department of Environment and Climate Change at: www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_threats.aspx

[259] See the NSW list under Schedule 3 at: www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm

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

not currently listed as they have not yet been assessed.[261] For example, of the 350 weed plant species that pose a threat to native plant species, only 100 are encompassed under current listings.[262]

Out of the 31 KTPs listed, only two have TAPs prepared for them – the Red Fox and the Bitou Bush, although a number of other plans are under consideration.[263] Currently, no TAP has been prepared for 'human-caused climate change'.

Threat abatement planning provides an important mechanism for identifying and coordinating the management of threats at a broad scale.[264] However, there are a number of problems with the process in NSW, which are similar to the problems identified for recovery plans, including:

- Funding for the implementation of actions to abate threats is often inadequate.[265]
- Monitoring of the effectiveness of actions to abate threats is often inadequate.[266]
- TAPs lack 'teeth' (e.g. again, decision-makers must merely take TAPs 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.[267] 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?

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

[262] 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.

[263] See Department of Environment and Climate Change at: http://www.environment.nsw.gov.au/threatenedspecies/ThreatAbatementPlansByDoctype.htm

[264] 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.

[265] 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.

[266] 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.

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

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.[268]

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 climate change are only just beginning and lack of knowledge and uncertainty poses a significant barrier to effective threat abatement.[269] 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.[270] Climate change will also create novel threats, such as impacts due to higher temperatures and carbon dioxide levels, and more frequent extreme weather events.[271]

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.[272] 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.[273] However, some scientists argue that we should be cautious in focusing too much on TAPs 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.[274] TAPs 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.[275] As such,

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[268] 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.

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

[270] 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.

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

[272] 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;

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

[274] 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.

[275] 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.

climate change may increase the need to manage threats at a landscape scale. Unlike the current PAS, TAPs provide a good mechanism to co-ordinate threat abatement actions across regions and targeted to priority areas.[276] 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').[277] This would allow the NSW government to identify and target priority areas or regions.

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. In this regard, the 'Statement of Intents' may be a good concept in theory. However, they risk being too general to enable proper co-ordination of threat abatement actions across regions.

Recommendations: threat abatement plans

- A greater focus should be given operationally under the *TSC Act 1995* to threat abatement planning over recovery planning (as noted above).
- Threat abatement efforts under the *TSC Act 1995* should generally be focussed on sets of threats that overlap and interact to affect large numbers of species.
- Threat abatement plans under the *TSC Act 1995* should be made shorter, simpler, and be more tightly focused on threat abatement actions and outcomes.

5.6 Catchment Management Authorities

What is the tool?

The *Catchment Management Authorities Act 2003* (*CMA Act 2003*) provides for the establishment of 13 Catchment Management Authorities (CMAs) across NSW.[278] CMAs are statutory authorities controlled by a board, which is appointed by the Minister, and are subject to the direction of the Minister.

The key function of each CMA is to carry out or fund activities relating to the management of natural resources in their region,[279] including the management of water, native vegetation, salinity, and soils. In particular, CMAs are required to:

- Provide loans, grants, or other financial assistance in relation to natural resource management activities it is authorised to fund.

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[276] 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.

[277] 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.

[278] (NSW) *Catchment Management Authorities Act 2003* s 6

[279] (NSW) *Catchment Management Authorities Act 2003* s 14

- Enter contracts or do any work in relation to natural resource management activities it is authorised to carry out.
- Provide education and training to landholders in connection with natural resource management in the region.

The Minister has also delegated to CMAs the role of consent authorities for land clearing applications under the *Native Vegetation Act 2003* (*NV Act 2003*) (see section 5.9).

Each CMA is required to prepare a draft Catchment Action Plan (CAP).[280] The CAP must identify the investment priorities within the region over the next 10 years and the results expected to be achieved by the implementation of the plan. The CAP must have regard to any Environmental Planning Instrument that applies to the land, the need to promote State-wide natural resource management targets, and the need to comply with the standard for natural resource management.

The Natural Resources Commission (NRC) is responsible for establishing the state-wide natural resource management targets and the standard for natural resource management. The NRC is also responsible for auditing the implementation of CAPs and is required to report on their effectiveness in terms of meeting the state-wide targets and achieving compliance with the standard.[281]

The draft CAP is referred to the Minister and the NRC, who assists the Minister to review the plan. The Minister decides whether to approve a plan or refer it back to the CMA for further consideration. A CAP must be reviewed at least every five years. Each year a CMA must submit an 'implementation program' to the Minister, which sets out what activities, in accordance with the CAP, the CMA proposes to carry out or fund during each financial year.

How is it currently working?

The key role of CMAs is to fund natural resource management activities on private land in priority areas within their regions, in accordance with their CAPs.

CMAs have been established for four years, and most CMAs are now two years into implementing their 10 year CAPs. The NRC recently reported on the current progress in implementing CAPs.[282] While the NRC concluded overall that CMAs are effectively implementing CAPs, a number of key problems were identified:

- CMAs are not always prioritising investments in their regions effectively. Available decision-support tools for prioritisation are often not being used.
- Baseline data on the condition of natural resources in CMAs and monitoring data on the effectiveness of investment decisions is inadequate, is difficult to access, and much uncertainty exists as to how it should be used.
- The alignment of objectives and the integration of decisions and activities between CMAs and other government authorities are very poor. This undermines the ability of CMAs to achieve state-wide and CAP targets.

[280] (NSW) *Catchment Management Authorities Act 2003* s 19

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

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

The NRC identified significant problems with natural resource monitoring at the CMA scale. Despite the establishment of the NSW Monitoring, Evaluation and Reporting Strategy in 2006, the NRC was unable to obtain adequate resource condition data to support its audits of the implementation of CAPs and to report on progress towards the state-wide targets.[283] The Australian National Audit Office also found a lack of data prevented proper evaluation of regional investment decisions under the National Heritage Trust.[284]

In our view, the integration of decisions and activities between CMAs and other government authorities, particularly Councils, is a critical issue in relation to the effective management of biodiversity in NSW. There is a clear relationship between land-use planning under the *EP&A Act 1979* and the health of natural resources. Historically however, legislation and institutions responsible for land-use planning and natural resource management have developed and operated separately.[285] The *CMA Act 2003* attempts to improve this situation. However, it still fails to properly integrate the two systems, and land-use decisions made by Councils are likely to be undermining CMA investment actions, particularly in coastal and peri-urban areas subject to significant development pressure.[286]

Key issues are:

- CMAs have no regulatory powers.
- Councils are under no legal obligation to consider CAPs when preparing Local Environmental Plans (LEPs) or assessing development applications.[287]
- In approving LEPs, the Minister is under no legal obligation to consider whether the LEP will contribute towards meeting state-wide or CAP targets.
- The NRC is not provided a role in reviewing or making recommendations in relation to LEPs in terms of their consistency with state-wide or CAP targets.
- CAPs can only require Councils to carry out management activities (e.g. within priority investment areas) with their prior agreement.
- The Minister responsible for approving CAPs and the Minister responsible for approving LEPs is no longer the same (as was the case originally).

Additional issues identified by the NRC are:

- Unlike LEPs, CAPs are not geographically or spatially expressed, which means that Councils cannot easily recognise and consider investment priorities in the CAPs when making decisions under the EP&A Act.

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

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

[285] Submission by Professor David Farrier, Institute for Conservation Biology and Law, University of Wollongong, to the *Independent Review of the Environment Protection and Biodiversity Conservation Act 1999*. Available at: www.environment.gov.au/epbc/review/submissions/index.html

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

[287] However, the EP&A Act requires a Council, when preparing Local Environmental Studies and draft LEPs, to consult with public authorities that in Council's opinion may be affected (s 62). In addition, EPIs may appoint CMAs as consent authorities under Part 4 of the EP&A Act.

- Land-use planning and natural resource management processes do not share common objectives, such as state-wide and CAP targets.

There is a clear need to align objectives and better integrate the decisions and activities of CMAs and other government authorities. In particular, there is a significant need to better integrate land-use planning undertaken by Councils with investment planning undertaken by CMAs. Clearly, the poor alignment between the two systems will create conflicts and is likely to continue to significantly undermine the ability of CMAs to achieve state-wide and CAP targets.

Will it conserve biodiversity under climate change?

Clearly, CMAs, as the main vehicles for natural resource investment planning in NSW, have a major role in protecting biodiversity under climate change. However, the problems noted above are likely to continue to limit the effectiveness of CMAs in protecting biodiversity under climate change.

In addition, we make three further points:

First, it will be even more important that CMAs prioritise investments in their regions effectively. CMAs will need access to appropriate decision-support tools for prioritisation. Such tools should be based on appropriate prioritisation criteria (see section 4.9) and should be informed by the public debate that we should have over what we try to protect and why (see section 5.1). Research facilities such as the Applied Environmental Decision Analysis hub[288] have been recently established specifically to develop tools to assist prioritisation and environmental decision-making. There appears to be scope for the NSW government to work with such institutions to ensure that CMAs have access to the best-available tools.

Second, it will be vital to ensure that the problems identified by the NRC in relation to monitoring at the CMA scale are addressed under climate change. Without good resource condition data the ability of CMAs to effectively prioritise investments, evaluate investment decisions, and manage within an adaptive management framework, will be severely limited. As the NRC has noted:[289]

> *To effectively implement CAPS, NRM decision-makers need ready access to reliable resource condition data that is suited to their purpose. These data are essential to inform investment decisions, evaluate the success of projects in achieving CAP targets and drive continuous improvement through adaptive management in compliance with the Standard.*

Third, is likely to be a greater need to give CMAs more flexibility over when they spend their investment budgets. As noted, CMAs are required to submit an annual 'implementation program' to the Minister, which sets out what activities the CMA will fund that year. However, the NRC has identified that such requirements, which require CMAs to spend budgets in single years, have resulted in investments that are less likely to be effective. For example, CMAs are forced to spend budgets when climatic conditions are poor (e.g. during droughts), which increases the risk of failure of some projects (e.g. tree planting).[290]

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[288] For example, see Applied Environmental Decision Analysis research facility at: www.aeda.edu.au/

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

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

Recommendations: CMAs

- Investment priorities under the *CMA Act 2003* should be developed through a statutory requirement to take into account climate change impacts.
- CMAs need to use appropriate decision-support tools for prioritisation and environmental decision-making.
- Increased funding and resources need to be made available to ensure that CMA monitoring on natural resource condition and trends is improved.
- Land-use planning undertaken by Councils should be better integrated with investment planning undertaken by CMAs through requiring Councils under the *EP&A Act 1979* to take into account CMA plans.
- CMAs should be given greater flexibility under the *CMA Act 2003* over when they spend their investment budgets by increasing the period over which funding must be spent, to ensure investments are more effective.

5.7 Land-use planning and landscape-scale assessment

(a) Environmental Planning Instruments

What is the tool?

Land-use planning is regulated at a State rather than a Federal level. In NSW, land use planning is regulated through Environmental Planning Instruments (EPIs), which are made under the *EP&A Act 1979*.[291] EPIs set out the overall plan and vision for development for a particular area or relating to a particular issue or habitat type. There are two types of EPIs in NSW:

- Local Environmental Plans (LEPs).
- State Environmental Planning Policies (SEPPs).

The EP&A Act expressly provides that EPIs may make provisions for the protection of native vegetation or the conservation of flora and fauna and provides wide scope for innovative land use planning for conservation.[292]

LEPs are made by Councils for Local Government Areas (LGAs) of NSW. LEPs determine land uses within an LGA usually through the identification of zones, such as commercial, residential and environmental protection zones. LEPs may control land-uses within zones in various ways, including by:[293]

- Prohibiting certain types of development.
- Requiring Council consent for certain types of development.
- Setting down development standards for various types of development.
- Setting out objectives that must be addressed when assessing development applications (DAs).

[291] (NSW) *Environmental Planning and Assessment Act 1979, Part 3*

[292] Fallding M, Kelly A, Bateson P, Donovan I (2001) *Biodiversity Planning Guide for NSW Local Government* NSW NPWS, Hurstville.

[293] Fallding M, Kelly A, Bateson P, Donovan I (2001) *Biodiversity Planning Guide for NSW Local Government* NSW NPWS, Hurstville.

- Identifying matters that must be considered when determining DAs.
- Specifying circumstances that must be met before DAs can be approved.

A *Standard Instrument – Principal Local Environmental Plan* was introduced in 2006, which provides a template model for LEPs that prescribes the form and content of LEPs that Councils are required to follow. The standard instrument prescribes mandatory and optional provisions. All LEPs are now required to incorporate the mandatory provisions of the standard LEP instrument.[294]

The EP&A Act provides for the preparation of 'environmental studies' (known as Local Environmental Studies or LESs).[295] The purpose of a LES is to provide information to enable better decisions on appropriate land-uses in the area subject to the EPI. An LES must be prepared where a draft EPI is the first to be made for an area. However, in most cases, there will be a deemed EPI in existence, and in these cases, the Director-General decides whether an LES is required.[296] In relation to an LEP, Council decides what matters relating to the environment of the area must be addressed in the LES. However, the Director-General may also specify what must be addressed in the LES.[297] A LES is publicly exhibited at the same time as an LEP, but submissions can only be made on the draft LEP, and not on the adequacy of the LES.[298]

SEPPs cover matters that the Minister believes are of environmental planning significance for NSW. These policies may take many forms – they may facilitate development or provide increased planning protection in sensitive areas. They may apply generally across NSW or may apply to specific areas. Examples of SEPPs that relate to biodiversity protection include SEPP No. 14 – Coastal Wetlands, SEPP No. 19 - Urban Bushland, and SEPP 44 - Koala Habitat Protection.

How is it currently working?

It is difficult to determine the extent to which land-use plans such as LEPs have been successful in protecting biodiversity in NSW. Much depends on the nature of the specific instrument. Some Councils are conservation minded and through their LEPs have protected high conservation value areas in their LGAs, while others are focused on increasing development and economic opportunities.

A key issue with land-use planning in NSW is that Councils are not required to prepare a LEP that has the overall effect of adequately protecting biodiversity (i.e. a LEP is not required to meet any objective standard for biodiversity protection). A LEP is not required, for example, to prohibit development in high conservation value areas. Furthermore, the Standard Instrument provides little in the way of mandatory provisions relating to biodiversity. While it sets out standard environmental protection zones and prescribes the objectives and land uses of these zones, again there is no mandatory requirement for Councils to adopt an environmental protection zoning in high conservation value areas. As noted below, the NSW government has recently introduced 'biocertification', which introduces a biodiversity-related legal test into the land-use planning process and

[294] (NSW) *Standard Instrument (Local environmental plans) Order 2006*
[295] (NSW) *Environmental Planning and Assessment Act 1979* s 57.

[296] Farrier D, Stein P (eds) (2006) *The Environmental Law Handbook* Redfern Legal Centre, Sydney.

[297] (NSW) *Environmental Planning and Assessment Act 1979* s 57.

[298] Farrier D, Stein P (eds) (2006) *The Environmental Law Handbook* Redfern Legal Centre, Sydney.

provides planning authorities with some incentive to use it. However, implementation of biocertification so far has been very problematic.

As noted, an additional key issue with land-use planning in NSW is that it is poorly integrated with investment planning undertaken by CMAs (see section 5.6). The NRC has recently noted that some Councils, particularly in coastal areas, have made significant progress in developing new draft LEPs in accordance with the Standard Instrument, despite limited available information on CMA investment priorities. As such, there is significant risk of conflict between land-use planning and investment priorities in these LGAs.[299]

The LES is an important concept in land-use planning. However, whether the LES will result in the adequate protection of areas important for biodiversity will depend on the adequacy of the assessment process and how the LES is used to inform the draft LEP, which depends largely on the priorities of Council.

Several SEPPs have been made that relate specifically to biodiversity. However, these instruments are procedurally focused and again do not require the mandatory protection of high conservation value areas. For example, under SEPP 14, the Director-General is free to grant consent to development within a coastal wetland as long as certain factors have been considered.[300]

Will it conserve biodiversity under climate change?

Land-use planning will be a key mechanism for the protection of biodiversity under climate change. It provides a key mechanism to strategically identify areas important for biodiversity under climate change, such as climate refugia, areas important for connectivity, etc. Compared to site-scale regulatory protection mechanisms, land-use planning has a number of advantages, including:

First, a landscape is an appropriate unit of assessment because species and ecosystems function at a landscape scale. Species are not confined to specific sites and depend on the surrounding landscape to persist.

Second, land-use planning provides a mechanism to protect areas that are important for biodiversity across an entire landscape and to better consider landscape-scale processes such as connectivity, buffers, etc.

Third, assessment of impacts of developments at a site-scale cannot adequately address cumulative impacts. Cumulative impacts can only be effectively addressed at a landscape scale through land-use planning.

Fourth, much of NSW was zoned prior to adequate knowledge of biodiversity values and much high conservation value land is zoned for development. This creates an expectation that development will be allowed to proceed in some form, which is often difficult to address at the DA stage, where 'a head of steam has built up' and the process is subject to decision-making discretion.[301]

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

[300] (NSW) *State Environmental Planning Policy No. 14 Coastal Wetlands* Clause 7.

[301] Farrier D and Whelan R '(Why) Do we need threatened species legislation?' in Hutchings P, Lunney D, Dickman C (eds) (2004) 'Threatened species legislation: is it just an Act? Royal Zoological Society of New South Wales.

In our view, there are two key issues that are required to be addressed to ensure that land-use planning is an effective conservation tool under climate change.

First, there is a need to ensure that land-use plans such as LEPs have the overall effect of adequately protecting biodiversity, including under climate change. One possible way of addressing this issue would be to introduce into legislation a compulsory legal test that requires a decision-maker to be satisfied that the land-use plan as a whole will adequately protect biodiversity (see section 5.7(b)).

Second, there is a clear need to better integrate land-use planning undertaken by Councils with investment planning undertaken by CMAs (see section 5.6).

SEPPs have the potential to be a useful tool to increase the protection of areas important for biodiversity under climate change. However, as noted, currently biodiversity-related SEPPs merely introduce procedural requirements and do not require the mandatory protection of high conservation value areas.

Recommendations: land-use planning

- Land-use plans such as LEPs should contain a legal test under the *EP&A Act 1979* that requires a decision-maker to be satisfied that the land-use plan as a whole adequately protects biodiversity, including under climate change.
- Land-use planning undertaken by Councils should be better integrated with investment planning undertaken by CMAs through requiring Councils under the *EP&A Act 1979* to take into account CMA plans (as noted above).

(b) Landscape-scale assessment

What is the tool?

In 2004, amendments were made to the *TSC Act 1995* to establish 'biodiversity certification'. A key intent of biocertification is to shift the focus of biodiversity assessment in urban areas from the site-scale to the landscape-scale.[302]

Biocertification is a voluntary process by which EPIs (such as LEPs) can be certified by the Minister if the Minister is satisfied that the EPI would lead to the 'overall improvement or maintenance of biodiversity values', which includes threatened species, etc (called the 'improve or maintain test').[303]

The 'improve or maintain' test is not defined under the *TSC Act 1995*. In making a decision to biocertify an EPI, the Minister must consider a range of factors, including:[304]

- The likely social and economic consequences of implementation of the EPI.
- The principles of ecologically sustainable development.
- Conservation outcomes resulting from any action to secure the protection of land for conservation purposes.
- Conservation outcomes resulting from the operation outside the EPI of strategies, plans, agreements and other instruments.

[302] (NSW) *Threatened Species Conservation Act 1995* Part 7 Division 5.

[303] (NSW) *Threatened Species Conservation Act 1995,* s 126G.

[304] (NSW) *Threatened Species Conservation Act 1995,* s 126G.

The main effect of biocertification is that it removes the requirement to undertake site-scale assessments of the impacts of biodiversity in urban areas, including on threatened species (e.g. the Assessment of Significance). In essence, biocertification introduces a biodiversity-related legal test into the land-use planning process and, by removing the requirement to undertake site-scale assessments, provides planning authorities with an incentive to use it.

The NSW government suggests that biocertification has a number of benefits, including:[305]

- Allowing up-front strategic assessment of conservation values.
- Enabling decision-makers to assess the cumulative effects of decisions.
- Reducing land-use conflict and increasing certainty of planning outcomes.

How is it currently working?

As noted, a key issue with land-use planning in NSW is that Councils are not required to prepare a LEP that has the overall effect of adequately protecting biodiversity. Biocertification addresses this issue by introducing a biodiversity-related legal test into the land-use planning process. In theory, biocertification (if applied) should ensure that a land-use plan meets a certain standard of protection. As such, biocertification is an important addition to land-use planning. However, in our view, the implementation of biocertification so far has been very problematic and is likely to have resulted in poor conservation outcomes.

To date, biocertification of an EPI has only been granted once – in relation to the Growth Centres SEPP, which facilitates the development of about 180,000 dwellings and other associated infrastructure in two large areas in western Sydney (called the north east and south west growth centres). The Growth Centres SEPP will result in the clearing of 1,867 ha of 'high quality' threatened ecological communities (including about 12% of the total remaining area of Cumberland Plain Woodland), populations of 15 threatened flora species, and habitat for 22 threatened fauna species, in exchange for the protection of about 2,300 ha of vegetation within the broader Sydney Basin bioregion.

The key issue related to biocertification is the interpretation and operationalisation of the 'improve or maintain test'. As noted, the test is not defined under the *TSC Act 1995* and as such there is significant potential that it will be interpreted in various and inconsistent ways. For example, in our view, there were a number of key problems with how the 'improve or maintain test' was interpreted in relation to the Growth Centres SEPP:[306]

First, the level of analysis required to satisfy the test. For example, threatened fauna were assessed based only on very broad categories of habitat, while threatened flora were assessed without knowing population sizes in most cases. In addition, the criteria used to determine what vegetation must be protected in

[305] DECC (2007) Guidelines for Biodiversity Certification of Environmental Planning Instruments: Working Draft. Available at: www.environment.nsw.gov.au

[306] As a result, the EDO commenced proceedings in the Land and Environment Court challenging the validity of the decision to biocertifiy the Growth Centres SEPP on various grounds, including that the Minister had no logical basis for reaching the conclusion that the SEPP was likely to meet the 'improve or maintain test'. The case was discontinued when the NSW government passed special legislation rendering the proceedings futile. See *Threatened Species Conservation Amendment (Special Provisions) Act 2008*.

the Growth Centres to meet the test were based on significant ecological assumptions. Finally, there was little knowledge of the adequacy of the offset areas in relation to the habitat to be lost in the Growth Centres.

Second, the appropriate reference point for the test. The assessment was undertaken based on the assumption that development would occur according to the terms of the Growth Centres SEPP. This suggests that the test being applied was whether there would be an 'improve or maintain' outcome relative to a predicted future level of biodiversity values (assuming ongoing loss and decline), rather than relative to the present level of biodiversity values.

Third, the adequacy of the offsets. The assessment took the position that offsets are adequate in relation to the 'improve or maintain test' where the area of biodiversity lost in the Growth Centres is less than or equal to the area of biodiversity protected in offsets. This approach is likely to result in the net loss of biodiversity values equivalent to the area cleared.[307] In addition, the principle of 'additionality' was not properly considered in determining offsets. It appears that much of the vegetation to be protected as a result of the Growth Centres SEPP was likely to have been difficult to clear in any case.

In our view, it is vital that issues in relation to the interpretation and operationalisation of the 'improve or maintain test' are addressed as soon as possible to ensure that biocertification does not result in poor biodiversity outcomes. The key challenge is to make the test work in practice.

Will it conserve biodiversity under climate change?

As a concept, biocertification has the potential to be a very important conservation tool under climate change because, at least in theory, it provides a mechanism to objectively determine whether a land-use plan will adequately protect biodiversity into the future. Importantly also, it provides a mechanism to address cumulative impacts.

However, in our view, there are a number of key issues that are required to be addressed to ensure that biocertification is an effective conservation tool under climate change:

First, there is a significant need to clearly define the meaning of 'overall improve or maintain biodiversity values' under the *TSC Act 1995*. Currently, there is significant potential that the test will be interpreted in various and inconsistent ways. The test should be defined to include consideration of the impacts of climate change on biodiversity.

Second, our ability to undertake landscape-scale assessments such as biocertification 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,

[307] 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.

daily movements, migration in response to climate change, etc).[308] However, planning for biodiversity processes is a relatively new and undeveloped concept.

Third, biocertification is currently voluntary, which means that Councils have the choice of subjecting their LEP to the 'overall improve or maintain' test. Because implementation so far has been problematic, in our view it would be too risky for biodiversity to make biocertification compulsory. However, if the process can be significantly improved, eventually making it compulsory could ensure that land-use planning better protects biodiversity, including under climate change.

Fourth, biocertification may be applied to only part of a land-use plan. While this may ensure that the process is limited only to areas with good quality information on biodiversity values, it may mean that the key benefits of land-use planning, such as an ability to consider landscape-scale processes, will not be realised.

We have given some preliminary thought to how the biocertification process could potentially be improved in terms of amendments to the *TSC Act 1995*. 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 biocertifying an EPI (with some allowance for discretion).

A brief summary of a potential model follows:

For example, the *TSC Act 1995* could be amended to specify that:

- The Minister must be satisfied on reasonable grounds that the EPI 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)…..

  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 *TSC Act 1995* 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 and under the *NV 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

[308] 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.

process than the current 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 TSC Regulations.

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.[309] We suggest that offsetting rules in the context of biocertification should be clearly defined under the TSC Regulations and that the offset rules be defined in accordance with the principles set out in Gibbons and Lindenmayer.[310]

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 NSW. As such, we suggest that a discretionary mechanism be included under the *TSC Act 1995*, which allows the Minister to override the rules in certain circumstances.

For example, the *TSC Act 1995* 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 biocertification 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.
- 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 biocertification 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 biocertification 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

[309] 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.

[310] 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.

ensure the persistence of species.[311] 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

- Before certifying an EPI under the *TSC Act 1995*, the Minister must be satisfied on reasonable grounds that the EPI will meet the 'overall improve or maintain' test.
- In deciding whether the 'overall improve or maintain' test has been met under the *TSC Act 1995*, 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 *TSC Act 1995*, he/she can refer the biocertification assessment to an expert panel.
- The expert panel should be required under the *TSC Act 1995* 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 *TSC Act 1995*.
- The Minister should be required under the *TSC Act 1995* to consider the expert panel's report when making a decision, and should publish reasons for the decision.

5.8 Site-scale assessment in urban areas

What is the tool?

In NSW, there are two main legislative mechanisms that regulate the impacts of development on biodiversity in urban areas. These are:

- The 'Assessment of Significance' and the 'Species Impact Statement', which are established under the *EP&A Act 1979*.
- The Biobanking scheme, which is established under the *TSC Act 1995*.

The impacts of development are regulated under either Part 4, or Part 5, or Part 3A of the *EP&A Act 1979*, depending on the type of development proposed.

Under Part 4 and 5 of the *EP&A Act 1979*, a consent authority must consider the impacts of development on the environment, including threatened species, etc.

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

Impacts are required to be assessed by preparing an 'environmental impact assessment' (EIA).[312] Impacts on threatened species, etc are required to be assessed by considering seven factors (called the 'Assessment of Significance'), which include consideration of whether the development will place a viable local population at risk of extinction, the importance of the habitat being impacted, and whether the action is consistent with the objectives of a recovery plan or threat abatement plan.[313] If the decision-maker considers there is likely to be a significant impact, a Species Impact Statement (SIS) is required to be prepared, and concurrence is required from the Director-General.[314] An SIS is a more detailed assessment of impacts on threatened species, and must be prepared in accordance with the *TSC Act 1995* and directions from the Director-General.[315]

Under Part 3A of the *EP&A Act 1979*, a consent authority is under no specific obligation to consider the impact of the development on the environment, including threatened species. An 'environmental assessment' (EA) is normally required, but this is not mandatory. There is no requirement to consider whether there is likely to be a significant impact on threatened species, etc and a SIS is not required. However, the Director-General normally requires an EA to consider whether a development will 'improve or maintain biodiversity values' (this term contemplates offsets), which includes consideration of threatened species, etc.[316]

Amendments were made to the *TSC Act 1995* in 2008 to establish the Biobanking scheme. Biobanking is a voluntary alternative to the Assessment of Significance/SIS process. It only applies to urban areas in NSW (although offset sites can be located in rural areas). Biobanking does two main things:

- It controls clearing for development in urban areas. Clearing for development is only allowed if, overall, biodiversity values are 'improved or maintained'.
- Where clearing is allowed, it establishes a procedure to offset the impacts of the clearing through the buying and selling of 'biodiversity credits'.[317]

Where Biobanking allows clearing for development, biodiversity values may be 'improved or maintained' by the use of offsets. The impacts of a development and the benefits of offsets are measured in terms of 'biodiversity credits'. At an offset site, there is a gain in biodiversity values due to the implementation of management actions. This generates biodiversity credits that can be sold to a developer or anyone else. At a development site, there is a loss of biodiversity values due to the impacts of a development. This generates the need for biodiversity credits to be purchased and 'retired'[318] to offset the loss.[319]

[312] An EIA may include a 'Review of Environmental Factors', a 'Statement of Environmental Effects', or an 'Environmental Impact Statement'.

[313] (NSW) *Environmental Planning and Assessment Act 1979, s5A*

[314] (NSW) *Environmental Planning and Assessment Act 1979,* s 79B

[315] (NSW) *Environmental Planning and Assessment Act 1979, Part 6, Division 2*

[316] (NSW) *Environmental Planning and Assessment Act 1979,* Part 3A

[317] DECC (2008) Biobanking Assessment Methodology

[318] That is, surrendered and never used again.

[319] DECC (2008) Biobanking Assessment Methodology

A key element of Biobanking is the 'Biobanking Assessment Methodology', which is required to be applied when utilising BioBanking. The methodology is a biodiversity assessment tool that does the following:

- Determines whether clearing for development is allowed in the first place (called the 'red flag rules'). If a development gets a 'red flag', then generally it cannot meet the 'improve or maintain' test, irrespective of offsets.
- Quantifies biodiversity values at a site.
- Predicts the impacts of development (loss) and the benefits of offsets (gain).
- Calculates biodiversity credits.
- Establishes offsetting rules.

How is it currently working?

It is well established that the requirement to assess the impacts of development under the Assessment of Significance/SIS process is failing to protect biodiversity in urban areas in NSW.[320] In our view, there are a number of reasons for this:

- 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 surrounding the effectiveness of mitigation measures.
- Inadequate (and inconsistent) assessments, which mean that decision-makers often have incomplete information on the biodiversity to be impacted.
- The lack of adequate monitoring to enable proper evaluation of whether predictions are accurate and the lack of resources to enforce conditions placed on developments to mitigate impacts on biodiversity.
- The inability of the process to properly consider cumulative impacts of developments (e.g. it will always be difficult to conclude that a development that clears only a small amount of habitat for a species compared to that which remains is likely to have a 'significant impact' on that species).
- The wide discretion that decision-makers have in approving developments (approval can be given no matter how significant the impacts on biodiversity are, based on social or economic grounds) and the reluctance of decision-makers to refuse developments on biodiversity grounds.

Biobanking has only recently been established and so it cannot yet be properly evaluated. However, in our view, Biobanking, and more particularly, the 'BioBanking Assessment Methodology' has a number of potential benefits over the the Assessment of Significance/SIS process, including:

- The 'red flag' rules are likely to be more protective of biodiversity compared to the Assessment of Significance/SIS process.
- It is likely to improve the objectivity, consistency, and transparency of the assessment process because assessments must be undertaken in accordance with a standard method (the Biobanking methodology).

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

- It better addresses cumulative impacts because it prevents clearing of over-cleared vegetation types and threatened species habitat and it better ensures that offsets are adequate by establishing a set of offset rules.
- It reduces decision-making discretion because it introduces a condition precedent to the grant of approval (i.e. the Minister cannot allow a development to proceed under Biobanking unless the development will 'improve or maintain biodiversity values').

Will it conserve biodiversity 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 important under climate change.

The Assessment of Significance/SIS process raises two main issues in relation to climate change:

First, the focus of the assessment process is threatened species. While EIAs and EAs 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 and EAs 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.

The Biobanking methodology also does not explicitly require consideration of whether a development site is likely to be important for biodiversity under climate change. However, we see three advantages to the Biobanking methodology over the Assessment of Significance/SIS process in relation to climate change:

First, it incorporates the principle of representation (see section 4.2) because the 'red flag' rules generally prevent clearing of vegetation types that are greater than 70% cleared in each CMA area, irrespective of whether the vegetation type is listed as threatened. As such, this approach represents a move away from focusing site-by-site assessments solely on threatened species, etc.

Second, it incorporates landscape-scale considerations in determining biodiversity credits, including consideration of the amount of vegetation in the landscape, connectivity, and patch size. For example, a development gets penalised for clearing a site that is well connected to other vegetation and offsets are encouraged in large patches and well connected landscapes.

Third, it provides a potential mechanism to offset strategically. As noted, offsets are already encouraged in large patches and well connected landscapes. However, the methodology could be modified to further encourage offsets in 'priority areas' (i.e. areas likely to be important for biodiversity under climate change, such as habitat corridors). We note that an early draft of the methodology took this approach, but the concept was later removed.

Fourth, Biobanking provides a mechanism to fund in-perpetuity conservation management on private land. However, it must be recognised that BioBanking only generates funding in exchange for a loss of biodiversity elsewhere.

As noted, probably the most certain strategy to combat the impacts of climate change on biodiversity is to protect high quality existing habitats. This requires the NSW government to place strict controls on land clearing in urban and rural areas. It appears to us that Biobanking, because of the 'red flag rules', will be more protective of biodiversity than the current Assessment of Significance/SIS process. If this is so, clearly this is a step in the right direction. However, whatever site-scale assessment process is used, there is a clear need to ensure that controls in urban areas are further tightened wherever possible.

Recommendations: site-scale assessment

- Biobanking should be made compulsory subject to robust evaluation and review. Given that Biobanking is not yet underway, the statutory two year review of the scheme is unlikely to allow enough time for proper evaluation.
- Regular review and further tightening of the 'red flag rules' should occur to ensure that Biobanking becomes more protective of biodiversity over time, including areas important for biodiversity under climate change.
- 'Priority areas' for offsetting within regions should be identified using scientifically defensible approaches to enable future modification of the assessment methodology in order to encourage offsets within priority areas.

5.9 Land clearing controls in rural areas

What is the tool?

The *NV Act 2003* controls the clearing of native vegetation in rural areas in NSW. Clearing is only allowed if that clearing will 'improve or maintain environmental outcomes', which includes biodiversity values.[321] Where clearing is allowed, biodiversity values may be 'improved or maintained' by the use of offsets.[322]

A key component of the Act is Property Vegetation Plans (PVPs). PVPs are voluntary agreements between the landholder and the Minister. CMAs have the

[321] (NSW) *Native Vegetation Act 2003, ss 14, 29*

[322] Environmental Outcomes Assessment Methodology

responsibility of administering PVPs. PVPs must be used when seeking to use offsets for clearing under the Act. PVPs may:[323]

- Allow clearing in certain areas on a property.
- Identify certain areas on a property as offsets.
- Provide for continuing uses in certain areas.
- Facilitate financial assistance for conservation management.

Another important component of the Act is the 'Environmental Outcomes Assessment Methodology' (EOAM), which is established under the NV Regulation The EOAM establishes two assessment methodologies ('BioMetric' and the 'Threatened Species Tool'), which are similar to the Biobanking Assessment Methodology and are required to be used when determining whether land clearing or a PVP will 'improve or maintain environmental outcomes'.

How is it working now?

The *NV Act 2003* has significantly reduced land clearing in NSW[324] and is generally regarded as having been successful in ending broad-scale land clearing in rural areas.[325] There have been approximately 300 PVPs approved under the Act. The total area cleared in relation to these PVPs is approximately 5,350 hectares, while the total area protected as offsets comprises approximately 18,300 hectares.[326] In 2007, 97,017ha of vegetation was restored or revegetated using 'Incentive PVPs' and funding administered through CMAs.[327]

Will it conserve biodiversity with climate change?

The PVP process and the EOAM under the *NV Act 2003* will be an important mechanism for the protection of biodiversity under climate change. As noted, probably the most certain strategy to combat the impacts of climate change on biodiversity is to protect high quality existing habitats. This requires the NSW government to place strict controls on land clearing in rural areas. Clearly, the *NV Act 2003* is a large step in the right direction and will be beneficial to biodiversity under climate change. However, land clearing continues to occur in rural areas there is a need to ensure that controls are further tightened wherever possible.

The two EOAM methodologies are very similar to the Biobanking methodology (and have recently been made more similar under a review process). As with the Biobanking methodology, the EOAM methodologies do not explicitly require consideration of whether clearing is likely to impact areas important for

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[323] (NSW) *Native Vegetation Act 2003* Part 4.

[324] For example, compare figures from Audit Office of New South Wales (*New South Wales Auditor-General's Report, Performance Audit, Department of Land and Water Conservation, Regulating the Clearing of Native Vegetation*. August 2002, at 22) with figures from the latest Native Vegetation Report Card www.environment.nsw.gov.au/resources/vegetation/JulyDec2007reportcard.pdf

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

[326] See Department of Environment and Climate Change 'Public register of approved clearing PVPs and development applications' at: www.environment.nsw.gov.au/vegetation/approvedclearing.htm

[327] See Department of Environment and Climate Change 'Native Vegetation report card' at: www.environment.nsw.gov.au/resources/vegetation/JulyDec2007reportcard.pdf

biodiversity under climate change. However, in our view, the methodologies have similar advantages in relation to climate change because they:

- Incorporate the principle of representation in relation to vegetation types.
- Incorporate landscape-scale considerations in determining biodiversity values.
- Provides a potential mechanism to offset strategically.
- Provides a mechanism to fund in-perpetuity conservation management on private land through the PVP process.

Recommendations: land clearing controls

- Regular review and further tightening of the 'red flag rules' should occur to ensure that the *NV Act 2003* becomes more protective of biodiversity over time, including areas important for biodiversity under climate change.
- 'Priority areas' for offsetting within regions should be identified using scientifically defensible approaches to enable future modification of the assessment methodologies in order to encourage offsets within priority areas.

5.10 Mechanisms for conservation on private land

What is the tool?

The NSW government has established a range of statutory schemes for the protection of biodiversity on private land in NSW. The main schemes are:

- Conservation agreements established under the *NPW Act 1974*.
- Wildlife refuge agreements established under the *NPW Act 1974*.
- Trust agreements established under the *Nature Conservation Trust Act 2001*.
- Biobanking agreements established under the *TSC Act 1995*.
- Property Vegetation Plans established under the *NV Act 2003*.

All private land conservation schemes in NSW are voluntary. The schemes allow various types of landholders to participate, including owners of freehold land, private lessees of Crown land, local Councils, and managers of Crown land such as government agencies (e.g. Forests NSW). Most agreements are made between the landholder and a Minister, although Trust agreements are made between the landholder and the Nature Conservation Trust.

All agreements except Wildlife Refuge agreements are attached to the land title and are binding on current and future owners of the land. Generally, agreements may restrict the use of land, impose obligations to manage land for conservation, provide the landholder with funds and technical assistance, and require the preparation of a management plan. The terms of most agreements are enforceable in the Land and Environment Court. In addition, most agreements are in-perpetuity (although Property Vegetation Plans are valid for 15 years), although most can be revoked in certain circumstances, which usually requires the consent of the Minister and the landholder. Wildlife Refuge agreements can be revoked or varied by the Minister or the landholder at any time.

The schemes are primarily applied to land that is of high biodiversity value. However, Wildlife Refuge agreements can apply to multiple-use land (e.g. agricultural land or mining land) and Biobanking agreements and Property

Vegetation Plans can apply to land that is of low or moderate value, but with the implementation of management actions, will increase in value in the future.

Most schemes are eligible for funding under various government grant programs, including from the NSW Environment Trust, the Australian government's 'Caring for our Country' program, and through CMAs. However, funding for Biobanking agreements comes from developers who are using the agreement as an offset for the impacts of development elsewhere. In addition, land subject to some agreements may be exempt from Council rates or land tax and in some cases landholders may be eligible to claim a tax deduction for any loss in value of the land.[328] For example, conservation agreements are exempt from Council rates[329] and land tax[330] and landholders are eligible to claim a tax deduction.[331] However, non-binding agreements such as Wildlife Refuge agreements are not eligible for rate relief or tax exemptions.

How is it currently working?

Eighty-nine percent of all land in NSW is owned or managed by private landholders.[332] As such, most biodiversity occurs on private land and it is widely recognised that conservation schemes on private land will be vital to complement conservation on protected lands and ensure the overall protection of biodiversity.

Historically, the take-up of conservation schemes on private land has been limited, although this appears to have improved in recent years as a result of greater government attention to promoting and funding the various schemes.

About 200 conservation agreements, which are binding and difficult to revoke, have been established in NSW, covering an area of 17,000 hectares. The Nature Conservation Trust's 2006-2007 annual report identifies that there are 6,000 hectares of private land in NSW currently protected by the Trust through its activities.[333] No Biobanking agreements have yet been established.

Over 600 wildlife refuge agreements, which are non-binding and easy to revoke, have been established in NSW, covering an area of about 2 million hectares, with much of these in the west of NSW. About 10% of this area is managed exclusively for conservation and 85% for integrated conservation management, while the remainder comprises land use for infrastructure.

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).

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[328] (Commonwealth) *Income Tax Assessment Act 1997* division 31.

[329] (NSW) *Local Government Act 1993* s 555(1)(b1).

[330] (NSW) *Land Tax Management Act* 1956 s10.

[331] (Commonwealth) *Income Tax Assessment Act 1997* division 31.

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

[333] See Nature Conservation Trust (2007) *Annual Report 2006-07* at: www.naturetrust.org.au/pdf/NCT0607YIR.pdf

As a result, many landholders appear to be adopting a 'wait and see' approach.[334] A number of new schemes have recently been developed (e.g. BioBanking) and governments are now paying significant attention to providing incentives for sustainable land management. However, if landholders commit too early, they risk being locked into a scheme which may not be as financially beneficial as others. This is a significant problem for governments, which needs to be addressed if private land conservation schemes are to be effective.

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, the NSW government has established a range of statutory schemes for the protection of biodiversity on private land in NSW, which taken together, appear to provide an adequate and flexible framework.

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 NSW government to address barriers to up-take, which are likely to 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, 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) 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 CMAs.[335] Similarly, BioBanking, 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, which allow for the protection and management of land that is not necessarily of high biodiversity value currently,

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

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

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).

Fourth, there may be a key role for more flexible schemes, such as wildlife refuge agreements, 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.[336]

Finally, clearly it will be vital to ensure that legislation provides strong protection for areas of high biodiversity value on private land. The *NV Act 2003* 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, there is a clear need to ensure that land clearing controls in both rural and urban areas are further tightened wherever possible.

Recommendations: conservation on private land

- Financial and bureaucratic barriers that impede the take-up of conservation initiatives should be identified and removed.
- Incentives should be structured so that conservation effort is targeted in areas of greater strategic need.
- 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.

6. 'External' influences

6.1 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;[337] other times it will be due to restructures[338] or the vesting of responsibilities for biodiversity

[336] 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.

[337] 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). 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.

[338] 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-

conservation in different agencies (for example, terrestrial and marine).[339] In the context of biodiversity conservation, the establishment of the Australian government 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 Australian government to take the lead on biodiversity conservation.

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.*[340]

6.2 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".[341] 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.[342]

Second, biodiversity conservation has historically been under resourced, leading to problems of implementation[343] – witness the disparity between the conservation tools available under the various legislative schemes and their take-up (as discussed above). As noted, NSW 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.

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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'.*

[339] 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.

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

[341] 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.

[342] 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).

[343] 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'.

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.[344] Other costs will relate directly to biodiversity conservation - research, monitoring and intensive management and ex situ initiatives.[345]

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 recent report from the Working Group established by the previous Prime Minister focussed on a very narrow range of biodiversity actions, revolving around iconic sites.[346]

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.[347] 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.[348]

6.3 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.[349] The north of Australia has already been identified by some as a prime spot for agriculture under climate change.

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[344] 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.

[345] 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.

[346] 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.

[347] Tourism NT *NT Tourism Industry* Available at: www.tourismnt.com.au/nt/nttc/about/nt_tourism.html

[348] 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.

[349] 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. (CBD Technical Series no. 10)

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.

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*.

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

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.