



Our Ref: 09/340

National Biodiversity Response  
PO Box 1715  
Tamworth NSW 2340  
[admin@seftonpr.com.au](mailto:admin@seftonpr.com.au)

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Dear Task Group

**Re: Comments on the draft Australia's Biodiversity Conservation Strategy 2010-2020**

We thank you for the opportunity to provide comments on the draft Australia's Biodiversity Conservation Strategy 2010. Our detailed response can be found in the attached submission.

If you have any queries regarding the content of our submission or would like any further information, please do not hesitate to contact Ms Beth Riordan at CSIRO Government and International ([beth.riordan@csiro.au](mailto:beth.riordan@csiro.au); 02 6276 6368).

Yours sincerely

A handwritten signature in blue ink, appearing to read 'A. Johnson', with a long horizontal line extending to the right.

Andrew Johnson  
**Group Executive Environment**



CSIRO Submission 09/340

Comments on the consultation draft of  
“Australia’s Biodiversity Conservation Strategy  
2010-2020”

May 2009

**Enquiries should be addressed to:**

Ms Beth Riordan  
Senior Adviser  
CSIRO Government & International  
PO BOX 225  
Dickson ACT 2602

Email: [beth.riordan@csiro.au](mailto:beth.riordan@csiro.au)  
Ph: (02) 6276 6368

**Main Submission Author:**

Dr Michael Dunlop  
Senior Research Scientist  
CSIRO Sustainable Ecosystems  
PO Box 284  
Canberra ACT 2601

Email: [michael.dunlop@csiro.au](mailto:michael.dunlop@csiro.au)  
Ph: (02) 6242 1715

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## Executive Summary

CSIRO commends the approach being put forward in this draft (*Australia's Biodiversity Conservation Strategy 2010-2020*). The Strategy provides the high-level vision and framework needed to guide subsequent development and implementation of conservation strategies and initiatives at national, state and local level. This submission focuses on six crucial areas where increased explanation and promotion of this approach might further strengthen the strategy.

1. *Highlighting the novelty of the strategy*, by more explicitly describing the strategic and linked nature of the *Priorities for change* and the new elements of the strategy. For example, emphasising the themes of building resilience, engaging the whole community and increasing the effectiveness of conservation investments.
2. *Articulating the need for better understanding of biodiversity values*, so that practical biodiversity conservation objectives can be set, and efficient and effective investments planned, as species and ecosystems respond to climate change and other threats. This would also enable more effective use of market based mechanisms and consistent reporting of biodiversity outcomes, for example in the National Accounts.
3. *Clarifying the ecosystem-resilience based approach*, to better distinguish this key aspect of the strategy from current approaches. Key aspects of the concept include the two-way link between biological diversity and resilience, and the management focus on enabling biodiversity to persist through change, rather than intervening once species are threatened or ecosystems degraded. The role of whole-landscape management through integrated use of multiple conservation mechanisms to protect and restore habitat is also an important aspect of the approach.
4. *Clarifying the multiple roles of information and knowledge*, to highlight the strategic use of information to motivate people, and effectively plan investments and measure success. Underpinning this aspect of the strategy is the need for good knowledge of Australia's biodiversity.
5. *Increasing the emphasis on climate change*, to reflect the magnitude of the risk, community concerns and to explain the complex, pervasive and long-term nature of this new challenge.
6. *Distinguishing between "actions" and "results"* in the Strategy. This will clarify that, while investments flowing from the Strategy are medium-term, they are intended to translate into enduring results. The hierarchy of "actions" leading to "results" that build to achieve "objectives" within "key priorities" is an important part of the strategy.

This submission also comments on a number of other issues that relate to specific *Priorities for change* or sections, presented in the order they appear in the draft Strategy.

## Introduction

CSIRO makes this submission on the draft National Biodiversity Conservation Strategy consistent with its role as a key national research provider of biodiversity research. CSIRO has recently restructured its biodiversity research to more explicitly address threats to biodiversity and to build a strategic bridge between research and policy makers. Our capabilities include the following areas of expertise:

- Systematics and taxonomy through the National Biological Collections
- Biodiversity informatics
- Ecogenomics
- Ecology
- Economics
- Social science

Research in CSIRO is delivered via collaborative partnerships with biodiversity stakeholders such as policy makers, regional NRM bodies, land managers, NGOs and the wider community.

## Overall view of the Strategy

CSIRO commends the new approach to biodiversity conservation outlined in this Strategy. In general, the Strategy provides the kind of high-level vision and framework needed to guide the development and implementation of conservation strategies and initiatives at state and local level, in a period of ever-increasing threats to the persistence of biodiversity.

This submission focuses not on questioning the overall approach promoted in the Strategy – which we believe to be sound – but rather on suggesting ways in which the explanation and promotion of this approach might be further strengthened.

This submission begins by proposing six issues that CSIRO considers require particular attention in order to strengthen the impact of the Strategy:

1. Highlighting the novelty of the Strategy
2. Articulating the need for better understanding of biodiversity values
3. Clarifying the ecosystem-resilience based approach
4. Clarifying the multiple roles of information and knowledge
5. Increasing the emphasis on climate change
6. Distinguishing between actions and results

Each of these issues cuts across several sections of the document including the introductory sections and specific *Priorities for Change*.

This submission also comments on a number of other issues that by-in-large relate to specific *Priorities for Change* or sections of the strategy. These are presented in the order they appear in the draft Strategy.

CSIRO would be pleased to provide additional input to the task group on these or other issues if required.

# Strengthening critical aspects of the Strategy

## 1. Highlighting the novelty of the Strategy

### *Explaining the new approach*

The Strategy presents a new approach that builds on its predecessor by being more strategic and incorporating recent and emerging trends in conservation practice and thinking. CSIRO suggests the Strategy could be further strengthened by more explicitly highlighting this enhanced strategic nature and emphasising the novelty of the approach proposed. These new developments are significant and could be given greater prominence in the introductory sections and in section 3 describing the *priorities for change*.

The following key aspects could be highlighted:

- building resilience by focussing on:
  - Maintaining and restoring ecological processes, particularly at the landscape scale;
  - Retaining biodiversity values as species and ecosystems change (e.g. seriously tackling the task of stopping species becoming threatened rather than managing them only as they approach extinction);
  - Biological diversity (diversity of genes, species, ecosystems) as a contributor to the resilience of ecosystems, not simply as an output (objective) of this resilience.
- engaging the whole community through:
  - Raising government and community awareness of the state of Australia's biodiversity (e.g. consistent quantification of biodiversity outcomes);
  - Demonstrating the importance of biodiversity to the wellbeing of all Australians, and linking pressures on biodiversity from the investment and consumption choices society makes (e.g. including biodiversity in key national accounts);
  - Greater community-wide engagement in decision making about biodiversity and participation in the practical conservation of biodiversity.
- focussing on ensuring biodiversity management investments are effective, through
  - Improved availability and transparency of information at appropriate spatial and temporal scales;
  - Improved monitoring, evaluation and reporting;
  - Use of a wide range of management and policy tools that are appropriately matched to context within which they are utilised (e.g. incentives and trading, where appropriate and supported by good science).

### *Explaining the vision*

The logic of the framework underpinning this overall approach could also perhaps be communicated more explicitly by including a diagram depicting relationships (dependencies, feedbacks) between the six priorities for change (in section 3.1).

It might also be useful to include some brief explanation (either in section 1 or perhaps at the beginning of section 3) of the intended meaning of each component of the vision statement (from page 8) – i.e. defining more precisely what is meant by the key phrases: 1) “*Australian biodiversity is healthy*”; 2) “*resilient to climate change*”; and 3) “*valued for its essential contribution to our existence*”.

## **2. Articulating the need for better understanding of biodiversity values**

The ultimate aim of the Strategy is to preserve the multiple values of biodiversity. However without some understanding of these values it will be difficult to set clear objectives for biodiversity conservation and deliver investments efficiently and effectively. Thus, the nature and roles of different types of biodiversity values in conservation planning and management deserve more consideration in the Strategy, especially in the context of changes to species and ecosystems due to climate change and other pressures.

Understanding of the multiple values associated with different biodiversity outcomes would enable effective quantification, where appropriate, of biodiversity goods and services. Such quantification is necessary for underpinning the development of market based approaches (e.g. stewardship and trading schemes), assessments of the effectiveness and efficiency of different conservation mechanisms in different situations, and consistent reporting of biodiversity condition (e.g. in the National Accounts).

It could be noted that some valued characteristics of biodiversity may be impossible to maintain, particularly in the face of climate change, and therefore it is not practical to include them as conservation objectives. For example, section 1.2 might benefit from the inclusion of a statement about the need to not only protect current biodiversity values from decline, but also to ensure that key biodiversity values are not lost as species and ecosystems respond to on-going environmental changes. Similarly, different types of conservation programs may be required to protect different values.

Adopting this response is challenging and requires new biophysical information about how biodiversity is changing, social information about the implications of different values, and new ways to assess values and incorporate them into planning. It is also scientifically contested (Spash C.L. 2008 How much is that ecosystem in the window? The one with the bio-diverse trail. *Environmental Values* 17:259-284.). This could be included in Table 3.1 as a *result*, e.g. “a well informed and on-going community debate about (changing) biodiversity values”, with matching *actions* by governments and community leaders to facilitate the debate. This is also of sufficient importance to warrant consideration as a priority for the first two years (in Table 1.1).

Section 2.3 “Why biodiversity matters” is perhaps too narrowly focused on ecosystem-service values and could benefit from expansion to include and clearly articulate the other major types of values associated with biodiversity – e.g. option value, insurance value, intrinsic value (Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Biodiversity Synthesis*. World Resources Institute, Washington, DC.).

### 3. Clarifying the ecosystem-resilience based approach

#### *The ecosystem resilience concept*

Resilience is a key theme of the Strategy. As such the Strategy could be strengthened by more clearly articulating the distinguishing characteristics, and benefits, of a resilience-based approach relative to “business-as-usual”.

First, the goal of “ensuring that our natural environments are able to retain their biodiversity values and critical ecological functions in the face of growing pressure, including from climate change” would benefit from further explanation and qualification. For example it could address the crucial issue of scale – i.e. that the goal (presumably) is to “retain biodiversity values and critical ecological functions” within whole landscapes (or seascapes) not necessarily at each and every individual location within a landscape. In other words, the structure and composition of individual locations may change but the overall functions and values of the system as a whole persist.

CSIRO suggests the subsequent text then could be redrafted to highlight critical aspects of the approach to achieving this. Key points that could be highlighted include:

- Acknowledgement that there is a two-way relationship between biological diversity and resilience – i.e. biological diversity can be viewed as a contributor to the resilience of ecosystems, not just an output (objective) of this resilience;
- Recognition that the resilience approach seeks to stop species becoming threatened, thereby enabling ecosystems to be self maintaining with minimal management intervention;
- Commenting that the objective is to preserve values as species and ecosystems change (including as a result of climate change), not prevent that change;
- Suggesting that this can be done by providing as much opportunity as possible for species and ecosystem to persist through:
  - maintaining ecological processes across the landscape;
  - protecting habitat: considering the need for different types of habitat and environments, different spatial relations (connected and isolated), using multiple mechanisms (e.g. Protected Areas, covenants, biodiversity stewardship, formal voluntary agreements, supporting informal actions, incentives to reduce fertiliser and improve soils structure, threatened species legislation, broadscale vegetation clearing legislation etc.); and
  - reducing threats to habitat and species including: inappropriate fire regimes, invasive species, land use change and altered hydrological processes (Dunlop and Brown 2008).

The actions in Table 3.1 could be better linked with, and flow more directly from, the novel aspects of the resilience-based approach (as opposed to a business-as-usual approach) articulated in the preamble – for example, by including:

- an action around formulating and promoting guidelines to inform practical management under a resilience approach;

- a specific objective about protecting and restoring habitat across landscapes (and seascapes) through multiple mechanisms, including an overarching one about integrating these mechanisms; and
- an action about responding to *changing* threats, and managing increasing tension with other societal values (fire, water, etc).

Despite the increased and highly commendable focus on fostering overall resilience as the main means by which extinction is avoided, the Strategy could also more clearly acknowledge that there will still be a continuing role for intensive *in situ* management of selected individual species (e.g. those that are highly threatened and/or of particular value).

### ***The role of whole-landscape management, including off-reserve conservation***

We suggest that less emphasis be placed on the specific mechanisms used to protect habitat and more on the objective of making habitat available for occupation by native species and ecosystems. This would better reflect the recent expansion of conservation mechanisms and the need for integration of management across landscapes. One of the key elements of the “new” approach is the use of a wide range of mechanisms matched to different regional and local circumstances to attain landscape outcomes. Mechanisms include:

- Protected Areas on public, indigenous and private land which are managed in-perpetuity for biodiversity (National Reserve System);
- covenants restricting land use on certain lands;
- incentive payments for management or biodiversity outcomes;
- off-setting;
- industry standards covering land/sea or wildlife management;
- formal voluntary agreements;
- informal actions;
- legislation prohibiting broad scale vegetation clearing;
- the *EPBC Act* and other threatened species legislation, which does in effect protect habitat diversity through the concept of critical habitat;
- managing grazing and wildlife harvest;
- management of environmental flows; and
- habitat restoration.

CSIRO would also suggest including the map *Fig A10.1* in the body of the Strategy. It is our view that this would reinforce the need for different approaches to conservation, especially different approaches to making habitat available for biodiversity in different regions.

### ***The role of restoration***

The draft Strategy correctly includes various references to the need to restore habitats (e.g. Section 1.3 Implementation “restore ecological function to critically degraded landscapes through sustainable practices that manage our soil and water resources”, and in many of the case studies.) Habitat restoration is also being considered as an option for countering or off-setting losses of biodiversity resulting from unavoidable human activities. Within the

framework of building resilience, this could be seen as one of the most active conservation interventions – restoring ecosystems to a state where they are capable to maintaining biodiversity values without requiring further human intervention.

Restoration of habitat is likely to be essential to halting biodiversity decline in many areas that have experienced extensive habitat loss (NRPPC 2005 report to NRMCC “A National Approach to Biodiversity Decline

[www.environment.gov.au/biodiversity/publications/pubs/biodiversity-decline.pdf](http://www.environment.gov.au/biodiversity/publications/pubs/biodiversity-decline.pdf)) however, the topic gets little attention in the key priority areas and supporting text, relative to the attention devoted to habitat protection. CSIRO considers that a greater emphasis on broad-scale restoration of habitat, and the science needed to assess different methods and scales of restoration would strengthen the argument being put forward. There are also several references to protecting “critical intact habitat” in the draft document which could be extended to include restoration of critical habitat (i.e. “protection or restoration of critical habitat”).

#### **4. Clarifying the multiple roles of information and knowledge**

*(relating to Mainstreaming 3.2.2, Knowledge 3.2.3, Getting results 3.2.4 and Measuring success 3.2.6)*

The Strategy gives considerable attention to information and knowledge, and how this is collected, distributed and used, across four *Priorities for Change*. However, the inter-dependence of these themes could be better articulated and demonstrated. We suggest that the demarcation and relationships between these themes be reviewed, along with the objectives, results and actions in each. This may require some rearrangement of actions between the four relevant *Priorities for Change*, and also some re-working of the results linked to various actions.

It may also be useful to articulate the different uses of information (what types of decision will be made by whom), and the different types of information that might be needed to support these uses. For example: “Mainstreaming” will require improved dissemination of information on the value of biodiversity; “Getting results” requires improved knowledge of how values are likely to change with and without intervention; and “Measuring success” requires information about how biodiversity (and associated values) change over time.

CSIRO also suggests that it would be useful to convey the need to develop clear and measurable performance indicators that are well aligned to biodiversity conservation objectives more strongly. Agreement on such indicators would then enable programs to better monitor and evaluate the outcomes of conservation efforts. The statement at the end of the introductory text for *Priority for change 6* “Measuring success” regarding the “need to be explicit about which long-term outcomes the strategy is trying to achieve. These outcomes will provide the basis for measuring the strategy’s objectives” could be expanded and moved either to the beginning of this text, or possibly to the introductory text for *Priority for change 3* “Knowledge”, to reflect that this should be the first step in designing a program for measuring success.

Scientifically robust quantification of biodiversity outcomes will also enable the choice of the most effective conservation tools in different circumstances, and the development of tools that are potentially more widely applicable and efficient tools (e.g. market based instruments). This would also help the integration of biodiversity conservation, carbon sequestration and water management.

The Strategy could more explicitly articulate the crucial ongoing importance of taxonomy in providing the fundamental foundation for all efforts to plan for, and measure progress in, the conservation of Australia's biodiversity. Species are the basic currency of biodiversity knowledge and management, whether the focus is on managing individual species, genetic diversity within species, or species interactions in ecosystems or landscapes. Species knowledge constitutes the unique *content* that makes possible the construction of species databases, such as the *Atlas of Living Australia*. The scientific discipline of taxonomy is responsible for discovering species and their characteristics, and classifying them according to evolutionary principles. The biodiversity of our continent, rivers and oceans is so vast that Australia's taxonomic community has treated only about 20% of our species so far, even at the most basic level. Evaluating the effectiveness of conservation strategies depends on our ability to recognize species in ecosystems and track their population dynamics through time. Our ability to understand and manage our biodiversity is severely impeded by incomplete knowledge of Australian species. Furthermore, it is difficult to adequately assess the benefits and values of Australia's biodiversity unless we first know what species constitute this biodiversity.

## 5. Increasing the emphasis on climate change

While climate change impacts are highlighted in the Strategy's vision, CSIRO would suggest that the document could benefit from a more detailed discussion of climate impacts and adaptation in the introductory sections as well as the discussion in Appendix 9. The nature of climate change and its impacts on biodiversity means that it may best be thought of not as an additional threat, but as a pervasive process to be addressed in all conservation strategies.

Key points that could be highlighted in the introductory sections include:

- Species and ecosystems will be affected by climate change in many different ways with few, if any, being unaffected (Dunlop and Brown 2008).
- Some, possibly many, species will be threatened with extinction and the health of many ecosystems will be degraded from the combined impacts of climate change, habitat destruction and invasive species. However, the details of the impacts are uncertain, and the impacts will vary between species, ecosystems and regions.
- It is essential that future conservation strategies manage continual change in species and ecosystems, while seeking to avoid losses.
- Strategies that build the capacity of biodiversity to change, without requiring detailed information about particular species, are likely to be most robust, including making as much habitat available for biodiversity in as many different types of environment as possible, and reducing the impact of threats now and as they change.

These and related issues are discussed in detail in a recent report prepared by CSIRO for DEWHA and DCC (*Dunlop and Brown (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*).

While climate change is emerging as a major long-term threat to biodiversity, existing threats remain a greater challenge in the short term. As well as having direct impacts, climate change will exacerbate the impact of these other threats (Dunlop and Brown 2008). Therefore, the various lists of threats in the document (e.g. pg 5 and especially Appendix 9) might benefit from placing climate change last, thus avoiding giving the impression that it is considered the primary threat. A statement could then follow to the effect that climate change directly

threatens biodiversity and compounds the existing threats, and that it remains one of the greatest long-term challenges.

Finally, to highlight the important impact of climate on Australian's biodiversity, the discussion on pg 10 could be augmented to include a statement that "natural climate variability and now climate change" make our species and ecosystems dynamic in time and space.

## 6. Distinguishing between actions and results

The distinction between *actions* and *results* in the *Priority for change* tables could be improved. It needs to be clear that *actions* are what will be implemented by various parties during the next 10 years, and the *results* are intended consequences of the actions (often in terms of biodiversity, but also people). The actions and results should all clearly reflect this linkage and distinction. In some cases the wording of the results largely mimics that of the actions, in other cases the causality appears to be reversed and in a few cases the link between the desired result and the stated action is not obvious. The results should logically build up to the objectives, and the objectives construct the key priorities.

The Strategy sets out to be long term in its impact, recognising that many of the challenges to halting biodiversity decline will take many decades to address. It may be useful to be more explicit that the Strategy is outlining directions and actions for the next 10 years, but that these directions will need to be continued well beyond that before many of the desired results, and an overall halting of biodiversity decline, are observed.

Table 1.1, could be improved if it was clearly stated which of the actions are intended to start in the next two years and which have a likelihood of being completed within the two years. Some of these actions are long term actions. Highlighting the short-term actions in the tables in Section 3 would also help to keep these actions at a high level. CSIRO suggests a reassessment of which actions are to be highlighted as the most pressing short-term priorities (i.e. included in Table 1.1) on the basis of clear criteria; for example, they need to be conducted prior to other actions or they are required to avoid imminent loss.

## Refining more specific aspects of the Strategy

### *Principles*

The key role of the principles (pg 8) is to articulate the fundamental concepts and directions used to develop the Strategy. However, it is not clear to the reader how the Strategy logically flows from application of these principles. Some of the principles as stated could potentially be contentious and hence detract from the Strategy itself. While individually they maybe sound, CSIRO questions whether their inclusion adds value to the strategy overall.

### *Section 1 - Call to action*

#### *Importance of biodiversity, pg 9 and elsewhere in the Strategy*

When arguing the importance of biodiversity, more impact would be achieved if at least one benefit for *every Australian* was described rather than benefits that are only relevant to certain sections of the population. This would demonstrate relevance to every Australian. Suitable examples could include clean air, fresh water, food and stable climate.

#### *National Reserve System*

Capitalise “National Reserve System” pg 9 and elsewhere.

The comment “separate work is underway for the expansion of the National Reserve System” (pg 9), could be read to mean that the activities of the National Reserve System are separate to, rather than under the umbrella of, this Strategy. Wording could be clarified to indicate there is an on-going cross-jurisdictional process specifically focussing on development of the National Reserve System.

#### *Pollution as a threat, pg 10 and elsewhere*

On the basis of our research, we suggest that pollution, both terrestrial and marine, be included in the various lists of threats.

#### *“Tragedy of the commons” and “tyranny of small decisions” pg 10*

It is useful to include “tragedy of the commons” and “tyranny of small decisions” in this section as phenomena leading to biodiversity decline. However for those unfamiliar with the terms it might be more useful to spell them out; (e.g. “decisions made in individual interests that erode the public good” and “cumulative negative impact of many decisions each of which, in its own right, is sensible and with minimal impact”).

#### *Biodiversity decline*

This section takes the reader through environmental degradation and threats to impacts on biodiversity. It may have greater impact if it provided data about the nature of the decline: numbers of species threatened with extinction, percentage of certain ecosystem types remaining, and so on.

### *Land clearing legislation*

The list on pg 11 includes “we have achieved: ... legislation by all governments to protect native vegetation from broadscale land clearing”. Does this include all local governments and all states and territories? If not, clarification should be provided.

### *Greenhouse gas emissions*

While some of the processes that will lead to reductions in Australia’s greenhouse gas emissions have begun, reductions in total emissions have not been achieved (Department of Climate Change 2006, National Greenhouse Gas Inventory 2006; <http://www.climatechange.gov.au/inventory/2006/index.html>). The bullet point on emissions could be worded to more accurately reflect this with “efforts to reduce greenhouse gas emissions have *commenced*”.

## ***Section 2 - Background***

### *Australia’s biodiversity, Sec 2.4, pg 17*

The readability of the first part of this section could be improved by merging the species numbers from the opening quote directly into the first paragraph.

This whole section is focussed on species and could be expanded to include ecosystems, landscape-scale ecological processes, and Australia’s unique biogeographic history.

### *Undescribed fungi*

The Chapman reference used earlier on pg 18 may be a more taxonomically focussed reference for the observation that less than 10% of Australian fungi being described.

### *Indigenous people, 2.5, pg 18.*

This section would be enhanced by the inclusion of key unique aspects of the relationship between Indigenous peoples and Australia (e.g. over 40,000 years of habitation and links between biodiversity and many creation stories). This would help distinguish the special relationship with the environment that Indigenous people have and the special relationship that some other Australians have.

## ***Section 3 - Making enduring changes***

### *NGO and private sectors*

In recent years, the NGO and private sector have had a growing role in biodiversity conservation and the new Strategy seeks to promote this. To better reflect this desirable objective, more mention could be made of these efforts in leading and facilitating biodiversity protection and restoration (e.g. a case study could be included specifically on NGO or private sector conservation efforts).

*Carbon and water markets, Pg 26, Action 2.3.3.*

Emerging markets for carbon sequestration and water rights have potential to lead to significant investment in revegetation and de-intensification of agriculture in Australia, both of which could have gains for biodiversity. There may be scope for *actively directing* investments in these markets (and biofuels) *to increase biodiversity benefits* through supplemental incentives, rather than simply ensuring negative impacts are avoided. For example, the recent NSW government acquisition of irrigation properties in NSW was funded by a combination of water programs and biodiversity conservation programs. Development of scientifically-robust biodiversity markets would be one mechanism that would allow investors to efficiently find synergies between landscape outcomes.

## ***Appendices***

### *Conservation connectivity - Appendix 10*

The role of connectivity in dealing with climate change is contentious and, amongst our scientists, there is not yet general agreement. For example, it is unclear whether the focus of connectivity should be between regions or within regions or landscapes; and what types of habitat linkage would actually be required to facilitate movement of species over different spatial scales at rates that are relevant under climate change.

Connectivity would presumably enhance the rate at which some expanding species transform ecosystems or displace existing species, and in some circumstances it could lead to more widespread fires. It is worth noting that habitat isolation is critical for the survival of many species and at biogeographic scales it has led to many of the unique characteristics of Australia's species and ecosystems. Given these uncertainties need a more flexible approach that includes connectivity research to learn from management interventions and help devise new management options.