Draft National Wildlife Corridors Plan

March 2012

Prepared by the National Wildlife Corridors Plan Advisory Group

Foreword

The Hon Tony Burke MP
Minister for Sustainability, Environment, Water, Population and Communities
Parliament House
Canberra ACT 2600

Dear Minister

In March 2011 you appointed me Chair of an independent National Wildlife Corridors Plan Advisory Group with Terms of Reference to prepare a draft National Wildlife Corridors Plan. I am pleased to report that your Advisory Group has now completed its work and on their behalf I commend the attached draft Plan to you for consideration by the Australian Government.

The draft Plan reflects our conviction that biodiversity conservation and sustainable land uses can be better integrated across Australia's landscapes in ways that will improve the connectivity and resilience of our natural ecosystems. It recommends a framework for conservation planning, investment and management which, we believe, can bring enduring benefits to our natural environment. Natural resource land managers, local communities and government at all levels can work together with industry to harness resources in ways that strengthen the social and economic fabric of our regions.

The draft Plan identifies a set of guiding principles and objectives and proposes a framework for progressively creating a network of corridors at different scales, local to national, across Australia. It acknowledges the significant effort already undertaken by State governments and community leaders to create regional corridors. We envisage that the Plan, once finalised, will encourage the progressive design and implementation of a national network over many years.

To assist the implementation of the Plan we have proposed the introduction of a Wildlife Corridors Act. The legislation would establish an independent assessment procedure which will allow the community to nominate future National Wildlife Corridors for declaration by the Minister for the Environment. It would also strengthen the Minister's ability to monitor and report upon corridor development and to provide guidance on strategic opportunities for future conservation investments.

On behalf of the Advisory Group I would like to thank you for giving us the opportunity to undertake this important and timely work. I do believe that Australia is in the forefront of connectivity conservation policy, in the science that supports it and the community leadership that is necessary for its implementation.

I would also like to take this opportunity to acknowledge the professionalism and support of your departmental officers and to thank them for their diligence and hard work over the past twelve months.

Yours sincerely
Bob Debus AM
Chair, National Wildlife Corridors Plan Advisory Group
March 2012

Contents

Foreword **i**

Vision **1**

Part 1: Why do we need a National Wildlife Corridors Plan? **3**

1.1 Wildlife corridors and climate change 5

1.2 What are wildlife corridors? 6

1.3 The objectives of the National Wildlife Corridors Plan 9

1.4 Guiding principles for wildlife corridor design and implementation 12

1.5 A national network of wildlife corridors 15

1.6 Different landscapes, different solutions 17

1.7 Who will be involved in building a national network of wildlife corridors? 20

1.8 Foundation stones 21

Part 2: Building a national network of wildlife corridors **25**

2.1 The five point plan of action 25

2.2 A collaborative governance framework 30

2.3 Next steps 32

Glossary **33**

References and suggested further reading **39**

Appendix A: Land use, condition and biodiversity maps **43**

Appendix B: Potential National Wildlife Corridors **49**

Appendix C: National Wildlife Corridors Plan Advisory Group **69**

Appendix D: National Wildlife Corridors Plan Expert Working Groups **71**

Figures

Figure 1	Corridor components	3
Figure 2	Elements of connectivity within the landscape	8
Figure 3	Corridor scales	16
Figure 4	Management activities related to corridor building: some examples	18
Figure 5	The National Reserve System, World Heritage Areas and private conservation agreements	21
Figure 6	Species richness in Australia's bioregions	27

Vision

Diverse, connected and healthy landscapes that support and sustain biodiversity, communities and wellbeing

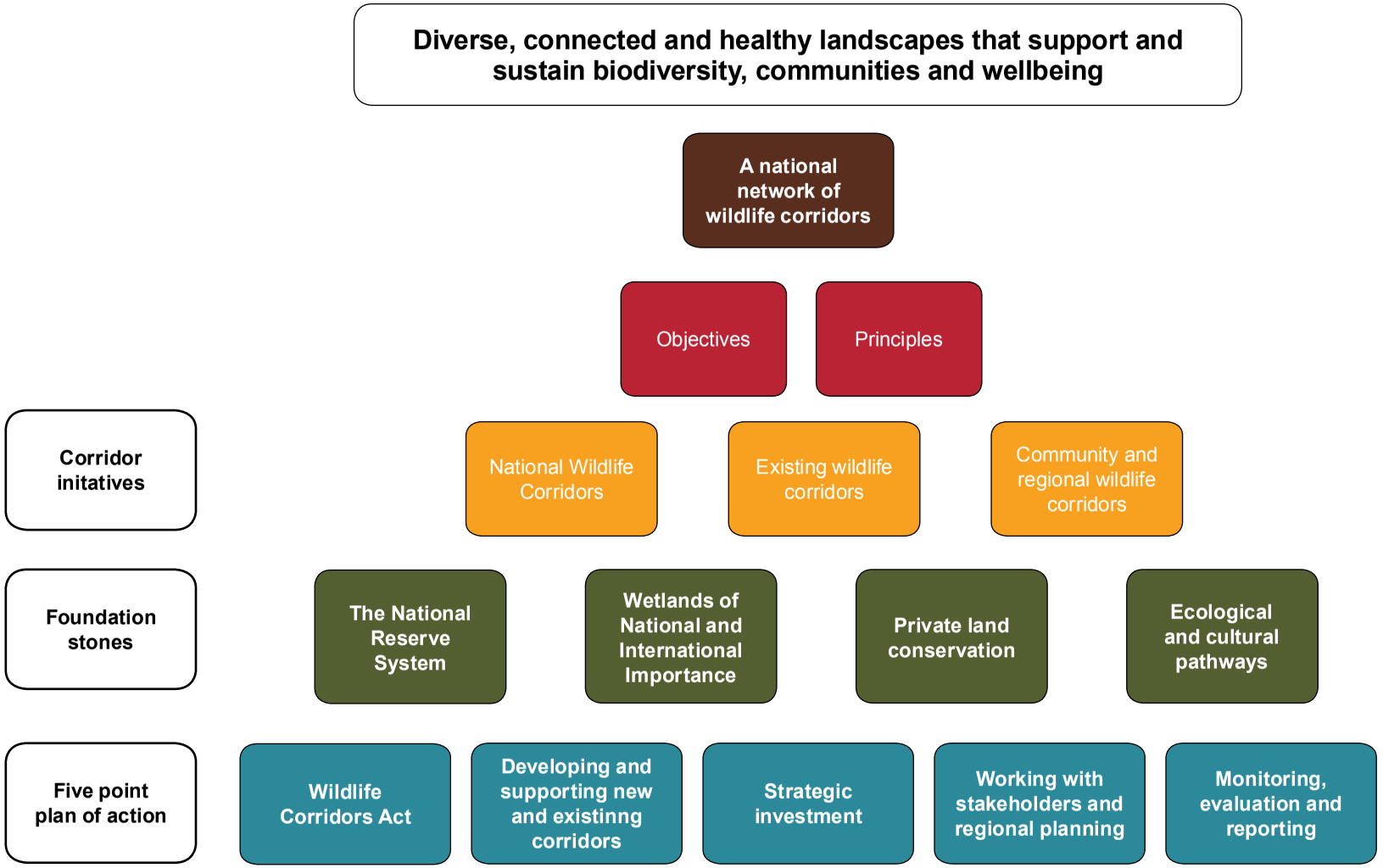
The National Wildlife Corridors Plan is the Australian Government's strategy to restore and manage ecological connections in the Australian landscape. It recognises that connectivity is a fundamental requirement of healthy, productive landscapes. The Corridors Plan lays the foundation for a new, collaborative, whole-of-landscape approach to biodiversity conservation that is based on voluntary cooperation and the existing efforts of communities, landholders, governments and industry. The role of the Australian Government is to enable and coordinate the efforts of all participants.

In our vision of the Corridors Plan, a diversity of land tenure and land use types will contribute to wildlife corridors. The rights which landowners have under the law are to control and enjoy their property, to control access to their property and to legally dispose of the property in part or in whole. None of these rights are altered or affected by the National Wildlife Corridors Plan.

The Corridors Plan builds on Australia's Biodiversity Conservation Strategy, the National Reserve System (including Indigenous Protected Areas), climate change policies, and other public and private sector initiatives. It will guide and support individuals, private land managers, community groups, policy makers, planners and natural resource managers to develop and manage corridor initiatives.

This document consists of two parts: Part 1 describes the purposes, guiding principles, objectives and foundation stones of the Corridors Plan; Part 2 explains how the Australian Government will work to build a national network of wildlife corridors.

Mature native forest contains diverse species and structural features, such as fallen wood, hollows and understorey vegetation that provide valuable habitat for many species.


Diverse, connected and healthy landscapes that support and sustain biodiversity, communities and wellbeing
A national network of wildlife corridors
Objectives
Principles
Corridor initatives
National Wildlife Corridors
Existing wildlife corridors
Community and regional wildlife corridors
Foundation stones
The National Reserve System
Wetlands of National and International Importance
Private land conservation
Ecological and cultural pathways
Five point plan of action
Wildlife Corridors Act
Developing and supporting new and existinng corridors
Strategic investment
Working with stakeholders and regional planning
Monitoring, evaluation and reporting

Part 1: Why do we need a National Wildlife Corridors Plan?

Australia is one of the world's 17 mega-diverse nations, with an estimated ten per cent of all species on Earth occurring on this continent. More than 50 per cent of the earth's marsupial species occur only in Australia. Almost all of our mammal, flowering plant, reptile and frog species are not found anywhere else. However, as Australia has developed, our natural environment has become increasingly fragmented and as a result there has been a significant decline in many species. In some parts of Australia over 50 per cent of mammal species have been lost and more than 20 per cent of Australia's flora and fauna are currently classified as threatened (see map of nationally threatened flora and fauna at Appendix A). Today, the Australian landscape is a complex patchwork of natural areas, productive lands, towns and cities. Pockets of relatively healthy habitat have often become isolated in the landscape. This has reduced the environment's capacity to function naturally and disrupted the connectivity of the ecosystems that support our economy and wellbeing.

The draft Corridors Plan reflects our conviction that biodiversity conservation and sustainable land uses can be better integrated across Australia's landscapes in ways that will improve the connectivity and resilience of our natural ecosystems. There is growing recognition that in order to rebuild connected, functioning landscapes and maximise the benefits provided by the system of protected areas, it is necessary to strategically link protected areas with areas of remnant habitat and ecological value across all lands (Figure 1).

Figure 1 Corridor components

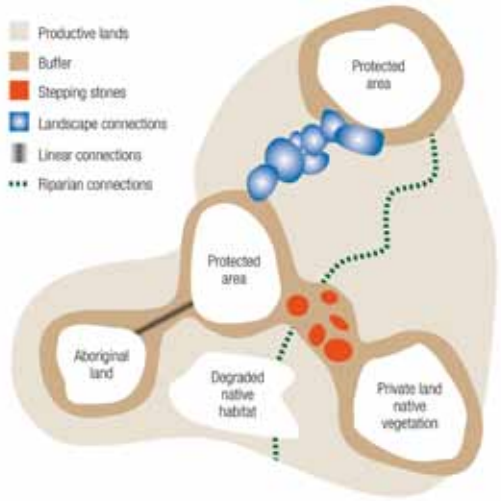


Figure 1 shows the elements of connectivity conservation at the local landscape-scale. Productive lands may incorporate fewer elements of native ecosystems, but often still contain valuable elements of connectivity and biodiversity, whilst some areas are higher quality and more intact. Adapted from Bennett (2004).

The National Wildlife Corridors Plan represents the Australian Government's commitment to rebuild, maintain and facilitate active management of corridors and natural patterns of vegetation, waterways and other landscape features across public and private lands, through our cities and towns and between our national parks. The Corridors Plan will support cooperative, voluntary endeavours by all land managers—whether they are managing farm land, urban land, conservation reserves or Indigenous lands—to restore ecological connections throughout the landscape.

Biodiversity conservation has traditionally focused on protecting large, representative remnant patches of habitat through formal reservation and management. Australia's National Reserve System covers about 13 per cent of the continent and is a cornerstone of the nation's strategy for conservation of our unique wildlife and ecosystems.

The Australian Government recognises that landholders across Australia have undertaken significant landscape restoration work, particularly over the past 30 years and that a number of non-government, voluntary-based and government initiatives have pioneered the development of corridor conservation projects in Australia. The national network of wildlife corridors developed under the Corridors Plan will build upon this experience, as well as other successful environmental and natural resource management initiatives across Australia. Our collective efforts will help ensure that the Australian environment and people have a secure, sustainable and prosperous future.

Private land conservation

As important custodians of Australia's environment, private landholders can contribute to the development of wildlife corridors by restoring, managing and protecting valuable ecological links between formal protected areas and other complementary land uses. Participation in the development and maintenance of wildlife corridors is voluntary. A range of Australian Government and other incentives, such as Environmental Stewardship, Caring for Our Country, the Biodiversity Fund and local catchment programs exist to support and encourage private landholders to undertake conservation management on their lands.

Property and holistic farm management plans can assist landholders to manage connectivity on their properties.

1.1 Wildlife corridors and climate change

Australia's climate is changing, with average annual temperatures in Australia having increased by between 0.4 and 0.7°C since 1950. The decade to 2009 was Australia's warmest on record, while the number of days having record high temperatures has increased every decade since 1950.

The Intergovernmental Panel on Climate Change reports that rapid climate change will change rainfall patterns and increase the frequency of extreme weather events, such as floods, storm surges and droughts. There will be significant impacts on our water supply, agriculture and urban environments. This will affect the wellbeing of Australia's unique native species, ecosystems and human population.

Fragmentation of our landscapes reduces species' and ecosystems' capacity to adapt to altered climatic conditions. If we are to halt the trend of biodiversity decline, there is an urgent need for practical strategies that increase the resilience of Australia's ecosystems and maximise the potential to adapt under changed climate conditions.

The report of the independent review of the Environment Protection and Biodiversity Conservation Act 1999 suggests that in light of climate change, future biodiversity management should focus on improvement of ecosystem resilience and the connectivity of fragmented ecosystems, the expansion of the National Reserve System, and protection of important refugia. Invasive species, fire and other disturbances should also be managed. In addition, the review suggests that policy frameworks should be re-oriented through the introduction of integrated regional approaches to biodiversity management.

Wildlife corridors are one of the most effective conservation tools available for protecting biodiversity and preparing landscapes for climate change. They can help insure against climatic uncertainty through the protection of a diversity of species and providing alternative pathways for species movement and adaptation. Naturally connected landscapes and ecosystems are generally healthier and can store carbon more effectively than degraded landscapes. The National Wildlife Corridors Plan can help protect natural stores of carbon in the environment and contribute to mitigating the effects of climate change. Through coordinating investment at the national scale, the Corridors Plan will improve the resilience of our landscapes and better prepare land managers for altered climatic conditions.

Productive lands can also provide important habitat. Remnant vegetation patches, paddock trees, fenceline, roadside and riparian vegetation provide important connections across the landscape.

Climate change and adaptation

One of the possible adaptive responses to climate change is for species to relocate as climatic envelopes shrink, expand or change location. This is likely to be a successful strategy for some highly mobile species, such as marine species and some birds. Some changes in range have already been observed as a result of consistently warmer temperatures. For example, it is thought that a reduction in the number and severity of frosts has enabled the Black Flying Fox to expand its range more than 750km to the south in the past 75 years. It is also thought that some species will colonise new areas at higher elevations or in the cooler edges of their ranges. Although climate change might create novel ecosystems with new combinations of species, the capacity of many species to tolerate and adapt to changed conditions is not known. Predicting the impacts on species is difficult because of the many interactions involved. In general, species that have specialised requirements, narrow physiological tolerances and geographic ranges, low genetic variability and long generation times are considered to be at greatest risk. For this reason, the Biodiversity and Climate Change Expert Advisory Group suggests an approach of spreading risk and maintaining fundamental ecosystem processes, rather than focussing on maintaining historical species distributions. Increased ecological connectivity can facilitate the movement of species and help maximise opportunities for ecosystems to adapt and reorganise. Steffen *et al* (2009a and 2009b).

1.2 What are wildlife corridors?

Wildlife corridors encompass all forms of natural connection and interaction across the landscape. They can support the diverse needs of plants and animals at multiple scales. Corridors may include large expanses of intact native landscapes, river systems and floodplains, networks of habitat patches or scattered paddock trees (Figure 2). Corridors offer a range of benefits. They allow the movement of species seeking resources, breeding opportunities or specific climatic conditions and support ongoing ecological processes that underpin healthy environments.

Connectivity is a critical function of wildlife corridors. The term describes the environmental characteristics operating at a range of scales that make landscapes habitable by communities of plants and animals, allowing their movement, adaptation and evolution. Connectivity can be considered at different levels.

Landscape connectivity refers to the physical connections between habitat areas across a landscape. For example, linear strips of native vegetation along roadsides, paddock trees in fields, and other structural elements such as rock formations can link larger patches of remnant habitat, allowing the movement of some fauna and the transfer of plant seeds and pollen.

Habitat connectivity refers to the connections between patches of habitat that are suitable to any particular species. For example, some bird species are able to traverse landscapes via ‘stepping stones’ such as paddock trees, while other species require continuous cover of a particular habitat.

Ecological connectivity is a broader concept that relates to the function of ecosystems across space and time. It considers the processes underlying healthy landscapes—for example,

interactions between fruiting trees and the animals that eat their fruit and disperse their seeds; flows of water across the landscape, allowing plants and animals to live and breed; and the production of resources, such as nectar that animals track from season to season. Many of these characteristics are supported by retaining habitat and landscape connectivity, allowing movement and flows across Australia's landscapes.

Evolutionary connectivity allows populations of species to interact naturally, share genes and, in time, adapt to changing environmental conditions. Evolutionary processes generally occur over very long periods. Protecting ecological processes, through managing for *ecological connectivity* in the immediate term can provide the best prospect and opportunity for evolution to occur.

Connectivity conservation includes the conservation of one or more of these four types of connectivity. Many corridor initiatives aim to manage all four types of connectivity.

Hospitable or hostile: landscapes from an animal's perspective

Australia's landscapes are not homogenous: they are composed of patches of various land uses and differing ecosystems. The response of wildlife to these landscape features depends on the species' ability and willingness to move across different types of land cover, the usefulness of resources found in different habitat patches, and the dangers to which the species are exposed on the way.

Landscape permeability is a term used to describe how hospitable land might be for a given species. For example, many rainforest birds will cross only short gaps between dense patches of vegetation. For these birds, a permeable landscape might include wide belts of tall, dense and structurally diverse vegetation in which they can find suitable places to perch and shelter. In contrast, a bare landscape is likely to be hostile because it lacks the shelter and food they need.

A hospitable or permeable landscape for migrating fish may be one that has sufficient water through river reaches or where fishways have been constructed to enable fish to move through regulated river systems. In addition, streamside vegetation and structural features such as logs can provide shelter and food sources, making the river systems more hospitable for fish and other aquatic fauna. In some cases landscapes can be *impermeable*, or hostile, not necessarily because an animal is unwilling to cross between core habitat patches but because of the dangers it encounters while doing so. For example, wombats and Koalas are often hit by vehicles when crossing busy roads. The landscape can be made more hospitable for these animals by construction of overpasses or underpasses.

Barriers such as fences and roads can reduce a landscape's permeability. However, landscapes converted for agricultural or urban development can maintain their permeability for many species if trees, rocky outcrops and other stepping stones between larger areas of habitat remain in good condition.

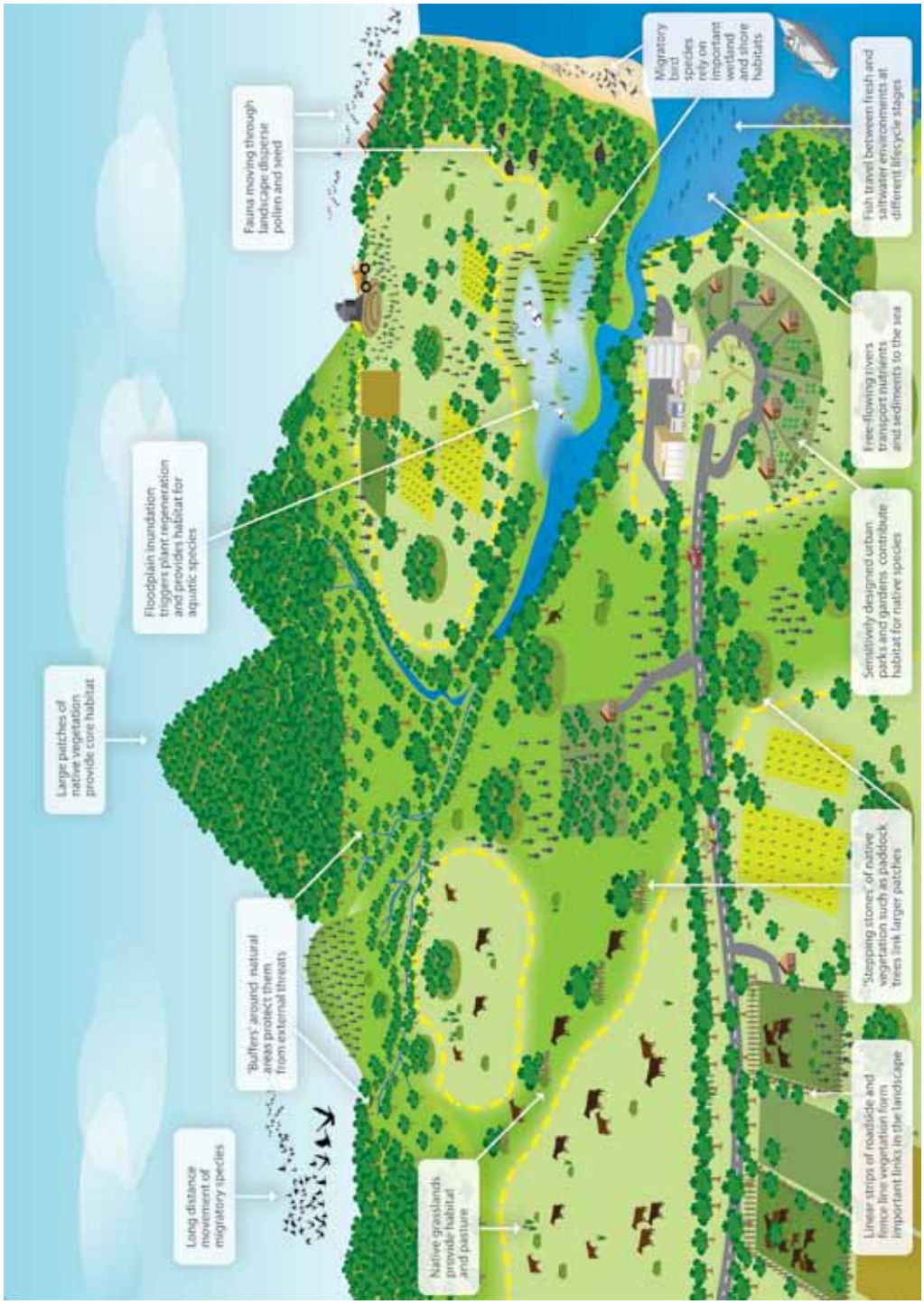


Figure 2 Elements of connectivity within the landscape

1.3 The objectives of the National Wildlife Corridors Plan

The National Wildlife Corridors Plan is a long-term strategy designed to protect and rebuild ecological connectivity and facilitate connectivity conservation. Existing and prospective corridors—at continental, regional and local scales—will all contribute to the national network of wildlife corridors. Some of these initiatives might also be designated as National Wildlife Corridors. Through the establishment of this national network, the National Wildlife Corridors Plan will help to achieve six primary objectives:

Protect, maintain and restore native habitats and ecosystems, and their critical processes and functions

Healthy ecosystems rely on enduring physical and ecological connections. Barriers to these connections, such as fragmentation and degradation of vegetation, threaten long-term ecological function, the survival of plants and animals, and agricultural productivity. The physical and ecological connections within and between ecosystems are therefore critical to the maintenance of healthy landscapes.

Many of Australia's ecosystems have been greatly modified by the loss of native vegetation; alterations to hydrological and fire regimes; soil composition, chemistry and structure; and the spread of feral animals and weeds. In addition, built structures and hard surfaces inhibit ecological processes and reduce the capacity of fauna to move across the landscape. This has resulted in many native species becoming threatened or extinct and landscapes declining in health and productivity. Landscapes that maintain their ecological functions and natural connections have much greater resilience in the face of threats.

> *"Hindmarsh Shire is 97 per cent cleared and it's been really important to restore connectivity and protect fragile soils from erosion for both agricultural productivity and biodiversity. We reconnected the Big and Little Deserts in four years. We started with seven landholders and now have 230 on board. It's a win-win for both farmers and biodiversity if this is done properly."*
>
> Darryl Argall AM,
> Former Mayor Hindmarsh Shire Council,
> Victoria; Hindmarsh Landcare Network
> (Habitat 141°)

Protect natural stores of carbon in native ecosystems to minimise greenhouse gas emissions.

Natural ecosystems including forests, woodlands, grasslands and wetlands contain large stores of carbon. Ecosystems that are not subject to excessive disturbance are better able to sequester greenhouse gases, such as carbon dioxide. The protection and restoration of the integrity and function of natural ecosystems can reduce the future impacts of climate change and are increasingly important aspects of environmental and natural resource management, economic development and social wellbeing.

Enhance the resilience of Australia's biodiversity and its adaptability to climate change

Many of Australia's native species have evolved to cope with boom-and-bust cycles of drought interspersed with periods of high rainfall. However, rapid climate change will push the limits of our plants' and animals' resilience and adaptive capacities. If large, well-connected populations of Australia's plants and animals are protected, their resilience in the face of climate change will increase and they will be better able to adapt or move across the landscape in search of food, breeding habitat or suitable microclimates.

Freshwater coastal wetlands may be threatened by saltwater inundation with rising sea levels. This may require species such as Magpie Geese and other waterbirds to adjust their ranges and adapt as wetland ecosystems change.

Support the global and national movements of fauna

Migration and nomadic movement to find resources such as food and breeding habitat are common features of Australia's native fauna. Many native animals move either seasonally or following irregular rainfall events. In addition, Australian habitats support millions of migratory birds that travel enormous distances each year, from as far away as Siberia and Alaska. Protection of their habitat and ensuring the connectivity of their migration routes are essential to their survival.

Assist in the management and protection of Australia's iconic landscapes and Indigenous and non-Indigenous culture and heritage

Cultural history often mirrors natural history, important connections between people and places being retained over generations. Indigenous and non-Indigenous people's cultural connections with landscapes, flora and fauna can be traced across the country. Australia's Indigenous people are custodians of the world's oldest continuous living culture, with traditions and knowledge of local environments passed between many generations over tens of thousands of years. Indigenous pathways, songlines and Dreamtime stories often directly reflect the migratory routes of birds, mammals, reptiles and insects, as well as watercourses.

Many of the stock routes and trade routes of early settlers followed Indigenous pathways. Today, these cultural pathways continue to provide some of Australia's most important areas of ecological connectivity.

> *"Gondwana Link has been good on many fronts. We [the Noongar people] did not know what to expect in the early days. We surveyed the country, found artefacts—and that brought us back to thinking about a time in the past and made us consider the songs and dances that had been on the country before us. By identifying sites, they are now protected and that is a wonderful thing for people to know."*
>
> Eugene Eades, Nowanup Program Leader Gnarjl Aboriginal Corporation

Increase community knowledge and understanding of wildlife corridors and connectivity conservation

Connections with natural places can be generated through providing opportunities for individuals and communities to be involved with wildlife corridor projects and natural resource management. Good conservation calls for consistent and sensitive land and resource management over the long-term. Individual and community stewardship provides important and enduring insurance for our environment. Expanding the community's understanding of the concepts of landscape connectivity and what this means for maintaining the health and productivity of local landscapes is an important objective of the National Wildlife Corridors Plan.

Many Indigenous Australians retain strong connections to country. Traditional land management practices and knowledge of the environment provide valuable insights for designing and building wildlife corridors.

1.4 Guiding principles for wildlife corridor design and implementation

The following principles underpin the Corridors Plan vision for the protection and restoration of connectivity and resilience in Australian landscapes:

Healthy, functioning landscapes require connectivity at a variety of scales

Different species require different scales of connectivity. For example, native bees may require flowering plants to be closely spaced in order to collect nectar and pollen, whereas Koalas have territories that can span many hundreds of hectares of healthy connected vegetation. For this reason, the Corridors Plan supports the design, conservation and management of connectivity at multiple scales, from local and regional to national scale corridor initiatives.

Effective corridors connect the landscape across a mosaic of land tenures and land uses without affecting property rights

Approximately 77 per cent of land in Australia is held and managed by private or Indigenous landholders. These landholders have a vital role in the protection, maintenance and restoration of connectivity in the landscape. Corridors are likely to be most effective if they are able to link National Parks, Indigenous Protected Areas and private conservation lands with other lands of conservation importance. Corridors may span a variety of land uses and types, including near natural, agricultural, forestry, coastal and peri-urban landscapes. This presents both challenges and opportunities for the promotion of ecological connectivity. The Corridors Plan recognises that diverse land tenures and land uses will contribute to wildlife corridors without affecting the rights attached to private property.

Fenceline or roadside vegetation can help wildlife to move throughout the landscape to find food, water and breeding opportunities.

The design and location of corridors should be based on the best available information derived from scientific research, traditional Indigenous knowledge and practitioner experience

Corridor initiatives should draw on a range of evidence and expertise. Scientific research provides a basis for recommendations about the location, design and management of corridors. Indigenous Australian and local community knowledge comes from an intimate understanding of the environment. The Corridors Plan seeks to draw on Indigenous and local community knowledge, the analytical skills and insights of the scientific community, as well as existing government and non-government connectivity initiatives and management practices.

Indigenous fire management practices, developed over thousands of years can inform the management of wildlife corridors. Here, burning is being carried out in the Laynhapuy Indigenous Protected Area.

Corridors should be designed to assist native species' adaptation to the impacts of climate change

The threats to Australia's ecosystems and native species are likely to be exacerbated by a changing climate and extreme weather events. Corridors can improve native species' capacity to adapt and move in response to such change. Where possible, corridor planning needs to take account of differences in dispersal ability and adaptation responses between species and geographic variation across the continent.

Corridor design recognises and manages for potential risks, such as those from invasive species and fire

Natural connectivity in landscapes helps ensure that native species are more resilient to threats, such as those posed by invasive species. In addition, native vegetation communities that retain full structural diversity and health are more likely to withstand and bounce back from bushfire and drought. However, some species' populations have remained protected by virtue of their isolation. Corridor design must consider the specific connectivity needs of all species. In addition, the design and implementation of corridor initiatives should be

supported by practical invasive species and fire management plans to ensure that the corridors do not inadvertently encourage the spread of invasive species or create fire hazards.

Cane toads, roads and risks

One concern raised about wildlife corridors is that they could become pathways for invasive plants and animals. However, case studies have shown that some of the most serious invasive species—such as cane toads, foxes and some weed species—are most likely to disperse and move through areas of disturbed vegetation and along cleared pathways such as roads. Areas of dense native vegetation are likely to be better protected against invasion and might help to reduce the overall dispersal of invasive species. Specific management regimes and initiatives to control invasive plant and animal species are an essential component of corridor design.

Corridors should be designed and implemented in ways that benefit local communities

Wildlife corridors and healthy landscapes provide a range of amenities for local communities and support their economic and social wellbeing. Among other things, these benefits can include rural and regional employment opportunities in natural resource management and tourism, as well as the protection and enhancement of ecosystem services such as water supplies that benefit agricultural productivity.

Wildlife corridors in regional Australia can provide economic and social benefits for rural communities.

Building wildlife corridors across Australian landscapes is a cooperative endeavour

Promotion of ecological connectivity calls for sensitive land and resource management over the long-term. Local, regional and national efforts should be a coordinated and cooperative endeavour between government, non-government bodies, the private sector and the community. Strategic approaches between stakeholders are needed to plan and allocate resources effectively, so as to support corridor development, seize opportunities as they arise, determine spatial priorities across landscapes, manage at ecologically suitable spatial and time scales, and meet both conservation and other needs.

International connectivity initiatives

Some of the best known international corridor initiatives have been designed to facilitate the long distance migration requirements of large animals and the need for top order predators to maintain large territories. For example, the *Yellowstone to Yukon* project protects the habitat and migration routes of large mammals such as grizzly bears, wolves, caribou, elk and bison. Only 10 per cent of the region lies in national parks, so public education and assisting communities to live harmoniously with nature are fundamental to the project's success. Some initiatives also focus on socio-economic opportunities and benefits of connectivity conservation. *The Mesoamerican Biological Corridor* (also known as *The Path of the Panther)* spans eight Central American countries in a region characterised by high levels of poverty but rich biological diversity. A central principle of the project is that biological conservation can be achieved only through poverty reduction and strengthening of the economic viability of participant countries. Farmers are encouraged to use ecologically sensitive farming techniques. Payments for environmental services such as carbon sequestration and water provision are an increasingly important part of local income streams.

1.5 A national network of wildlife corridors

The National Wildlife Corridors Plan supports the development of a national network of wildlife corridors at a range of scales across Australia. The network will consist of national, regional and local-scale corridors (Figure 3). National Wildlife Corridors might be new or existing initiatives identified through a community-led nominations process. The national network of wildlife corridors will protect, manage and restore ecological connectivity across a variety of land uses, landscapes and ecosystems. It will connect habitat patches within and across borders, along rainfall gradients and between altitudes, stretching from north to south and from east to west.

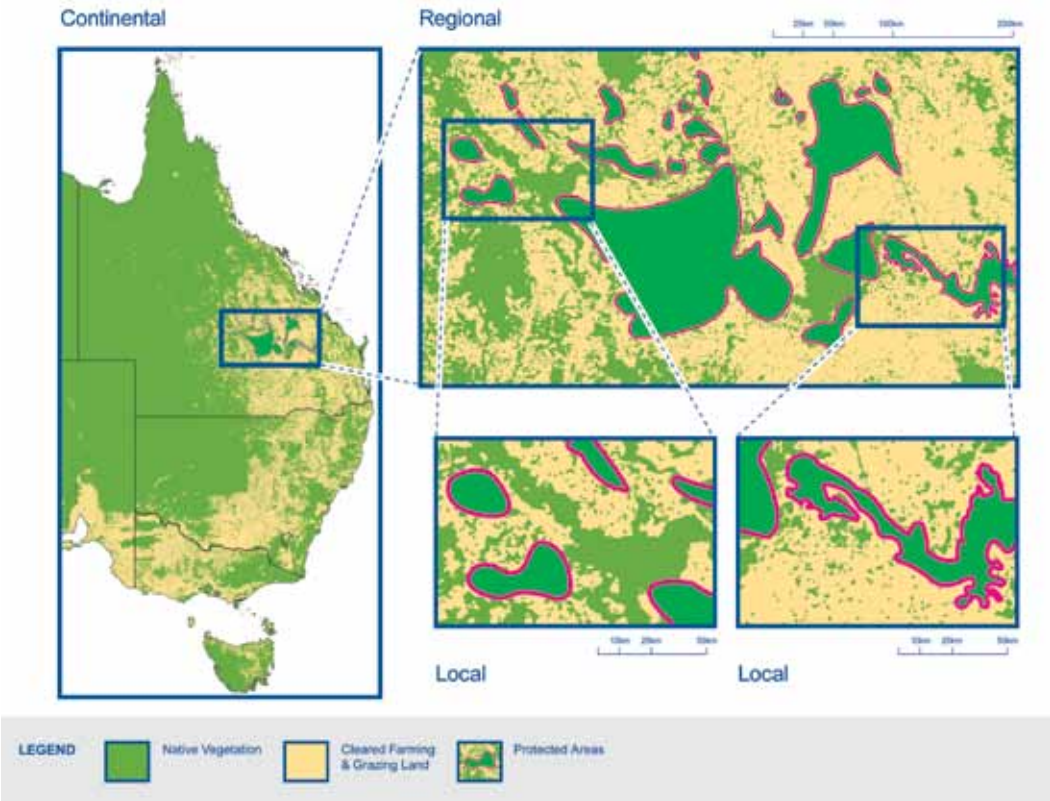
Many natural systems operate through networks. These networks provide a flow of water, energy and nutrients throughout the landscape and enable species to breed and disperse. The national network of wildlife corridors will reflect the networks of natural systems occurring at different scales, from major hydrological systems to interactions between species.

A national network of wildlife corridors will be created through the following measures:

- Building National Wildlife Corridors to create major landscape links
- Enhancing existing major corridor initiatives
- Supporting community and regional-scale corridor initiatives.

As the national network of wildlife corridors develops, new opportunities to link National Wildlife Corridors and other corridor initiatives will emerge. The Australian Government will seek to identify and support these opportunities.

Figure 3 Corridor scales



Corridors will be developed at a variety of scales. Local action to protect, manage and restore natural connections will contribute to regional efforts that in turn increase ecological connectivity at the continental scale. The actions contributing to building corridors will differ according to the local situation —for example, whether there are large, intact natural areas to be buffered and managed or many small fragments to be linked.

1.6 Different landscapes, different solutions

A wide range of management actions can contribute to building wildlife corridors; some of which are shown in Figure 4. The types of management actions that are most feasible and effective will vary according to landscape type. In most cases, a mix of actions will benefit landscape health, with their effectiveness dependent on ecological context. Planning can help with developing priorities for management that suits local ecosystems and landscape condition. It can also help ensure that there is compatible and complementary management and land use between properties.

Australia has a largely urbanised population predominantly settled in coastal areas, while the more fertile, productive inland soils tend to be dominated by agriculture. Urbanised and agricultural lands have often been preferentially cleared, and native vegetation in these areas is highly fragmented. Nonetheless, these areas still contain some of our richest biodiversity dispersed across patches of remnant habitat. In more remote regions, where land use is less intensive, natural systems have remained more intact. However, intensification of land uses from a range of developments, such as mining, urbanisation and intensive agriculture often impact on the natural environment.

Different management strategies are needed for different landscapes, and in each case management across tenures is needed in order to protect and restore biodiversity. On land that has been heavily cleared and fragmented, large-scale ecological restoration and rehabilitation are required; in contrast, in near intact landscapes, protection and maintenance of existing connectivity are likely to be the activities of focus.

Wildlife corridors through our cities and towns help protect wildlife and improve community wellbeing.

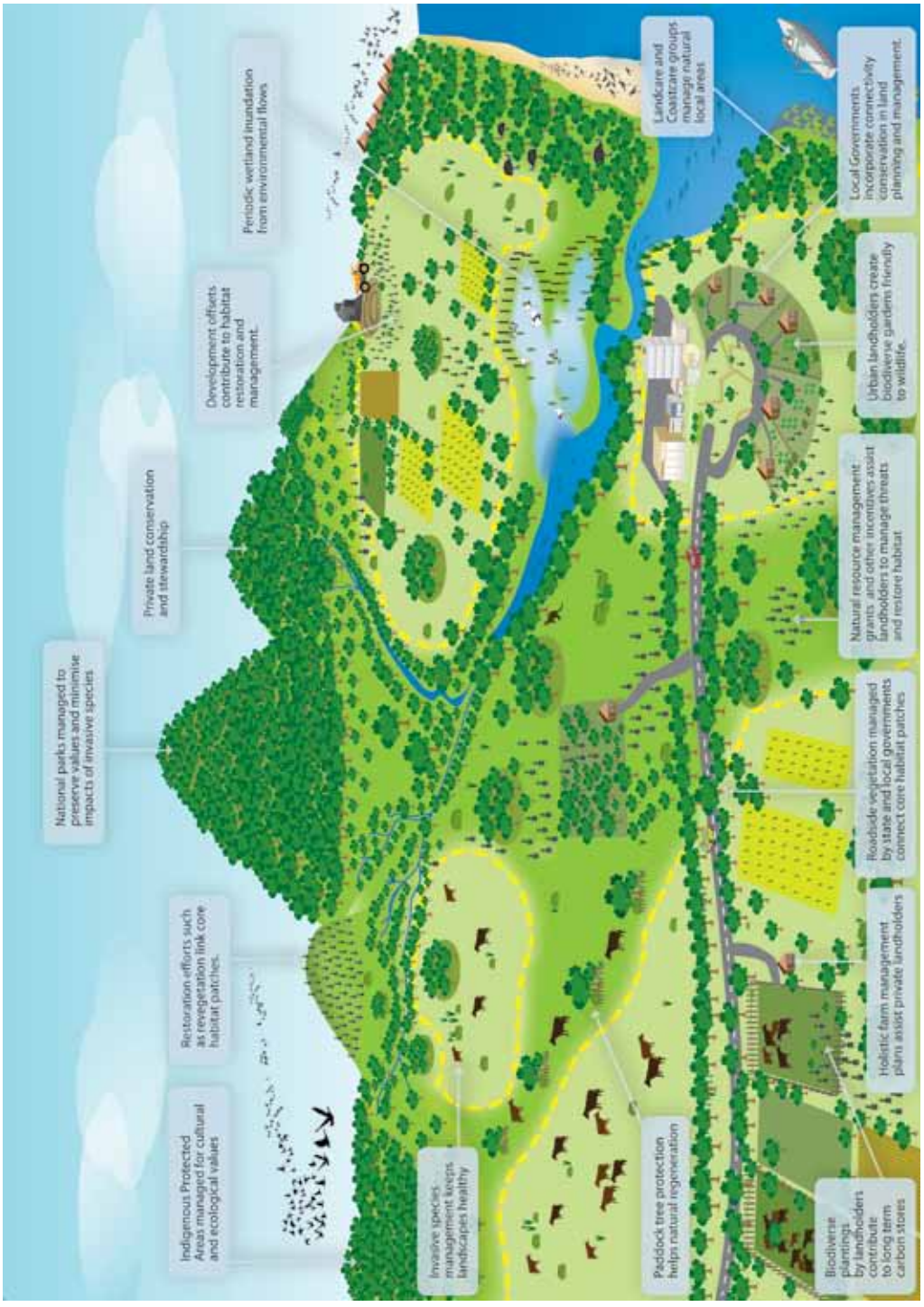


Figure 4 Management activities related to corridor building: some examples

Corridors in fragmented landscapes

Although much of the native vegetation in Australia's agricultural zones has become fragmented as land use has intensified, these landscapes also contain some of our most valuable areas of remnant habitat. Remnant habitat might not be formally protected, but has often been managed and maintained by private landholders. In fragmented landscapes, paddock trees, riparian zones, and remnants of native vegetation on farms, along fence lines, tracks and railroads can provide links for animals and support connected populations of native plants.

Remnant habitat can provide important connections within fragmented landscapes.

Corridors in near intact and natural landscapes

Typically, Australia's intact and natural landscapes are relatively remote from urban centres. Among these landscapes are rugged mountainous areas, the rangelands of the arid interior and remote northern Australia. Although the landscape condition is generally good in near intact landscapes, feral pests such as cane toads, camels, foxes, pigs and cats as well as inappropriate fire regimes pose a threat to connectivity and biodiversity. Near intact areas present challenges for protecting and promoting connectivity due to their relative remoteness, their inaccessibility, and limited resources and community capacity. However, large-scale action can occur with the involvement of a small number of landholders. Many large areas of remote Australia are managed and owned by Indigenous groups. Indigenous knowledge and experience of land management, as well as their deep cultural connections to country provide a strong foundation for corridor development.

Near intact and natural landscapes, such as parts of the Kimberley provide important opportunities for conservation.

Corridors in peri-urban and urban landscapes

Our urban and peri-urban areas are moderately or highly engineered landscapes, and are particularly concentrated along Australia's coastlines. Nevertheless, some peri-urban areas do retain substantial natural areas at their fringes. In recent times, many urban planners and developers have been more mindful of environmental needs when designing urban areas. Zoning and planning that supports connectivity conservation can protect watercourses and important habitat, and keep valuable ecosystems healthy and resilient. Urban and peri-urban wildlife corridors, which can flow between towns, suburbs, parks and reserve lands can raise community awareness and actively engage a diversity of community in conservation and management activities.

In peri-urban areas it may be necessary to provide structures, such as underpasses to enable wildlife to move through the landscape.

1.7 Who will be involved in building a national network of wildlife corridors?

The development of a national network of wildlife corridors calls for coordinated and collaborative efforts between government agencies, regional bodies, non-government organisations, industry, philanthropic, Indigenous and community groups, and individuals. These participants bring the different scales of oversight, skills, knowledge and resources needed to create and sustain a national network of wildlife corridors.

Individuals, state and territory governments, industry, community groups and non-government organisations have already provided important support and leadership for a number of pioneering wildlife corridor projects in Australia. For example, in the Hunter Valley Partnership region of the Great Eastern Ranges corridor more than 40 organisations—ranging from the coal, energy and tourism industries, agricultural and equine enterprises to community groups and individuals— are participating in developing local wildlife corridors.

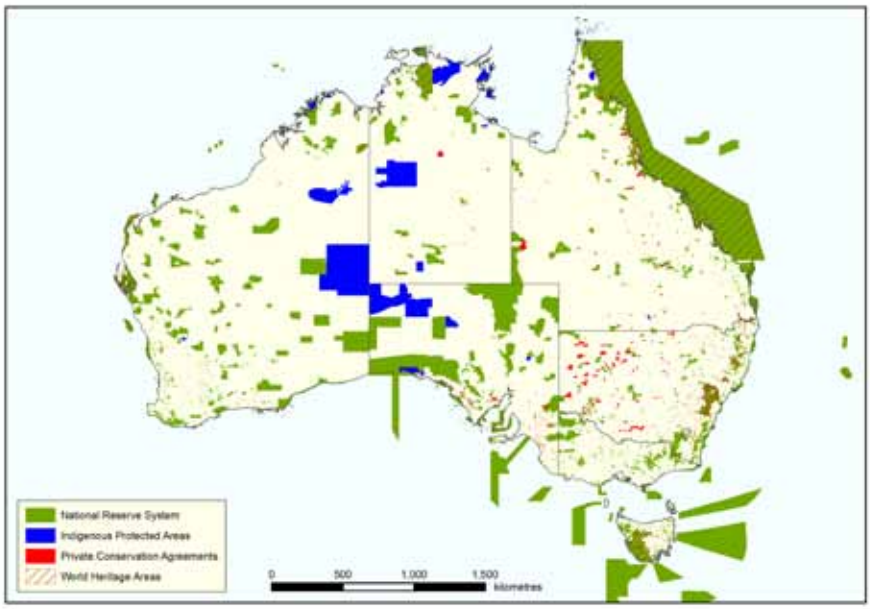
1.8 Foundation stones

The foundation stones for the national network of wildlife corridors are national parks, reserves and Indigenous Protected Areas, wetlands and riparian zones, and high-quality habitat on private land. In Australia many large patches of native vegetation are formally protected as part of the National Reserve System, through regulation or the custodianship of private landholders. Significant tracts of land are not formally within the conservation estate, but still retain important remnant habitat for wildlife, such as the large area of native vegetation that is used for grazing (Appendix A). Sustainable management of these areas can provide benefits for both biodiversity and production. Habitat areas that are in good condition are more resilient to disturbances such as wildfire and extreme weather events and provide anchors of connectivity within the landscape. Ecological pathways such as migratory routes and cultural pathways such as songlines are also important areas for consideration in wildlife corridor planning and implementation.

The National Reserve System

The National Reserve System (NRS) covers approximately 13 per cent of Australia's continent and is a pillar of Australia's biodiversity conservation efforts (Figure 5). Both public and private lands contribute to the NRS, with government agencies, private landholders and non-government organisations managing land for conservation purposes. However, some of these protected areas have become isolated islands in the landscape, which can reduce their resilience. The Corridors Plan will help to build connections between protected areas and other private and public lands in the surrounding landscape.

Figure 5 The National Reserve System, World Heritage Areas and private conservation agreements



Source: Commonwealth of Australia Protected Areas Database (2010)

There are more than 40 Indigenous Protected Areas which account for approximately 23 per cent of the National Reserve System. Indigenous Protected Areas are managed for a variety of purposes, including cultural uses, the conservation of flora and fauna, and economic development. There is great potential for building connectivity across the Australian landscape by managing the lands in and between Indigenous Protected Areas. In turn, this has the potential to enhance and protect the natural and cultural values of these designated areas.

World Heritage Areas

World Heritage Areas are listed under the World Heritage Convention. The Convention identifies sites of global importance and outstanding natural or cultural value for both current and future generations. There are many benefits to World Heritage Listing, including increased tourist visitation and employment opportunities and ongoing management and protection. In addition, World Heritage Listing supports public knowledge and appreciation of the unique natural and cultural values of an area. Australia's World Heritage properties are comprised of a variety of land tenures, including both public and private lands. World Heritage Areas are important potential foundation stones of wildlife corridors as their management is compatible with the aims of connectivity conservation. Wildlife corridors can help buffer World Heritage Areas from external threats and build connections between these sites and the surrounding landscape.

Wetlands of National and International Importance

Australia has many wetlands that are recognised under international treaties, such as the Ramsar Convention, and are also afforded protection under the *Environment Protection and Biodiversity Conservation Act 1999*. They are called 'Wetlands of National and International Importance'. Maintaining connectivity across Australia's wetlands through seasonal water flows and networks of riparian vegetation is essential if we are to support and maintain these areas, which contain important habitats for migratory species and are centres of biological diversity.

Restoration of vegetation near rivers and other water bodies can increase habitat for native species, as well as reduce soil erosion and improve water quality

Private land conservation

Much of Australia's highest quality remnant native habitat exists on private land. These valuable areas have often been afforded both formal and informal protection by the good custodianship of private landholders. Private landholders may voluntarily wish to manage these areas as part of wildlife corridors. For example, landholders may choose to become involved in a variety of conservation programs and incentives, such as Environmental Stewardship, Landcare projects, conservation covenants, voluntary conservation agreements and farm management plans.

'We are in our infancy of experiencing the changes that this site will undertake under the Environmental Stewardship Program. Last spring and summer was the first year in our time as owners of the property that we received average rainfall. The site bounded into its full glory, harbouring a diverse range of forbs, lilies, orchids and grasses. We have also witnessed extensive natural regeneration of native trees'.

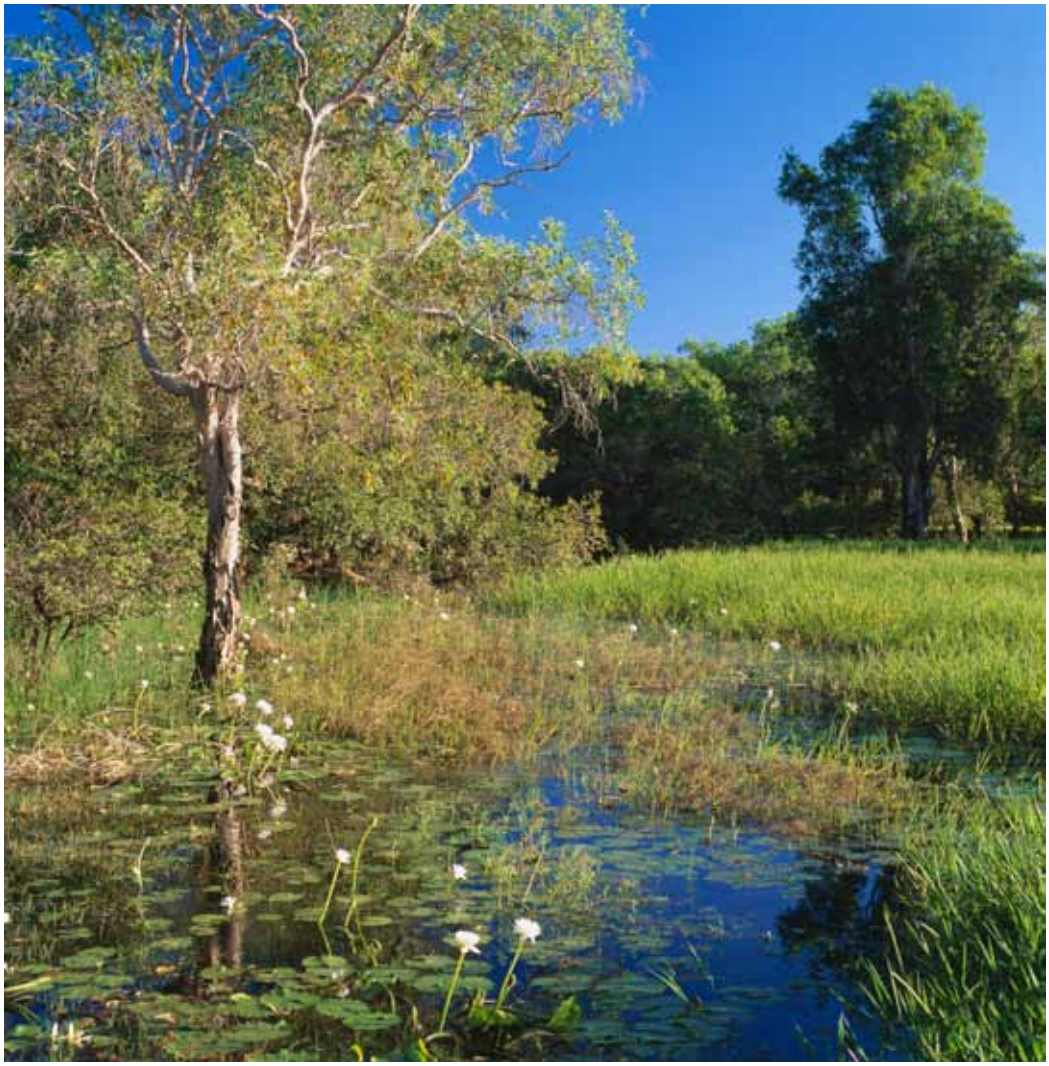
Selwyn and Pip Job
Contracted for 15 years under the Environmental Stewardship program to manage Box Gum Grassy Woodland on a cattle property in central west NSW

Ecological and cultural pathways

Ecological pathways—for example, river systems and migratory bird flyways—provide important natural connectivity within our landscapes. Ecological networks also provide the basis for many traditional Indigenous pathways, such as songlines and trading routes which for millennia have connected Indigenous communities through trade and seasonal travel. Many of these routes followed watercourses or linked water points. European explorers also took advantage of these existing pathways, some of which then developed to become the travelling stock route network. These ecological and cultural pathways provide a natural planning framework for wildlife corridors.

Existing major corridor initiatives

Existing major corridor initiatives are important foundation stones for the national network of wildlife corridors. The most developed projects are important models for building corridors across Australia and are characterised by integrated conservation planning over large areas, diverse ecosystem types and multiple tenures. Collaboration and community engagement are features of such initiatives, with action driven through a variety of incentive and support mechanisms. Some corridor initiatives have been led by non-government organisations, while others have been initiated by state government agencies and regional natural resource management organisations.



River systems and wetlands are important ecological pathways that support movement of wildlife for foraging and breeding, and also provide refuge during droughts and dry seasons.

Part 2: Building a national network of wildlife corridors

Part 2 describes the implementation of the National Wildlife Corridors Plan. In preparing the Corridors Plan, the National Wildlife Corridors Plan Advisory Group has drawn upon the Australian Government's experience in the development and implementation of a number of important environmental management initiatives:

- the National Reserve System and Indigenous Protected Areas
- Caring for Our Country
- Working on Country and the Indigenous Ranger Program
- the Environmental Stewardship Program
- the Land Sector Package of the Clean Energy Future Plan
- the National Environment Research Program
- the National Plan for Environmental Information
- the Environment Protection and Biodiversity Conservation Act 1999

2.1 The five point plan of action

The Advisory Group proposes that an enduring national network of wildlife corridors can be achieved through:

1. A Wildlife Corridors Act
2. Developing and supporting existing and prospective corridor initiatives
3. Strategic investment
4. Working with key stakeholders and supporting NRM regional planning
5. Monitoring, evaluation and reporting

Wildlife Corridors Act

A Wildlife Corridors Act could be established to ensure strategic oversight and long-term commitment to the protection and restoration of ecological connectivity through the development of National Wildlife Corridors. This would provide the authority for the Commonwealth Environment Minister to declare National Wildlife Corridors that buffer and link the National Reserve System, the Indigenous Protected Areas estate and other public and private land. It is anticipated that National Wildlife Corridors legislation could be enacted in 2012.

The listing of a National Wildlife Corridor under the Act would be a strong recognition of the conservation importance of an area. While such status would be relevant in assigning some

priorities for funding, this does not mean that conservation efforts outside of listed corridors would be precluded from funding and support.

A possible process for establishing National Wildlife Corridors could involve: public nomination of a potential wildlife corridor; assessment of the nominated area against specific criteria; and a recommendation to, and approval by the Commonwealth Environment Minister.

A Wildlife Corridors Act could achieve the following:

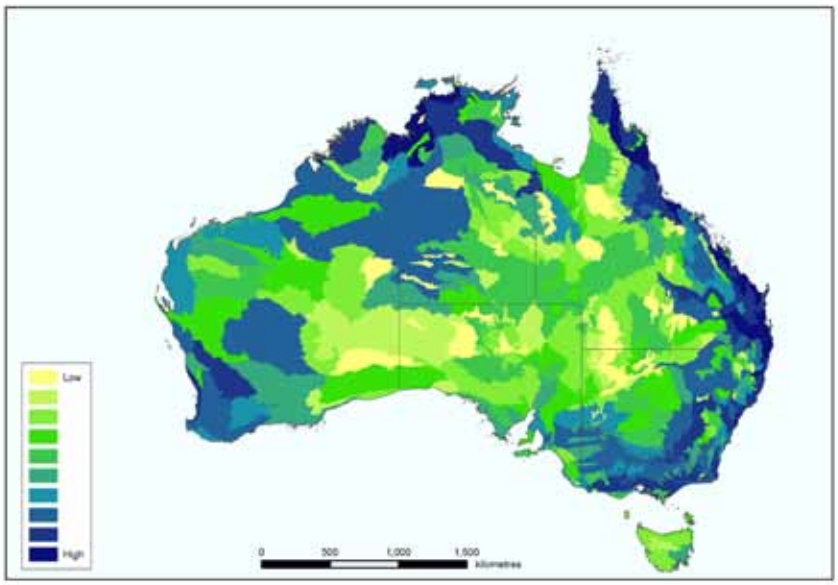
- define the policy intent and broad design principles and approaches for a national network of corridors;
- create authority for the Commonwealth Environment Minister to declare National Wildlife Corridors following a nomination and assessment process;
- establish the criteria for listing a National Wildlife Corridor;
- establish a National Wildlife Corridors Council to:
    - provide independent expert advice on the implementation of the National Wildlife Corridors Plan
    - assess nominations and advise the Commonwealth Environment Minister on declaring National Wildlife Corridors
    - monitor and report on progress of National Wildlife Corridors
    - provide guidance for Australian Government decisions with relation to biodiversity conservation and climate change adaptation
- provide a mechanism for annual reporting to parliament on progress.

Developing and supporting existing major and prospective corridor initiatives

The Advisory Group anticipates the progressive development of National Wildlife Corridors through a community-initiated process supported by legislation. In order to start this process, some potential National Wildlife Corridors have been identified on the basis of their biodiversity values, as well as conservation and community needs. Corridor design and location may take into account a range of biophysical attributes, such as those displayed in Figure 6, which illustrates the density of species richness throughout Australia, as well as in the maps found in Appendix A.

Existing major corridor initiatives, as well as new initiatives could become listed National Wildlife Corridors under the proposed Wildlife Corridors Act. The prospective corridors identified below have also been proposed based on their different landscape settings. More information on these existing and prospective corridors can be found in Appendix B.

Figure 6 Species richness in Australia's bioregions



Source: Australian National Heritage Assessment Tool (2011)

Existing major corridors:

- Gondwana Link, Western Australia
- Great Eastern Ranges, New South Wales
- Habitat 141°, Victoria/New South Wales/South Australia
- NatureLinks, South Australia
- Tasmanian Midlandscapes, Tasmania
- Trans-Australia Eco-link, Northern Territory/South Australia

Prospective corridors:

- Kimberley region, Western Australia
- Cape York Peninsula, Queensland
- Noosa to Ballina region
- Edward-Wakool Rivers region

Under the five point plan, nominated National Wildlife Corridors would be assessed by the Wildlife Corridors Council before the Commonwealth Environment Minister considered them for listing. Should the National Wildlife Corridors legislation be established by the Australian Government, the corridors named above would be the first set of National Wildlife Corridors considered under the legislation. It is expected that additional community-led nominations for National Wildlife Corridors would occur once the Wildlife Corridors Act is enacted and criteria and guidelines are finalised.

Many other connectivity and landscape-scale corridor projects are in various stages of development. These initiatives can differ in physical scale and ecological, social and development context. Some might emphasise land purchase and reservation, while others emphasise private property management. The diverse situations, emphases, and governance arrangements relating to these projects are indicative of the wide scope of corridor initiatives that could be developed under the Corridors Plan.

The national network of wildlife corridors will develop gradually, with linkages developing between existing and prospective initiatives, National Wildlife Corridors and more localised projects over time.

Strategic investment

The Advisory Group proposes that the Australian Government's approach to investment is based on the guiding principles outlined in this document. Competitive grants and commissions for building wildlife corridors would be made available through Australian Government programs.

The Corridors Plan acknowledges the substantial efforts that have already been made to creating corridors and other landscape-scale biodiversity conservation projects. In addition to supporting the development of new corridors, the Corridors Plan will support recognised existing corridor projects.

National Wildlife Corridors identified under the Wildlife Corridors Act may be prioritised for Australian Government investment. Regional natural resource management (NRM) organisations, landholders, non-government organisations, philanthropic bodies, governments and communities will be invited to nominate potential National Wildlife Corridors for consideration by the Commonwealth Environment Minister.

Working with stakeholders and supporting NRM regional planning

Through the Clean Energy Future Plan, the Australian Government has committed funds that will enable regional NRM organisations to prepare regional plans that are "climate ready". These plans will draw on available scenarios for climate change, provide spatial support for land use planning and identify opportunities for climate change mitigation and adaptation. Principles to guide development of these regional plans are included in the Clean Energy Future Land Sector Package. Regional planning provides opportunities for collaboration between local communities, governments and industry partners.

Opportunities for wildlife corridors to be established in and between NRM regions will be considered in these plans. Embedding corridor development in regional NRM planning will increase the capacity of many organisations to contribute to this work and encourage partnerships to build and support enduring corridors.

The Australian Government will support access to information on corridors design and planning through the Department of Sustainability, Environment, Water, Population and Communities website and other publications.

Monitoring, evaluation and reporting

The National Wildlife Corridors Council established under the Wildlife Corridors Act would report on progress of the Plan and National Wildlife Corridors, and table an annual report in parliament.

The effectiveness of the National Wildlife Corridors Plan can only be determined if there is an appropriate system in place to monitor outcomes. Monitoring and evaluation will provide evidence about the appropriateness, effectiveness, efficiency and legacy of investments. This will enable corridor managers to continuously adapt and improve their management practices and will generate a body of empirical knowledge about the impacts and effectiveness of management regimes.

Choosing suitable indicators to accurately attribute responses to management at various spatial scales is essential. The ability to collect, collate and interpret this data in a consistent way is another important consideration in planning monitoring strategies. A consistent monitoring approach will also make it more likely that information can be aggregated, which will help in tracking changes in ecological connectivity and function at greater spatial scales. In cases where adequate guidelines do not already exist, the Australian Government will assist individuals and organisations engaged in corridor initiatives to design and carry out monitoring programs.

There are a wide range of management activities that may contribute to building wildlife corridors. Some of these actions are shown in Figure 4. The effectiveness of these actions will depend on ecological context as well as other factors such as community willingness to participate.

Working with private landholders to improve connectivity on their properties will be an important element of the National Wildlife Corridors Plan.

2.2 A collaborative governance framework

The national network of wildlife corridors will depend on collaboration to ensure effective cross-jurisdictional and cross-regional planning, management and performance reporting. New collaborative governance arrangements may be established or existing governance arrangements may be used where practicable. For example, regional NRM organisations are well placed to coordinate corridor projects along with a variety of partners. Organisations managing existing corridor initiatives may also broker new collaborative arrangements. Partnerships can involve state, territory and local governments, conservation groups, non-government organisations, private landholders, industry and businesses and Indigenous and community groups.

Existing corridor projects are managed under a diversity of governance arrangements, often reflecting their different histories, and the characteristics of their lead organisations. Many of the projects developed by partnerships of non-government organisations have become incorporated bodies in their own right and maintain governing boards or councils, whereas some operate under less formal partnership agreements. Likewise, it is anticipated that any future corridor initiatives will develop their governance arrangements according to their varying administrative and funding requirements. However, formalised governance arrangements help projects to seek funding from both government and private sources, and provide investors with confidence. The following broad principles are features of the most successful corridor projects and provide guidance for the governance of initiatives:

- **Accountability**: To be answerable for decisions and having meaningful mechanisms in place to ensure adherence to all applicable standards. Monitoring and evaluation should be incorporated into all corridor planning.
- **Transparency:** To have clear roles and responsibilities, clear procedures for making decisions, and necessary skills for effective management.
- **Integrity**: To act impartially, ethically and not misuse information acquired through a position of trust.
- **Efficiency:** To ensure the best use of resources and minimise the cost of administrative arrangements.
- **Leadership:** To achieve a commitment to good governance through leadership at all levels and at all spatial scales. Leaders should work in collaboration with others and seek to increase the capacity of future leaders.
- **Engagement:** To engage with stakeholders and cultivate enduring partnerships.
- **Social cohesion:** To support social networks that foster community development and build social capital across working landscapes.

A partnership approach that includes collaborative governance arrangements will assist in the implementation and governance of wildlife corridors. Different roles and responsibilities will be held by participants at a range of scales, including government and non-government agencies from national to local levels (Table 1). These roles can be considered to cover several kinds of activities: leading, planning, implementing and evaluating. Many activities

Table 1 Collaborative governance and management framework

Management functions / governance scale	Leading	Planning	Implementing	Evaluating
National	Establish national vision and policy commitment to connectivity conservation Establish the political, social and financial capacity to implement the vision National Wildlife Corridors Council Support development of environmental information resources and science	National Wildlife Corridors Plan Integrate the vision into national strategies for biodiversity EPBC Act strategic assessments and sustainability plans Whole-of-government coordination, support and endorsement of state and regional initiatives	Integrate the vision into national incentive and conservation programs Prioritise investment National Wildlife Corridors Act Integrate and disseminate best available scientific knowledge through programs	Standardised national monitoring, evaluation and reporting frameworks State of Environment and other international reporting obligations Parliamentary reporting
State and Territory	Policy and regulatory settings Initiate and lead corridor projects Develop trans-border initiatives	Biodiversity strategies and plans Strategic land use planning Planning guidelines for regional NRM and local government bodies	State incentive and conservation schemes Multi-jurisdictional coordination Management of state held conservation lands	State monitoring, evaluation and reporting frameworks State of catchment reporting frameworks Annual reporting
Regional	Initiate and lead corridor projects Achieve community support and facilitate multiple partnerships	Regional NRM planning including regional planning for climate change	Collaborative land management with landholders Regional incentives and conservation schemes Fund raising	Regional project level monitoring, evaluation and reporting Collating local project data
Local	Community-led initiatives Encourage individual champions and their initiatives Public awareness	Land use planning Conservation Action Planning	Management of locally held conservation lands Local conservation incentives Fund raising	On-ground monitoring, evaluation and reporting Collating site project data
Site	Individual conservation initiatives and stewardship Leading by example	Property management plans Local knowledge and expertise	On-ground site management Income diversification and investment strategies	On-ground monitoring, evaluation and reporting Adaptive management approaches

The national network of wildlife corridors

Adapted from Worboys *et al* 2010.

are carried out at more than one scale. For example, monitoring activities may include on-ground collection of information at site level and regionally. This can allow site activities to be evaluated and adapted. At larger spatial scales information may be aggregated for analysis and evaluation against regional and national objectives.

2.3 Next steps

While this draft Plan is being considered and comment sought from interested parties, the Australian Government will continue to invest in projects that support corridors and landscape-scale connectivity conservation through the Biodiversity Fund and Caring for Our Country.

Once established, this Corridors Plan will provide the mechanism for identifying and recognising National Wildlife Corridors and provide the Minister with a process for reporting on progress.

To progress the implementation of the Corridors Plan, a set of existing and prospective corridor initiatives have been identified for early action (Appendix B).

> Information is regularly published on the Department of Sustainability, Environment, Water, Population and Communities website for the National Wildlife Corridors Plan.
>
> http://www.environment.gov.au/biodiversity/wildlife-corridors/index.html

Glossary

Adaptation— the process of change by which an organism or species becomes better suited to its environment[1]. Changes to temperature, rainfall and seasonal variability can require some species to move to find more suitable conditions, or over time, adapt to changed conditions.

Biodiversity—is the variety of all life forms:

- *Genetic diversity* the variety of genetic information contained in individual plants, animals and other organisms;
- *Species diversity* the variety of species; and
- *Ecosystem diversity* the variety of habitats, ecological communities and ecological processes

Buffer—a protective barrier around a core habitat area that does not necessarily provide core habitat. Buffers are managed to be compatible with conservation needs, but may also meet other needs, such as food production. They can reduce damage to core habitats caused when high quality habitat is surrounded with strongly contrasting land types (also known as edge effects).

Caring for our Country—an Australian Government funding program that supports communities to manage and protect the environment. Its goal is to promote an environment that is healthy, better protected, well managed, resilient, and provides ecosystem services in a changing climate. Funding is available to regional natural resource management groups, local, state and territory governments, Indigenous groups, industry bodies, land managers, farmers, Landcare groups and communities. See www.nrm.gov.au/

The **Clean Energy Future Plan**—the Australian Government's plan for reducing carbon dioxide emissions and re-investing funds raised to support further emissions reductions and other environmental work. The plan has four elements: a carbon price, renewable energy, energy efficiency and the *Land Sector Package*. See www.cleanenergyfuture.gov.au/

Climatic envelope—the area where the prevailing climate supports the set of environmental requirements that any species may require to survive. If climate change occurs the area with these conditions present may change over time.

Connectivity—the capacity of landscapes or aquatic environments to allow ecological movement and function. The broad concept of connectivity can be considered to have several main elements:

1 Oxford Dictionary online, Oxford University Press

- *Landscape connectivity*—the physical connection between areas with vegetation cover across a landscape
- *Habitat connectivity*—the connection between patches of habitat suitable to any particular species
- *Ecological connectivity*—the ecological processes that underpin the function of landscapes, for example, the transfer of pollen or seeds and the sequestration of soil carbon
- *Evolutionary connectivity*—populations of species are able to interact naturally, sharing genes and adapting to changing environmental conditions.

Connectivity conservation—a management approach that focuses on the maintenance and restoration of connectivity within ecosystems across landscapes and marine areas.

Conservation Action Planning—a widely used conservation planning tool developed by The Nature Conservancy. It involves identification of environmental features of interest, target condition, threats and their causes. The tool is used to develop strategies to abate threats, maintain or restore condition, implement strategies and monitor outcomes to feed into the next cycle of planning and activity. See www.conserveonline.org/workspaces/cbdgateway/cap/resources/index_html

Core area / core habitat area—an area of habitat that is of a suitable size, shape and condition for an assemblage of species, or a single organism. Core habitat provides nutrients and water resources, and supports successful reproduction.

Ecosystems—a complex network or interconnected system; a biological community of interacting organisms and their physical environment[2]. For example, combinations of plant, animal and other organisms in communities and their non-living environment (e.g., soil, water and the climate) interacting as a functional unit, such as forest, wetland or grassland.

Ecological processes—actions and events that shape ecosystems, for example, nutrient cycling, pollination, animal and plant breeding, periodic patterns of flooding, and fire.

Ecosystem services—the processes or materials provided by ecosystems. Ecosystem services benefit biodiversity, humans and society through the provision of essential goods and services such as clean air, water, food, shelter, energy, nutrients, amenity values and cultural resources.

***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**—the Australian Government's primary legislation to protect and conserve biodiversity. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. The EPBC Act focuses Australian Government interests on the protection of matters of national environmental significance, with the states and territories having responsibility for matters of state and local significance. For more information see http://www.environment.gov.au/epbc/index.html

The **Environmental Stewardship Program**—part of the broader Caring for our Country program. It offers private land managers the opportunity to enter long-term contracts

2 Oxford Dictionary online, Oxford University Press

with the Australian Government to manage, protect and rehabilitate particular ecological communities on their own land. Funding is provided up to 15 years. The program provides support and recognition for the important role of private landholders in conservation. See www.nrm.gov.au/funding/stewardship/index.html

Habitat—the natural home or environment of an animal, plant, or other organism[3]

Hydrological systems—networks of water in the environment. These include inputs such as rain or snowfall, surface water bodies such as rivers and lakes, and groundwater.

Indigenous Protected Areas—reserves contributing to the National Reserve System that are owned and managed by Indigenous people.

Invasive species—a species occurring beyond its accepted normal distribution and which threatens valued environmental, agricultural, marine or social resources by the damage it causes.

Landscape—a scale of conservation planning or implementation which typically incorporates areas larger than individual sites, properties or habitats, and often includes a mix of different vegetation types and landforms, ranging across several sub-catchments or environmental domains.

The **Land Sector Package**—a component of the *Clean Energy Future Plan.* It will guide the investment of revenue raised through imposing a price on carbon dioxide pollution. The package includes the following programs: Carbon Farming Initiative, Regional Natural Resource Management Planning for Climate Change Fund, Carbon Farming Futures, Indigenous Carbon Farming Fund, Carbon Farming Skills, Biodiversity Fund and establishment of the Land Sector Carbon and Biodiversity Board. See www.cleanenergyfuture.gov.au

Landscape Permeability—the habitability and accessibility of a landscape for animals, as well as the ability of biophysical elements, such as water, to infiltrate the landscape unimpeded by solid surfaces.

Migration—see **Nomadic and migratory movement**.

The **National Environment Research Program**—an Australian Government program that supports environmental research. The program aims to improve capacity to understand, manage and conserve Australian ecosystems. Research hubs provide a suite of work that is relevant to current Australian Government programs and policies. See www.environment.gov.au/biodiversity/science/nerp/about.html

The **National Plan for Environmental Information**—an Australian Government initiative to coordinate and prioritise its use of environmental information. It will establish the Bureau of Meteorology as an authority for environmental information, formalise arrangements to coordinate activities across government, review existing information resources and begin building priority national environmental datasets. See www.bom.gov.au/inside/eiab/NPEI.shtml

3 Oxford Dictionary online, Oxford University Press

National Reserve System—Australia's network of formally protected areas which conserve examples of landscapes, native plants and animals. The reserve system includes more than 9000 protected areas and is comprised of national parks and other classes of reserves managed by government, ***Indigenous Protected Areas***, reserves run by non-profit conservation organisations and areas protected by landholders on private properties.

Nomadic and migratory movement—the movement of animals, sometimes over large distances across the Australian continent seeking resources. This movement can be regular, often seasonal and repeatedly using similar routes, described as migration. Alternatively, movement can be more opportunistic, seeking occasionally available resources such as temporary wetlands–this is known as nomadic movement.

Peri-urban—landscapes found at the expanding margin of urban areas. They may have characteristics both of urban areas and rural areas.

Resilient/Resilience—resilience of ecosystems refers to an ecosystem's capacity to adapt to changes and disturbances, yet retain its basic functions and structure. A resilient ecosystem can adapt to shocks and surprises, and rebuild itself when damaged.

Philanthropic/philanthropy—voluntary financial support provided by private donors.

Protected area—part of the National Reserve System or a property that is privately managed for conservation purposes.

Refuge/refuges—an area that provides shelter, food or water to organisms when other parts of the landscape are inhospitable. For example, rocky areas may provide shelter during bushfires while riparian areas may provide food and water during times of drought.

Refugium/refugia—an area that has or will escape changes occurring elsewhere and continues to provide suitable habitat. The term climate change refugia refers to areas that may provide habitat for species displaced as the climate changes.

Remnant vegetation—native vegetation that has not been cleared.

Revegetation—the re-establishment of native vegetation in areas that have been cleared or highly modified.

Riparian areas—areas of vegetation alongside watercourses, lakes and wetlands. They often contain different vegetation from the surrounding landscape, providing important habitat and ecological resources.

Stepping stones—patches of habitat that while not physically connected, are functionally connected, allowing movement between larger patches.

Stewardship—voluntary care of land provided, usually, by its landholder. It also recognises the concept of inter-generational responsibility taken for land condition. Some stewardship is formally recognised and financially supported by government and natural resource management programs (see **Environmental Stewardship Program** above).

Sustainability—the ability of something to persist. Ecological sustainability describes interactions between humans and natural systems that do not endanger the existence or quality of those natural systems.

Wildlife corridors (also corridors)—connections across the landscape between habitat patches used by organisms. Corridors are one way of achieving various types of connectivity across landscapes, meeting the diverse needs of organisms at multiple scales. Corridors allow short-term movement of organisms seeking resources and breeding opportunities; long-term change in the distribution of organisms, for example following suitable climatic conditions; and ongoing ecological processes that underpin healthy environments.

Working on Country—a component of the Caring for Our Country program. It supports projects that incorporate Indigenous traditional knowledge in managing and protecting land and sea country. The initiative includes an Indigenous Ranger Program, currently employing over 600 people in managing land to protect its environmental values. See www.environment.gov.au/indigenous/workingoncountry/index.html

References and suggested further reading

Books and Reports

Bamford, M, Watkins, D, Bancroft, W, Tischler, G & Wahl J, 2008 Migratory Shorebirds of the East Asian-Australasian Flyway: Population Estimates and Internationally Important Sites, Wetlands International – Oceania.

Bennett, A 1999 *Linkages in the Landscape: The role of corridors and connectivity in wildlife conservation*, IUCN, UK.

Bennett, G 2004 *Integrating Biodiversity Conservation and Sustainable Use: Lessons Learned From Ecological Networks* IUCN, Geneva.

Cork, S (ed) 2010 *Resilience and Transformation: Preparing Australia for Uncertain Futures*, CSIRO, Australia.

Crooks, K R & Sanjayan, M (eds) 2006 *Connectivity Conservation*, Cambridge University Press, UK.

Crooks, S, Herr D, Tamelander, J, Laffoley, D & Vandever, J 2011 *Mitigating Climate Change through Restoration and Management of Coastal Wetlands and Near-shore Marine Ecosystems: Challenges and Opportunities, Environment Department Paper 121,* World Bank, Washington, DC.

Department of Environment and Conservation, 2009 *Protecting the Kimberley: A synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia*, Department of Environment and Conservation, Western Australia.

Department of Environment, Food and Rural Affairs, 2011 *The Natural Choice: securing the value of nature,* HM Government, UK.

Doerr, V, Doerr, E, Davies, V 2010 *Does structural connectivity facilitate dispersal of native species in Australia's fragmented terrestrial landscapes?* Collaboration for Environmental Evidence Systematic Review no. 44.

Dunlop, M & Brown, P 2008 *Implications of climate change for Australia's National Reserve System: A preliminary assessment, CSIRO report to the Department of Climate Change, and the Department of the Environment, Water, Heritage and the Arts*, Commonwealth of Australia, Canberra.

Hilty, J A, Lidicker, W Z & Merenlender, A M 2006 *Corridor Ecology: The Science and Practice of Linking Lanscapes for Biodiversity Conservation,* Island Press, USA.

Hobbs, R J & Suding K N (eds) 2009 *New Models for Ecosystem Dynamics and Restoration,* The Society for Ecological Restoration International, Island Press, USA.

Jianguo, L & Taylor, W W (eds) 2002 *Integrating Landscape Ecology into Natural Resource Management,* Cambridge University Press, UK.

Lindenmayer, D & Hobbs, R J (eds) 2007 *Managing and designing landscapes for conservation: moving from perspectives to principles,* Blackwell Publishing Ltd and the Zoological Society of London, Oxford, UK.

Lindenmayer, D & Fischer, J 2006 *Habitat Fragmentation and Landscape Change: An ecological and conservation synthesis*, CSIRO, Victoria.

Lindenmayer, D & Likens, G E 2010 *Effective Ecological Monitoring*, CSIRO, Australia.

Lovett, S, Lambert, J, Williams, J E, & Price, P 2008 *Restoring landscapes with confidence –an evaluation of the science, the methods and their on-ground application, Final Report* Land and Water Australia, Canberra.

Mackey, B, Watson, J & Worboys ,G 2010 *Connectivity conservation and the Great Eastern Ranges corridor*, An independent report to the Interstate Agency Working Group (Alps to Atherton Connectivity Conservation Working Group) Published by the Department for Environment, Climate Change and Water.

Moilanen, A, Wilson K A, Possingham, H P (eds) 2009 *Spatial Conservation Prioritization: Quantitative Methods and Computational Tools*, Oxford University Press, New York, USA.

Morton, S, Short, J & Barker R, 1995 *Refugia for Biological Diversity in Arid and Semi-arid Australia,* Biodiversity Series Paper no. 4 Department of the Environment, Sport and Territories, Commonwealth of Australia.

Natural Resource Management Ministerial Council 2010 Australia's *Strategy for the National Reserve System 2009-2030,* Commonwealth of Australia.

Natural Resource Management Ministerial Council 2010 *Australia's Biodiversity Conservation Strategy 2010-2030*, Commonwealth of Australia.

Parris, H, Whitten, S, Wyborn, C, Hill, R, Freudenberger, D 2010 *An overview of key socio-economic factors, principles and guidelines in wildlife 'corridor' planning and implementation*. A report for the Australian Government Department of Sustainability, Environment, Water, Population and Communities. CSIRO, Canberra.

Steffen, W, Burbidge, A, Hughes, L, Kitching, R, Lindenmayer, D, Musgrave, W, Stafford Smith, M, & Werner, P, 2009a *Australia's Biodiversity and Climate Change: Summary for Policy Makers 2009*, Commonwealth of Australia.

Steffen, W, Burbidge, A, Hughes, L, Kitching, R, Lindenmayer, D, Musgrave, W, Stafford Smith, M, & Werner, P, 2009b *Australia's Biodiversity and Climate Change*, Commonwealth of Australia.

Taylor, M F J, Sattler, P S, Fitzsimons, J, Curnow, C, Beaver, D, Gibson, L & Llewellyn, G, 2011 *Building Nature's Safety Net 2011. The state of protected areas for Australia's ecosystems and wildlife,* WWF-Australia, Sydney.

Whitten, S, Freudenberger, D, Wyborn ,C, Doerr, V, Doerr, E, Langston, A 2010 *A compendium of existing and planned Australian wildlife corridor projects and initiatives, and case study analysis of operational experience.* A report for the Australian Government Department of Sustainability, Environment, Water, Population and Communities. CSIRO, Canberra.

Woinarski, J, Mackey, B, Nix, H & Traill, B 2007 *The Nature of Northern Australia: natural values, ecological processes and future prospects,* ANU E Press, Canberra.

Worboys, G, Francis, W & Lockwood, M, (eds) 2010 *Connectivity Conservation Management, A Global Guide*, Earthscan, UK.

Zachos, F E & Habel, J C (eds) 2011 *Biodiversity hotspots: Distribution and Protection of Conservation Priority Areas,* Springer-Verlag Berlin Heidelberg, Germany

Journal Papers

Boitani, L, Falcucci, A, Maiorano, L & Rondinini, C 2007 Ecological networks as conceptual frameworks or operational tools in conservation, *Conservation Biology* vol 21(6) pp 1414-1422

Cumming, G S 2011 Spatial resilience: integrating landscape ecology, resilience, and sustainability, *Landscape Ecology* vol 26 pp 899-909

Ferrier, S & Drielsma, M 2010 Synthesis of pattern and process in biodiversity conservation assessment: a flexible whole-landscape modelling framework, *Diversity and Distributions* vol 15 pp 286-402

Gilbert-Norton, L, Wilson, R, Stevens, J R & Beard, K H 2010 A meta-analytic review of corridor effectiveness, *Conservation Biology* vol 24(3) pp 660-668

Hobbs, R J, Hallett, L M, Ehrlich, P R & Mooney, H A 2011 Intervention ecology: applying ecological science in the twenty-first century, *BioScience* vol 61(6) pp 442-450

Klein, C, Wilson, K, Watts, M, Stein, J, Berry, S, Carwardine, J, Stafford Smith, M, Mackey, B & Possingham, H 2009 Incorporating ecological and evolutionary processes into continental-scale conservation planning *Ecological applications* vol 19(1) pp 206-217

Laurance, W F, Dell, B, Turton, S M, Lawes, M J, Hutley, L B, McCallum, H, Dale, P, Bird, M, Hardy, G, Prideaux, G, Gawne, B, McMahon, C R, Yu, R, Hero, J-M, Schwarzkopf, L Krockenberger, A, Douglas, M, Silvester, E, Mahony, M, Vella, K, Saikia, U, Wahren, C-H, Xu, Z, Smith, B & Cocklin, C 2011 The 10 Australian ecosystems most vulnerable to tipping points *Biological Conservation* vol 144 pp 1472-1480

Lindenmayer, D & Nix, H 1990 Ecological principles for the design of wildlife corridors, *Conservation Biology* vol 7 pp 627–30.

Loreau, M 2010 Linking biodiversity and ecosystems: towards a unifying ecological theory, *Philosophical transactions of the Royal Society B* vol 365 pp 49-60

Pittock, J,& Finlayson, C M 2011 Australia's Murray-Darling Basin: freshwater ecosystem conservation options in an era of climate change, *Marine and Freshwater Research* vol 62 pp 232-243

Polasky, S, Nelson, E, Camm, J, Csuti, B, Fackler, P, Lonsdorf, E, Montgomery, C, White, D, Arthur, J, Garber-Yonts, B, Haight, R, Kagan, J, Starfield, A, Tobalske, C 2008 Where to put things? Spatial land management to sustain biodiversity and economic returns, *Biological Conservation* vol 141 pp 1505-1524

Rouget, M, Cowling, R M, Lombard, A, T Knight, A T & Kerley, G I H 2006 Designing large-scale conservation corridors for pattern and process, *Conservation Biology* vol 20(2) pp 549-561

Soulé, M, Mackey, B, Recher, H, Williams, J, Woinarski, J, Driscoll, D, Dennison, W & Jones, M 2004 The role of connectivity in Australian conservation *Pacific Conservation Biology* vol 10 pp 266-279

Stem, C, Margoluis, R, Salafsky, N & Brown, M 2005 Monitoring and evaluation in conservation: a review of trends and approaches, *Conservation Biology* vol 19(2) pp 295-309

Wyborn, C 2011 Landscape scale ecological connectivity: Australian survey and rehearsals, *Pacific Conservation Biology* vol 17 pp 121-131

Appendix A: Land use, condition and biodiversity maps

The following maps provide insight into land use, biodiversity values and the current and future health of the Australian environment. Consideration of biophysical attributes, migratory pathways, key habitat areas and current and future threats can assist in determining priorities for wildlife corridors.

Map 1 Primary land use

This map indicates primary land use across Australia. The national land use data set is developed by the Australian Bureau of Agricultural and Resource Economics and Sciences. Land use mapping in Australia is conducted broadly at two scales: national scale and catchment scale. The mapping below uses the catchment scale land use data, which is produced by combining state cadastre, public land databases, fine-scale satellite data, other land cover and use data, and information collected in the field. The map and table below are updated with the latest 2011 data from the National Reserve System.

Land uses have a major effect on Australia's natural resources through their impacts on water, soil, nutrients, plants and animals. There is also a strong link between changing patterns of land use and economic and social conditions, particularly in regional Australia.

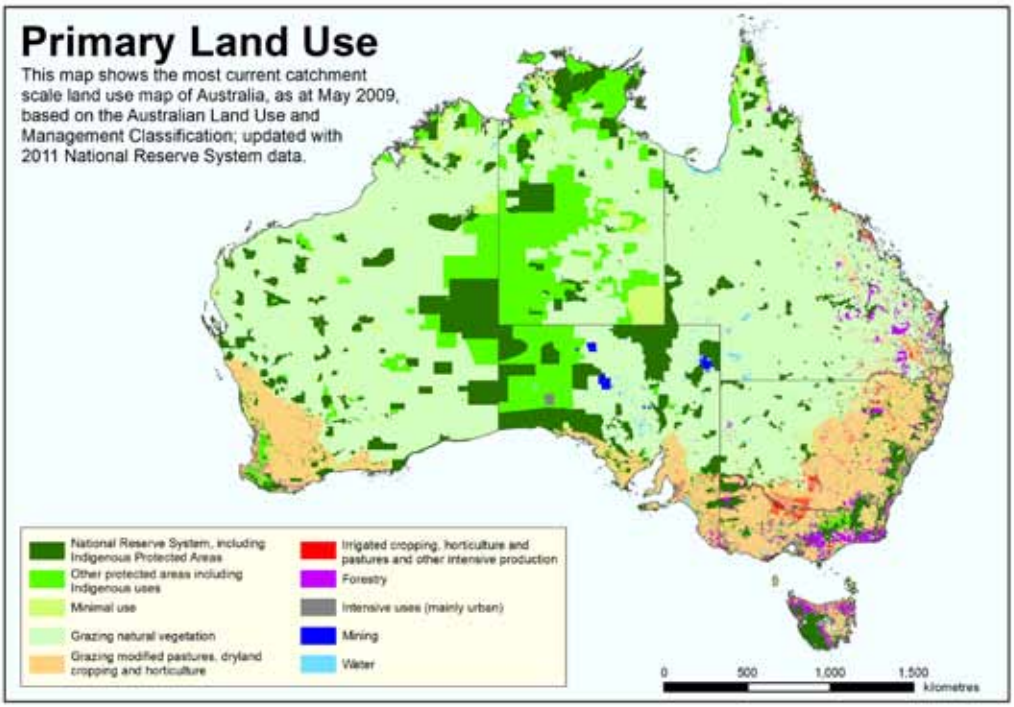
Land use is distinct from land tenure, although some categories of land tenure can reflect land uses. For example, pastoral leases suggest that grazing is the land use, although they may or may not be currently grazed. The dominant land use in Australia is grazing natural vegetation, much of which occurs on Crown land pastoral leases. The National Reserve System resides on both Crown and private land tenures. Land uses within the National Reserve System are generally restricted to conservation and Indigenous cultural uses. However, in some states mining is permitted in National Parks. Mining leases can also be issued on other Commonwealth lands if the correct permissions are sought. Although mining exploration leases cover significant tracts of land, at present mining operations only occur across a relatively small percentage of the land in Australia. If sustainably managed, productive lands can also be used for conservation purposes, including wildlife corridors. The primary land use categories and the percentage of land they occupy are stated in the following table[4].

4 Note these categories are combinations of some of the Land Use of Australia categories as follows: Plantation forestry *and* production forestry; Grazing modified pasture, dryland cropping *and* dryland horticulture; Irrigated cropping, irrigated horticulture, irrigated pasture *and* intensive animal and plant production; Intensive uses (mainly urban) *and* rural residential.

Primary land use category	Area (Hectares)	Percentage
National Reserve System, including Indigenous Protected Areas	103,857,211	13.5
Other protected areas including Indigenous uses	89,623,055	11.7
Minimal use	30,857,421	4.0
Grazing natural vegetation	442,694,846	57.6
Grazing modified pastures, dryland cropping and horticulture	75,264,032	9.8
Irrigated cropping, horticulture, pastures and other intensive production	4,181,469	0.5
Forestry	10,122,504	1.3
Intensive Uses (mainly urban)	4,568,013	0.6
Mining	1,569,399	0.2
Water	5,824,239	0.8
TOTAL	**768,562,189**	**100.0**

Based on Australian Land Use and Management Classification catchment-scale land use data, as at May 2009; updated with 2011 National Reserve System data.

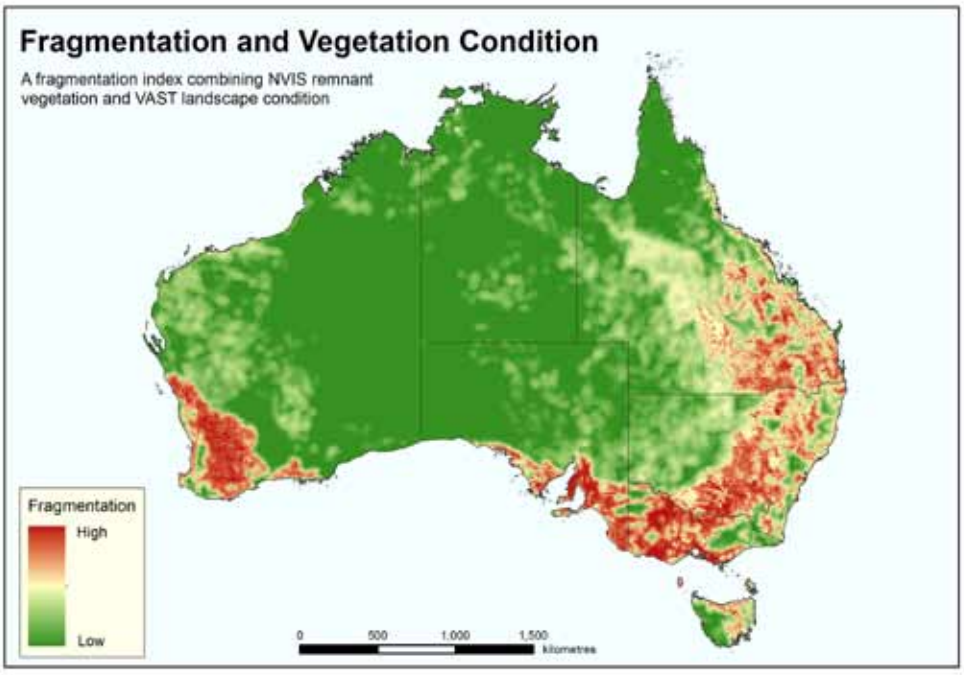
Map 1



Map 2 Fragmentation index and vegetation condition map

This map combines both a measure of fragmentation and condition. The ***measure of fragmentation*** was derived from levels of vegetation clearance since European settlement[5] and the number and size of patches of vegetation. The ***measure of condition*** was derived from the Vegetation Assets State and Transitions (VAST) framework, developed by the Bureau of Rural Sciences, Australian Government Department of Agriculture, Fisheries and Forestry. VAST classifies native vegetation by degree of anthropogenic modification as a series of condition-states, from a reference base-line condition through to total removal. The two measures are then combined to provide an insight into the overall condition and fragmentation of the Australian landscape.

Map 2



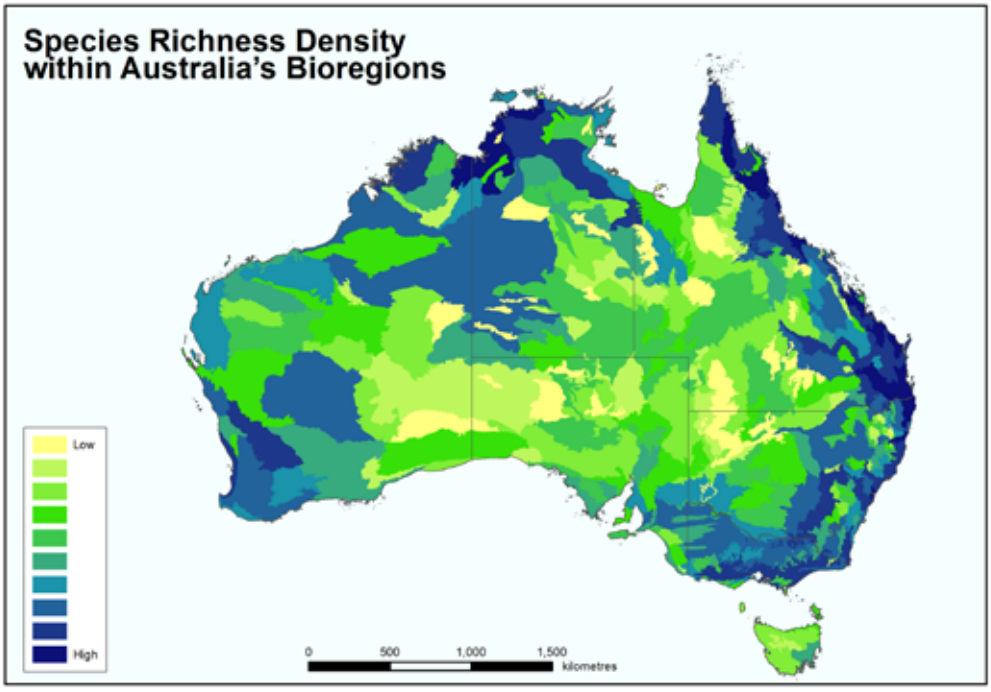
Map 3 Species richness by bioregion and Map 4 Endemism by bioregion

These maps indicate the areas of highest terrestrial species richness and endemism for a range of taxonomic groups (birds, mammals, amphibians, reptiles, butterflies and vascular plants) according to Australia's bioregions[6]. The source is the Australian National Heritage Assessment Tool (ANHAT). ANHAT compiles over 33 million location records of species observations and collections. These records are held by herbariums, museums, academic and research institutions, state, territory and federal government departments and recognised non-government organisations and individuals whose data collection methodologies are recognised by the Australian Government.

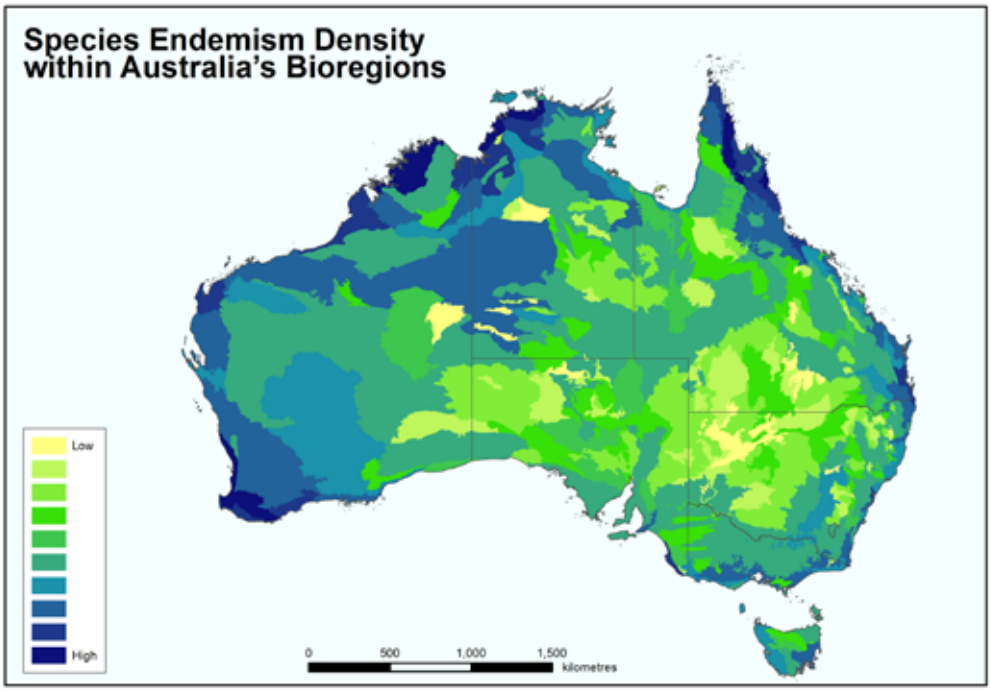
5 Present and pre-1750 (modelled) Major Vegetation Groups, the National Vegetation Information System. Collated by the Australian Government from data supplied by state and territory governments and other organisations.

6 Interim Biogeographic Regionalisation of Australia

Map 3


Species Richness Density
within Australia's Bioregions
Low
High
0
500
1,000
1,500
kilometres

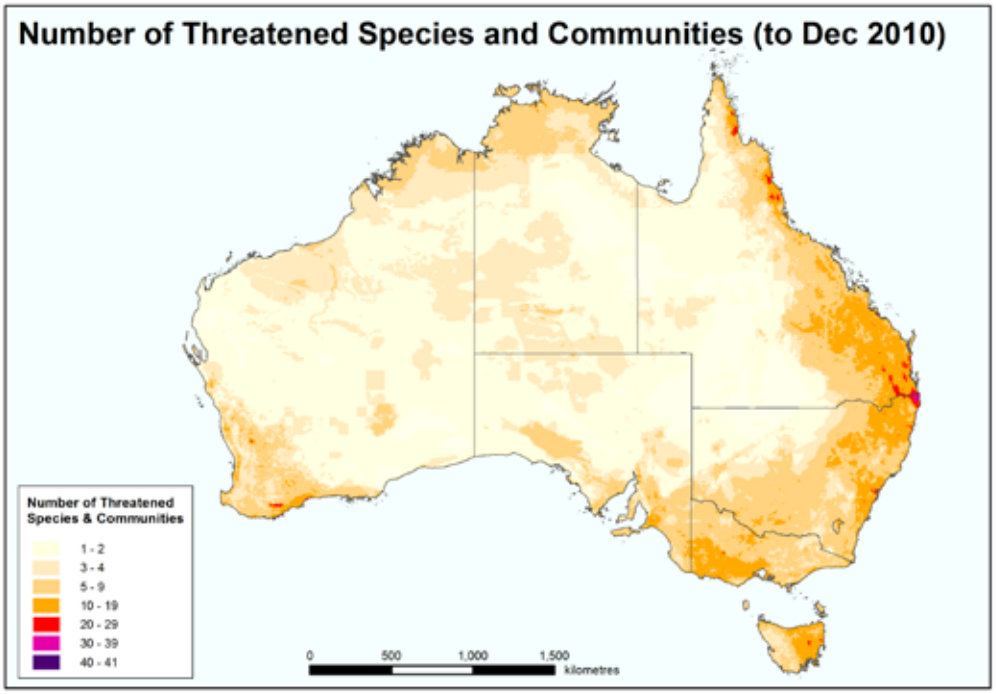
Map 4


Species Endemism Density
within Australia's Bioregions
Low
High
0
500
1,000
1,500
kilometres

Map 5 Nationally threatened species and communities

This map indicates densities of *Environment Protection and Biodiversity Conservation Act 1999* listed threatened species across Australia.

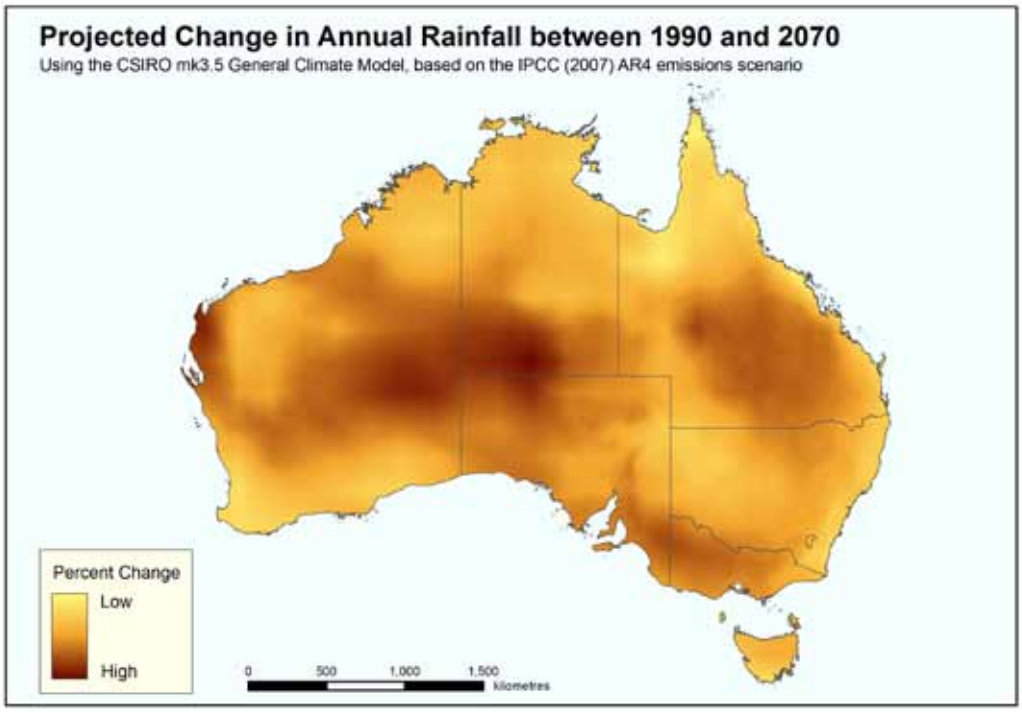
Map 5



Map 6 Projected change in annual temperature between 1990 and 2070

The climate projections shown here are based on the Inter-governmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) A1F1 emissions scenario[7] . Current global emissions are tracking around the upper range of the A1F1 scenario, which could lead to an average global warming of 4°C relative to the pre-industrial age during the 2070s, making this a plausible scenario for climate impact assessment. The 1990 historical rainfall and temperature reflect the 30-year climate average centred on 1990. The projected rainfall and temperature scenarios displayed in this map represent a snapshot of modelled conditions in 2030 and 2070[8].

Map 6



7 Pachauri, R K & Reisinger, A. (Eds.) 2007 *Climate change 2007 Synthesis Report* Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland

8 Harwood T, Williams K J, Ferrier S 2010 *Generation of spatially downscaled climate change predictions for Australia*, CSIRO Climate Change Adaptation Flagship, CSIRO Ecosystem Sciences, Canberra, Australia.

Appendix B: Potential National Wildlife Corridors

Under the proposed Wildlife Corridors Act, both existing major corridors and prospective corridor initiatives may be nominated by the community for consideration as National Wildlife Corridors. In order to start this process, some potential National Wildlife Corridors have been identified on the basis of their biodiversity values, existing conservation work, and conservation and community needs.

Existing Corridors

Six existing corridors are good examples of major corridors that could be nominated as National Wildlife Corridors, as follows:

Gondwana Link

Gondwana Link aims to protect and restore ecological values from Margaret River in south-western Australia to the Great Western Woodlands bordering the Nullarbor Plain in the east. It links a number of formally protected areas including the Walpole Wilderness Area, and the Stirling Ranges and Fitzgerald River National Parks.

Landscapes and biodiversity

Stretching across extensive plains and low mountain ranges, Gondwana Link includes most of the remaining large habitat areas in the south-west of the state. It crosses ecological, climate and altitudinal gradients, which could prove important for ecological adaptation to climate change. South-west Western Australia is a global 'biodiversity hotspot' and contains some of Australia's most distinctive flora and fauna. The region has the greatest diversity of plant species in Australia and encompasses coastal heath, tall temperate forests, semi-arid woodlands, mallee and shrublands. Many of the plant species in the region have small ranges, with almost half being endemic to south-west Western Australia and many being nationally threatened. A few examples of critically endangered plants restricted to the area are the Yellow-leafed Gastrolobium, Ironstone Beard-heath and Maroon-flowered Daviesia. A range of iconic animal species listed under the *Environment Protection and Biodiversity Conservation Act 1999* also occur within the Gondwana Link area, including species such as the Western Quoll, Southern Brown Bandicoot, Numbat, Bilby, and Baudin's, Carnaby's and Red-tailed Black Cockatoos.

Conservation areas

Approximately 17 per cent of Gondwana Link is part of the National Reserve System, including the Walpole Wilderness Area and D'entrecasteaux, Shannon, Stirling Ranges, Fitzgerald River, Frank Hann and Peak Charles National Parks, along with Lake Magenta, Jilbadji and Dundas Nature Reserves. More than 40 per cent of Gondwana Link area is also recognised with National Heritage listing.

Past and current pressures

The region has been subject to extensive, but largely historical, vegetation clearing and fragmentation. Most clearing has occurred since the late 1950's and the full impacts are yet to be felt. Rainfall in the past thirty years is over 15 per cent below the long-term average across much of south western Australia, suggesting climate change is already adding to existing impacts. Additional threats in recent decades include *Phytophthora cinnamomi* dieback, more frequent, intensive and extensive burning, and invasive species such as foxes, cats and goats. In particular, changes to fire regimes have been identified as a threat in the Great Western Woodlands area.

Activities

The work in Gondwana Link to date has involved land purchase and restoration, regional-scale management of feral animals and fire, conservation planning, research, negotiation of land uses across a variety of tenures and industries, supporting the rebuilding of Indigenous cultural networks and advocacy. Conservation Action Plans have been developed and are being implemented for all the main habitat gaps according to their different ecological characteristics and pressures, and conservation and land-use planning programs are underway in the Great Western Woodlands.

Governance and community participants

Among Gondwana Link's primary collaborators are a number of locally based organisations and businesses, agricultural and Indigenous groups as well as national non-government organisations including The Nature Conservancy, Greening Australia, Bush Heritage Australia, The Wilderness Society and Pew Environment Group. Gondwana Link is a not-for-profit entity with a board comprised of members from its lead contributing organisations. Gondwana Link encompasses regional centres such as Albany and smaller towns which depend on tourism to locations such as the Stirling Ranges and forests of the South West. The region supports strong pastoral and agricultural communities, as well as mining. See www.gondwanalink.org/

The Great Eastern Ranges Initiative

The Great Eastern Ranges (GER) Initiative aims to protect and connect the Great Dividing Range and escarpment that separates the east coast from the continent's interior. Almost all of the New South Wales population lives within 100 kilometres of the Great Eastern Ranges, including the four million residents of Sydney who rely on the catchments of the Great Eastern Ranges for their water supply.

Landscapes and biodiversity

The Great Eastern Ranges region is of great importance for biological conservation. Much of the area is part of the newly declared 'Forests of East Australia' International Biodiversity Hotspot, one of 35 such regions in the world. This recognises the high levels of species richness and endemism present within these forests, as well as significant threats to their condition and biodiversity. Almost 59 per cent of New South Wales' vulnerable and endangered fauna are found within the Great Eastern Ranges. Among the critically endangered plants endemic to the area are the Nightcap Oak, the Kangaloon Sun-orchid, Genowlan Point Pultenaea and the iconic Wollemi Pine. Similarly, the list of threatened fauna species in the region is also extensive and includes the Hastings River Mouse, Mountain Pygmy Possum, Eastern Bristlebird, Regent Honeyeater and the Southern Corroborree Frog. Nationally threatened ecological communities such as Weeping Myall—Coobah—Scrub Wilga Shrubland of the Hunter Valley and Turpentine—Ironbark Forest in the Sydney Basin Bioregion are almost exclusively found within the region. The topographical and latitudinal variation across the Great Eastern Ranges may help enable species' adaptation to climate change.

Past and current pressures

The degree of naturalness of the Great Eastern Ranges varies substantially, with some land heavily modified for agriculture, forestry, mining and urban development, while other areas remain substantially intact. The region is subject to a range of pressures. For example, within the Border Ranges weeds, feral animals and wildfire pose threats to the largely intact World Heritage listed Gondwana Rainforests. In peri-urban areas, vegetation loss continues at the expanding margins. Climate change is likely to result in average summer temperature increases of around 1°C across much of the Great Eastern Ranges by 2030. Summer rainfall is likely to decrease by around ten per cent and winter rainfall by around 20 per cent. These changes will increase the risk of extreme bushfires, while coastal wetlands are likely to be inundated as sea levels rise. Some specific threats include reduced nectar availability, likely to affect bird and possum species, and reductions in snow-cover changing habitat conditions for Mountain Pygmy Possums.

Conservation areas

Thirty-four per cent of the land within the Great Eastern Ranges is part of the formal National Reserve System, providing a substantial base for conservation efforts. The many National Parks in the area include Kosciuszko, Namadgi, Budawang, Blue Mountains, Wollemi, Barrington Tops and New England. Twenty two per cent of the region is recognised as an Important Bird Area by Bird Life International, and over 11 per cent of the region is on the World Heritage list.

Activities

The GER initiative aims to reconnect fragmented habitats across land uses and complement the conservation work undertaken in formal protected areas in order to address climate change threats. To date, the on-ground activity has concentrated in five priority partnership regions, developed through a conservation planning process along a 1200 kilometre stretch in New South Wales: Border Ranges, Hunter Valley, Southern Highlands, Slopes to Summit, and Kosciuszko to Coast. This has included scientific and participatory conservation planning, creation of incentives for private land conservation and revegetation.

Governance and community participants

The GER initiative is led by a consortium of non-government organisations and the NSW Office of Environment and Heritage. The group provides high level coordination and direction setting, and is responsible for maintaining and promoting the vision for a GER corridor nationally. Leadership at the regional level is provided by a working group of regional implementers in each priority area. Landholders and industry groups are among the local participants. Additional commitments have recently been made by government and non-government organisations in Victoria, Queensland and the Australian Capital Territory in anticipation of achieving the broader GER vision along the entire length of the Great Dividing Range. See: www.greateasternranges.org.au/

Habitat 141°

Habitat 141° is a 50-year vision for conserving, restoring and reconnecting ecosystems and habitats along the 141° longitudinal meridian, which straddles the borders of South Australia, New South Wales and Victoria. The project area covers 18 million hectares, stretching 700 kilometres from north to south.

Landscapes and biodiversity

The region's ecosystems include grassy woodlands, red gum forests, heath and mallee, with landforms ranging from the limestone plains and coastal wetlands of the Coorong to the rocky tors of the Grampians. The Murray River runs from east to west through the corridor and forms an important area of refuge during times of drought. More than a quarter of the region has been recognised by Bird Life International as an Important Bird Area; this includes a number of Ramsar wetlands, such as the Coorong. The region contains many iconic, but nationally threatened animals. For example, the Freckled Duck, the Red-tailed black Cockatoo, the Swift Parrot, the Orange-bellied Parrot, the Black-eared Miner, Murray Cod, Brush-tailed Rock Wallaby, the Long-nosed Potoroo, Smoky Mouse and the Golden Sun Moth. The many threatened plant species of the region include the critically endangered Wimmera Rice Flower and Blue Top Sun Orchid, while threatened communities of the region include the Grassy Eucalypt Woodland of the Victorian Volcanic Plain.

Past and current pressures

Over 50 per cent of the native vegetation in the Habitat 141° region has been cleared, particularly in areas such as the Wimmera, where there is intensive agriculture. The Murray River, which runs through the area is in poor condition, mainly as a result of clearing, water regulation and extraction. This adversely affects aquatic species and migratory birds using areas such as the Coorong. Feral animals, such as rabbits, foxes, goats and cats, as well as carp within the Murray River system are ongoing challenges to the condition of remnant habitat. The frequency and intensity of wildfires is likely to increase under climate change, with drier conditions resulting from a predicted 20–30 per cent reduction in both summer and winter rainfall. However, although many areas are heavily fragmented, there are also large areas of remnant habitat and protected areas that provide a strong foundation for rebuilding connectivity.

Conservation areas

Approximately 27 per cent of the project area is protected within the National Reserve System. The Grampians, Little Desert, Murray-Sunset, Big Desert, Lower Glenelg, Danggali and Coorong National Parks all sit within the project area.

Activities

The initiative is well established, with Conservation Action Planning progressively being run across the project's nine zones. Contributing organisations have purchased properties for conservation and revegetation has begun at large-scale, with over one million trees planted or grown from direct seeding. Hindmarsh Landcare Network, one of the contributing organisations, has linked protected areas such as Big and Little Desert. Ecological monitoring is supporting the development of management approaches for key environmental assets.

Governance and community participants

Partners in Habitat 141° include non-government organisations such as Greening Australia, the Wilderness Society, Victorian Trust for Nature, Catchment Management Authorities, Victorian and South Australian State Government agencies. Member organisations of the Habitat 141° alliance operate independently but seek to align their activities with the Habitat 141° vision. The formal governance structure includes a council, executive committee as well as working groups. The region is predominantly agricultural, with irrigated agriculture and grazing being major economic drivers within the region. Much of the land is privately owned. Large regional centres such as Ballarat and Mount Gambier also add to the diversity of the population. See: www.habitat141.org.au/

NatureLinks

NatureLinks is a set of conservation connectivity projects led by the South Australian Government. It is a 100-year vision for landscape conservation and restoration and aims to build the resilience of South Australia's environment, particularly in the face of climate change. Five main corridors have been defined.

Landscapes and biodiversity

The five areas cover a wide range of ecosystem types, including sclerophyll forests, mallee, deserts, rocky mountainous landscapes, riverine and coastal wetland communities. *Arid Lands* encompasses the Lake Eyre Ramsar site and many artesian springs, which host a wide variety of waterbirds and locally endemic species. *Flinders-Olary* covers the rugged Flinders and Olary Ranges, which provide refuge in a largely flat landscape. *East Meets West* follows the Great Australian Bight and connects areas of shrubland and woodland between eastern and western Australia. *River Murray-South East* covers the lower end of the Murray River and over 1000 wetlands, including Ramsar sites. *Cape Borda to Barossa* covers Kangaroo Island and the Mount Lofty Ranges, the latter being highly fragmented and containing many threatened species of woodland birds.

Conservation areas

About 26 per cent of NatureLinks are part of the National Reserve System, including the Lake Eyre, Witjira, Flinders Ranges, Flinders Chase, Coorong and Murray River National Parks, and the Hambidge and Yellabinna Wilderness Protection Areas. The Nantawarrina and Yalata Indigenous Protected Areas, as well as parts of Maralinga Tjarutja lands, Mamungari Conservation Park and Witjira National Park are managed by Traditional Owners.

Past and current pressures

The ecological condition of the landscapes varies substantially. Only 13 per cent of the total area has been cleared, but in some parts there has been intensive clearing and fragmentation. Over the combined area, the most common land use is grazing. The *Cape Borda to Barossa* initiative takes in urban and peri-urban areas as well as areas of intense viticulture, plantation forestry and horticulture. In contrast, *Arid Lands* and *East Meets West* are more remote and their native vegetation remains more intact. However, in the future, climate and associated rainfall and fire regime changes are likely to impact upon the corridor areas. By 2030, there is likely to be an overall reduction in winter rainfall of between 5–20 per cent, and a decrease of approximately 20 per cent summer rainfall across South Australia. Temperature increases of approximately 1°C are also predicted in coastal regions, with an 1.5°C increase expected in the arid north of the state.

Activities

In the highly modified corridor areas, such as *Cape Borda to Barossa*, restoration and revegetation projects are enhancing the connectivity and increasing the resilience of the area. Invasive pest management is a key focus in the more remote corridors, such as *Flinders-Olary* and *Arid Lands*. In some parts of NatureLinks, such as the Wild Eyre area in the *East Meets West* corridor, tools such as Conservation Action Planning are being used to coordinate effort.

Governance and community participants

The South Australian Government is leading Naturelinks, but the projects are being delivered in collaboration with regional natural resource management boards, non-government organisations and community groups. Some of the NatureLinks corridors also form part of the larger Trans-Australia Eco-Link Project. See: www.environment.sa.gov.au/naturelinks/

Trans-Australia Eco-Link

The South Australian and Northern Territory governments have recently announced the Trans-Australia Eco-Link as a combined corridor initiative. The intent is to create a wide band of connectivity stretching 3500 kilometres from Arnhem Land in the Northern Territory to Port Augusta in South Australia. The corridor incorporates two of the existing five South Australian NatureLinks areas, together with the Territory Eco-Link project, demonstrating the complementary approach of corridor activities across borders and at different scales. The project aims to provide refuge for flora and fauna, protecting them from threats such as fire, feral animals, drought and climate change.

Landscapes and biodiversity

The topography of this large area is diverse, covering mountain ranges, flat terrain, depressions and deserts, while ecosystem types include rainforest and rocky sandstone country, wetland systems, tropical savanna, arid shrublands, woodlands and stony country. The various ecosystems in the project region provide habitat for a range of nationally threatened and endemic animals and plants. A range of endemic species are associated with mound springs of the Great Artesian Basin. Among the nationally threatened fauna are the Northern Quoll, Yellow-footed Rock Wallaby, Northern and Southern Marsupial Moles, Sandhill Dunnart and Gouldian Finch. Endangered endemic fauna in the region includes the Yellow Chat (Alligator Rivers), Gove Crow Butterfly, and Desert Sand-skipper. The iconic Central Australian Cabbage Tree and MacDonnell Ranges Cycad are vulnerable and also found in the arid regions of Eco-Link.

Conservation areas

Fourteen per cent of the Northern Territory area is in the National Reserve System, including Litchfield, Gregory, Nitmiluk and West MacDonnell National Parks. The South Australian area includes Flinders Ranges, Vulkathunha-Gammon Ranges, Lake Eyre and Witjira National Parks. Kakadu and Uluru-Kata Tjuta National Parks are jointly managed with Traditional Owners. Important Bird Areas include the Kakadu and Lake Eyre Ramsar sites.

Past and current pressures

Less than one per cent of the native vegetation in the Northern Territory portion of the corridor has been cleared and most of the river and wetlands systems are relatively undisturbed. Nevertheless, in the arid parts of the corridor, as elsewhere across inland Australia there have been substantial losses of small and medium sized mammals. Similar losses have been observed recently in the northern part of the corridor and have been associated with interactions between grazing, weed incursion, changed fire regimes and the impacts of feral animals such as cats and cane toads. Temperatures in the Eco-Link regions are likely to increase by between 0.5 ° to 2°C by 2030, with the greatest warming occurring in central Australia. Rainfall predictions are less certain, but it is most likely that there will be decreases of up to five per cent in summer and ten per cent in winter, with declines most severe in central and southern Australia. An increase in the number of extremely hot days, especially in arid areas, may push some wildlife to their physiological limits.

Activities

The initiative aims to increase the extent of protected areas as well as develop tools and incentives for Indigenous and pastoral communities to be involved in conservation management. In the South Australian NatureLinks areas property management planning and stewardship for landholders are a major focus. In the Northern Territory, work so far has included creation of long-term conservation management agreements, re-establishment of the Land for Wildlife program and a new Northern Territory private land covenanting program. Almost 2500km² of land has been dedicated to conservation management in the first year of the program.

Governance and community participants

The South Australian and Northern Territory Governments are each committing funds towards establishing the Eco-Link. The major land uses in the corridor area are conservation and grazing. Darwin, Alice Springs and Port Augusta are major regional centres while in most of the area populations are sparse and towns are small. Substantial areas are managed by Indigenous groups.

See: www.environment.sa.gov.au/naturelinks/ecolink.html
and www.greeningnt.nt.gov.au/ecolinks/eco.html

Tasmanian Midlandscapes

The Midlandscapes project is located in the Tasmanian midlands, in an area that supports agriculture and plantation forestry. The project aims to respond to critical threats to biodiversity and connect major conservation areas in eastern and western Tasmania, protecting up to 64,000 hectares of land that is critical to conservation.

Landscapes and biodiversity

The climate of the midlands is relatively dry, as the area sits in a strong rain shadow and receives only about a fifth of the rainfall of the highlands to the west. The native vegetation of the region is predominantly eucalypt open forests and native grasslands on lowland plains and foothills. The area contains 65 per cent of the distribution of the *Environment Protection and Biodiversity Conservation Act 1999* Critically Endangered Lowland Native Grasslands of Tasmania. Among the iconic threatened species in the region are the Tasmanian Wedge-tailed Eagle, Swift Parrot, Tasmanian Devil and Tasmanian Azure Kingfisher, while lesser known threatened species include the fish, Swan Galaxia and the butterfly Tasmanian Chaostola Skipper. Many of the native orchid species are also critically endangered.

Conservation areas

Only six per cent of the Midlandscapes region are protected of part of the National Reserve System, but it is surrounded by important conservation areas. Ben Lomond National Park lies to the east, while the Great Western Tiers Conservation Area lies to the west. To the south and east respectively are the Ramsar wetlands of Interlaken (Lake Crescent) and the Apsley Marshes.

Past and current pressures

Almost 50 per cent of the native vegetation in the project region has been cleared in the past, leading to soil erosion, dryland salinity and weed invasion. Loss of fragments, firewood harvesting, logging and changed fire regimes and water extraction are the most pressing current threats. The impacts of climate change in Tasmania will not be as severe as many other parts of Australia, but substantial changes to rainfall are nonetheless expected. Central Tasmania is expected to have reduced rainfall, with changes between summer and winter rainfalls varying locally.

Activities

Eight targets have been identified by Midlandscapes as priorities for management, including lowland native grasslands, grassy woodland bush runs, dry heathy forests, lowland alluvial systems, upland riparian systems, valley floor wetlands, Wedge-tailed Eagles and vulnerable marsupials and birds. The midlands area is almost exclusively privately managed, so engaging with private land managers is seen as central to the project's success. Developing a market for conservation, increasing landowners' awareness of biodiversity values, and sustainable land management practices are important activities. The protected area network and other existing vegetation remnants can be supported by being buffered and connected.

Governance and community participants

The communities in the project area are predominantly agricultural. Midlandscapes builds on previous conservation projects and is partially supported by the Midlands Conservation Fund, which will provide annual payments as part of stewardship contracts. The Midlands Conservation Fund is run as an incorporated organisation with a Board. Among the lead partners in the project are the Tasmanian Land Conservancy, Bush Heritage Australia and the Private Land Conservation Program of the Department of Primary Industries, Parks, Water and Environment. See: www.tasland.org.au/documents/TLC_annualreport1011_final.pdf

Prospective corridor initiatives

Four potential corridors would bring major benefits for the proposed national network of wildlife corridors, as follows:

Kimberley region

The Kimberley region contains a range of ecosystem types, among them tropical savannas, rainforest, dissected rocky ranges, large rivers, waterfalls and spectacular coastlines. The region retains extensive areas of intact native vegetation and other habitats with high biodiversity value. Approximately 88 per cent of the proposed corridor area has recently been recognised on the National Heritage List for its historical, cultural, landscape and biodiversity values.

Landscapes and biodiversity

The remote Kimberley region has one of the most intact suites of mammal species remaining in Australia. Parts of the Kimberley shelter species already lost elsewhere in their ranges, for example, the Golden Bandicoot, the Golden-backed Tree Rat, Northern Quoll and the Gouldian Finch, which are listed under the *Environment Protection and Biodiversity Conservation Act 1999*. The region contains endemics such as the Scaly-tailed Possum and Monjon Wallaby. Additionally, the region contains globally important Ramsar sites, such as Roebuck Bay, which attracts many migratory birds.

Conservation areas

Over 40 per cent of the land in the Kimberley is classified as conservation land. Negotiations are underway for the creation of a number of new Indigenous Protected Areas, while much of the land is already managed by Indigenous communities for conservation and cultural purposes. At present, approximately 12 per cent of the region is formally protected as part of the National Reserve System. This includes Windjana Gorge and Mitchell River National Parks, as well as privately managed protected areas such as Mornington Sanctuary.

Past and current pressures

The Kimberley is subject to many of the pressures that affect other parts of northern Australia. For example, weed invasion, predation on native fauna by cats, feral herbivory and other grazing damage in sensitive habitats, such as rainforest, and unsustainable fire regimes. However, so far the region remains less affected than many other northern locations. One likely pressure in the near future is the invasion of cane toads. Invasive grasses, such as Gamba and Grader grass may also spread, promoting very hot and extensive fires that are ecologically damaging. It is anticipated that by 2030 winter rainfall may decrease by up to ten per cent, although summer rainfall is likely to remain stable. An average temperature increase of up to 1°C and reduced humidity is also likely.

Activities

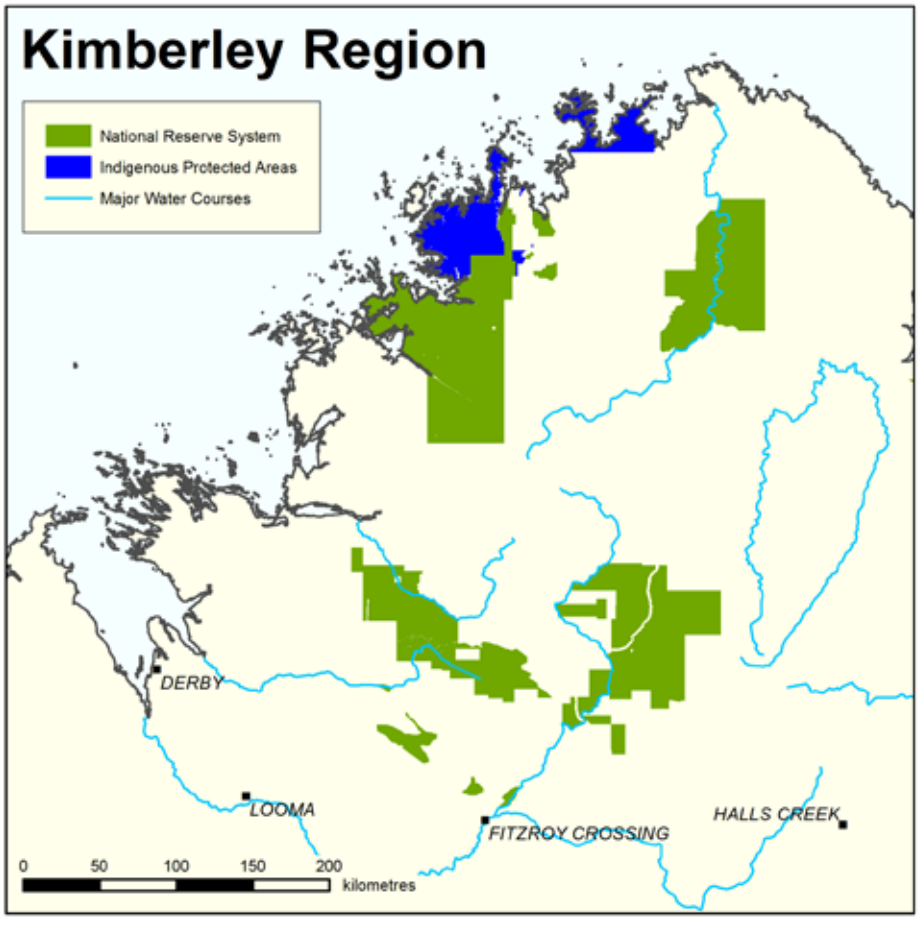
Although a vast area of land in the Kimberley is being managed, the number of landholders is relatively small. This presents an opportunity to improve connectivity through the coordinated action of landholders across large areas of land. For example, management of fire regimes and invasive species management can be most effective if coordinated across

the landscape, as shown by existing programs such as Ecofire. Further, sustainable land management such as appropriate grazing management practices, and feral animal and weed management can all reap significant benefits for biodiversity.

Community and potential participants

The Western Australian Government recently announced a commitment of funds to land management in the Kimberley region. This is designed to complement protected areas through a corridor linking Prince Regent and Drysdale River National Parks, and help build voluntary partnerships with Traditional Owners and pastoralists to manage threats to biodiversity. A corridor in the Kimberley region would build on this and other natural resource management initiatives within the region.

The cultural and eco-tourism industry is also expanding rapidly and provides local employment opportunities, particularly during the dry season. Nearly 48 per cent of the Kimberley's population is Indigenous, with many people retaining strong connections to country. Indigenous knowledge and land management practices provide significant insights into sustainable land management and the protection of biodiversity within the region. The Kimberley Land Council employs more than 50 rangers as part of their Indigenous Ranger program. Many people of the area also have strong links with the pastoral industry.



Cape York Peninsula

Cape York Peninsula in northern Queensland is characterised by a range of ecosystems, including tropical rainforests, savanna woodlands and grasslands, heath, and important mangrove and seagrass areas. Rainfall in the region makes a significant contribution to the recharge of the Great Artesian Basin. The biodiversity of Cape York is also influenced by its altitudinal gradients from coast to mountain, potentially offering important pathways for biodiversity adaptation to climate change.

Landscapes and biodiversity

The Cape supports a wide variety of endemic species, including 40 terrestrial vertebrates. Numerous species are also shared between Papua New Guinea and Cape York Peninsula as a consequence of past geological history, when a land bridge existed between New Guinea and Australia. The region also provides important habitat for seabirds and is part of the migration routes of birds over-wintering in northern Australia or continuing to Papua New Guinea. The Cape is notable for the diversity of its mangrove and orchid species, while the Jardine and Wenlock Rivers have the greatest freshwater fish species diversity reported in Australia. Substantial areas of the critically endangered Littoral Rainforest and Coastal Vine Thickets of Eastern Australia ecological community are found in the proposed corridor, as well as many plant species listed under the *Environment Protection and Biodiversity Conservation Act 1999*, such as the endangered Keeled and Blue Tassel-ferns and Antelope Orchid.

Conservation areas

Nature conservation areas, including National Parks, Indigenous Protected Areas and other areas managed for conservation cover more than 45 per cent of Cape York. Over 20 per cent of the region is covered by Nationally Important Wetlands. Cape York Peninsula is adjacent to both the Wet Tropics World Heritage Area and the Great Barrier Reef World Heritage Area. Nearly 23 per cent of the region is protected as part of the National Reserve System including Jardine River, Jack River, Lakefield and Mungkan Kandju National Parks and the Kaanju Ngaachi Wenlock and Pascoe River Indigenous Protected Areas.

Past and current pressures

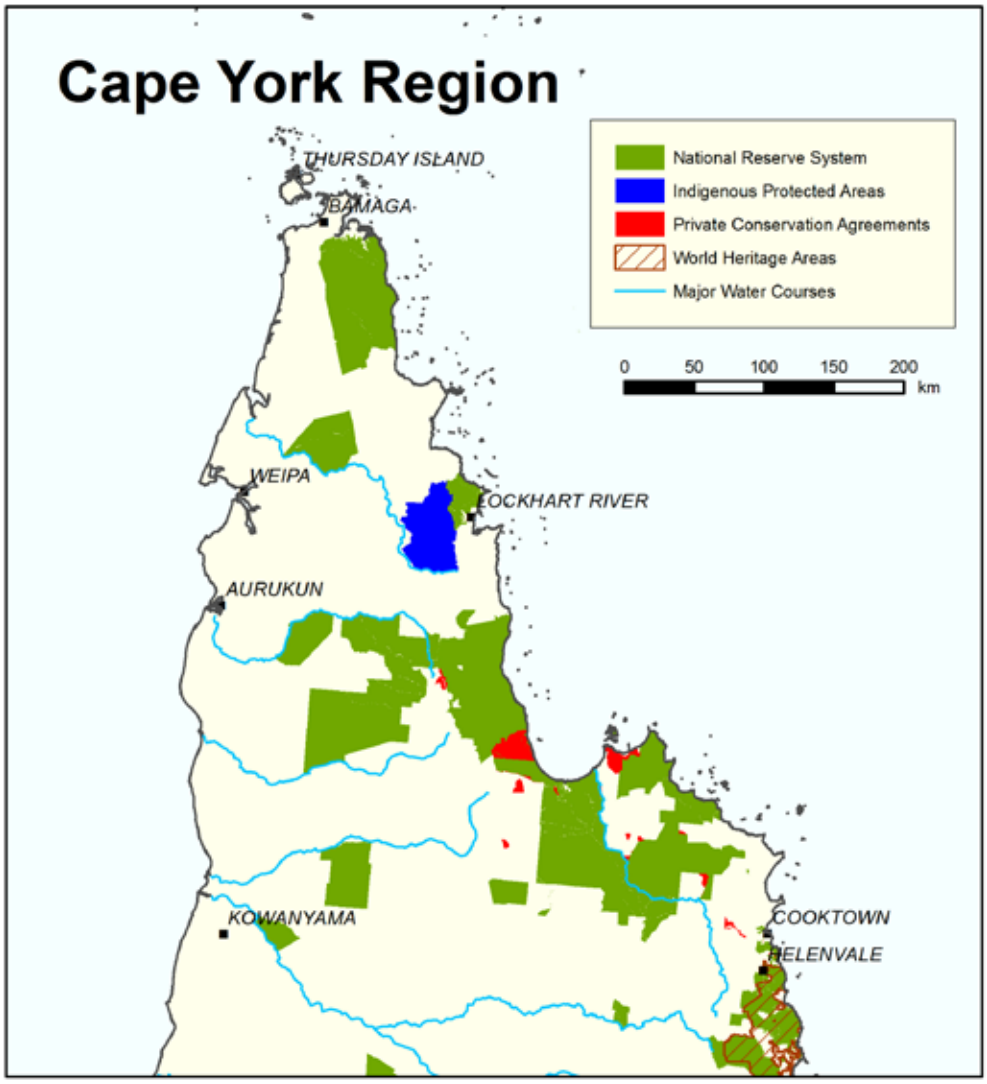
The vegetation of Cape York remains relatively intact. However, land use intensification through activities such as agriculture and mining has placed some pressure on the condition of vegetation and riparian areas in the region. Invasive fauna such as pigs and cane toads have caused considerable damage to ecosystems and threaten native fauna. Plant communities are also threatened by a suite of invasive species such as Gamba grass. Changing climates with altered rainfall patterns and increased temperatures could exacerbate some of these pressures and lead to increases in the size, frequency and intensity of fires.

Activities

The continuous vegetation cover and largely intact hydrological processes in the Cape present important opportunities for conservation of the unique biodiversity of the region. Through simple alterations to land management practices, such as strategic grazing, water, fire and invasive species management, the ecological integrity and connectedness of the Cape can be retained and restored.

Community and potential participants

Indigenous Australians' connections to country are strong on the Cape, with approximately half the population identifying as Aboriginal or Torres Strait Islander. Traditional knowledge and land management practices, such as fire management, can help maintain the region's biodiversity. Increasingly, there are opportunities for employment as Indigenous Rangers within National Parks and other conservation areas. Cultural and ecological tourism is an important growth industry within the region. The region also supports strong pastoral, mining and fishing communities.



Noosa to Ballina

The sweep of coastline between Ballina and Noosa is one of Australia's most biologically diverse regions, but also one of fastest developing urban and peri-urban zones.

Landscapes and biodiversity

The region is characterised by a range of temperate and subtropical ecosystems, with subtropical and wet sclerophyll forests, mountains and rocky outcrops support a huge variety of bird and macropod species, many of which are rare or threatened. The area includes the World Heritage Listed Gondwana Rainforests of Australia, which are the most extensive subtropical rainforests in the world and support a rich variety of ancient plant species, many of them similar to fossils from Gondwana. A large number of of the threatened plant species in the area are endemic, for example, the critically endangered Nightcap Oak, and the endangered Emu Mountain Sheoak and Davidson's Plum. The native populations of the two commercial species of Macadamia tree are also endemic to the region and are vulnerable. Among the threatened fauna of the region are the Wallum Sedge Frog, Fleays Frog, Grey-headed Flying Fox and Coxen's Fig Parrot. Some of the most significant natural populations of Koala also remain in the area, although their numbers have declined rapidly over the past decade.

Conservation areas

Eleven per cent of the region is protected as part of the National Reserve System. Among the protected areas are the D'Aguilar Range, Lamington, Border Ranges, Toonumbar, Mount Barney and Main Range National Parks. These are supplemented by substantial other natural areas in State Forests and other reserve types. The Noosa area is part of a UNESCO Biosphere reserve. On the coastline, Moreton Island is protected as Moreton Island National Park and the bay contains St Helena Island National Park and the Moreton Bay Marine Park, covering 3400 square kilometres. Parts of Moreton Bay are also listed as Ramsar sites and wetlands of international importance.

Past and current pressures

Existing pressures reflect the region's history of extensive land clearing, primarily for agriculture, followed by urban development; 65 per cent of the native vegetation has been removed. South- east Queensland continues to be Australia's fastest growing region, with an annual average of 55,000 new residents arriving over the last 20 years. There are a range of pressures associated with this increase in population. For example, weed encroachment, predation and competition by domestic and feral animals. Regional climate change predictions suggest rainfall decreases of up to eight per cent by 2070, potentially exacerbating other threats, such as fire.

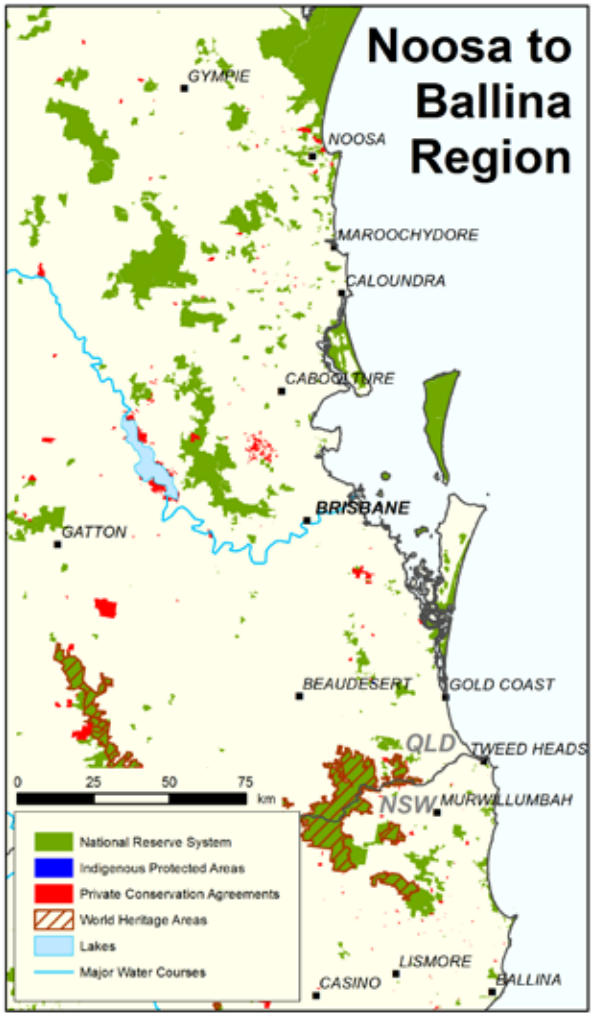
Activities

Corridors that link urban areas with the surrounding natural environment can increase the connectivity of the region as well as help protect its recreational values. As in other heavily urbanised locations, sensitive planning of growth areas can assist with maintaining the environmental integrity of an area. Road overpasses or underpasses for wildlife can help protect mammal species, such as Koalas and possums. Protection and restoration of ecological connectivity can be made through supporting rural landholders to manage

remnant habitat on their land. In more built up areas, there are opportunities for community engagement and improved environmental outcomes through the creation of wildlife-friendly parks and gardens.

Community and potential participants

Brisbane is one of the largest cities in Australia, with a population of over two million, while the Gold Coast, to the south also has a rapidly growing population. However, the hinterland areas support strong agricultural and grazing communities. Tourism, including ecotourism within the region, is also a significant economic driver. There are already some substantial efforts being made to incorporate ecological conservation into planning and land management in the region. For example, the South East Queensland Regional Coastal Management Plan, the Border Ranges Rainforest Biodiversity Management Plan and local government efforts such as the Gold Coast City Council Nature Conservation Strategy. A peri-urban wildlife corridor offers a unique opportunity to engage all sectors of the community in biodiversity conservation, from school children to sea- and tree-changers, and in urban as well rural communities.



Edward-Wakool Rivers region

The Edward-Wakool system is located in the Murray-Darling Basin between Deniliquin in NSW and Swan River in Victoria. It is an anabranch of the Murray River and comprises a complex series of interconnecting rivers, creeks, billabongs, floodrunners, wetlands and lakes covering more than 1000 square kilometres between the Murray and Edward Rivers. The area was developed for irrigated agriculture after the construction of the Hume Dam in the 1950s.

A corridor in the Edward-Wakool Rivers region would be the first of many potential corridor initiatives in the Murray-Darling Basin that may, in future, form part of the national network of wildlife corridors or be considered for nomination as a National Wildlife Corridor. A range of opportunities also exist for alignment and integration with existing conservation and corridor initiatives in the Murray-Darling Basin.

Landscapes and biodiversity

The ecosystems of the area include areas of river red gum forest, black box woodland and lignum shrubland as well as extensive wetland areas and floodplains. Permanent and semi-permanent wetlands and billabongs provide important refuges during drought and are important nurseries for fish breeding. Nationally listed threatened species present include Murray Cod, Trout Cod, Eel-tailed Catfish and Silver Perch. River red gum forests within the Edward-Wakool support breeding events of hundreds of waterbirds including listed migratory species during periods of inundation. The Edward-Wakool also provides habitat for species such as the nationally vulnerable Growling Grass Frog, endangered Australasian Bittern and listed migratory species such as the Black-tailed Godwit and Curlew Sandpiper.

Conservation areas

Less than one per cent of the area of the proposed corridor is part of the National Reserve System, but seven per cent is managed under less formal conservation agreements. Conservation areas found in the region include the Werai Forest, part of which is an Indigenous Protected Area and also listed as part of the NSW Central Murray State Forests Ramsar site. The area is also bounded by Barmah-Millewa Ramsar site to the east and to the Koondrook-Perricoota and Gunbower forests to the south. These are icon sites under The Living Murray program and provide important opportunities to increase regional ecological connectivity.

Past and current pressures

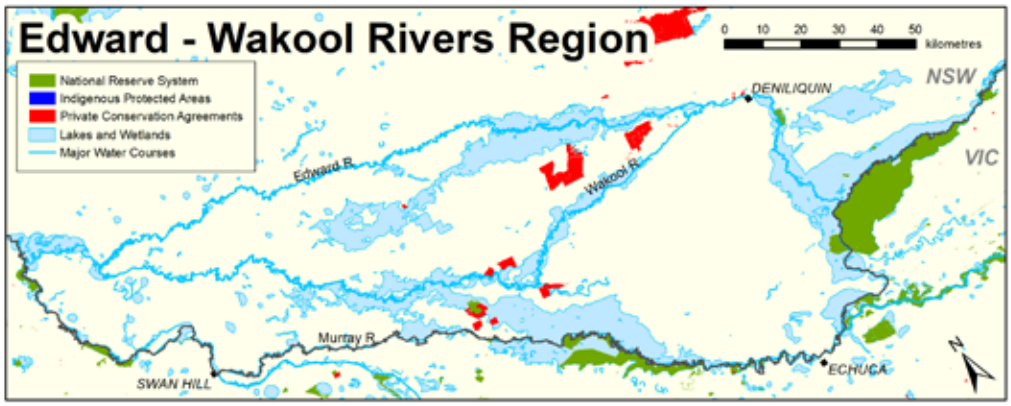
Parts of the Edward-Wakool system are very degraded. More than a century of water regulation, altered water regimes and prolonged periods of drought have led to salinity problems, declines in water quality and the condition of wetland dependent vegetation. Feral animals, such as rabbits, goats and foxes and increases in the severity and frequency of fire are also ongoing threats. There is still uncertainty regarding the specific impacts of climate change on water availability throughout the Murray-Darling Basin. However, most scenarios for the mid-Murray region predict reduced runoff and flows associated with reduced winter rainfall.

Activities

Although water extraction and the construction of infrastructure have reduced environmental flows in the river systems over many years, recent purchases of environmental water entitlements through the Water for the Future program have created opportunities to restore wetland and river red gum environments in the area. To date, Commonwealth Environmental Water has delivered almost 70,000 megalitres of environmental flows through the Edward-Wakool river system. The benefits of these flows can be optimised by complementary land management such as revegetation projects, modification of grazing and cropping regimes, and infrastructure projects to increase hydrological connectivity, such as replacing low level crossings and building fish weirs. Many private landholders in the region already have environmental management plans for their properties. Coordination of all conservation efforts, through a wildlife corridor initiative may help galvanise efforts across land tenure types and administrative boundaries to restore ecological condition and processes throughout the area.

Community and potential participants

Most land in the Edward-Wakool region is privately owned and 82 per cent of the land use is agricultural, with grazing, cropping and irrigation enterprises predominating. There is considerable local support for protecting and maintaining the region's environmental values. In recent years, Murray Irrigation, the NSW Murray Wetlands Working Group and local community members have provided environmental flows to 93 wetlands within the region. The Commonwealth Environmental Water Holder has also been working closely with local landholders, other local stakeholders, the Murray Catchment Management Authority and the NSW Office of Environment and Heritage (OEH) to develop environmental watering regimes.



Appendix C: National Wildlife Corridors Plan Advisory Group

National Wildlife Corridors Plan Advisory Group

Name	Affiliation
The Hon Bob Debus	Independent Chair
Kym Cheatham	Ecotourism Australia
Professor Steve Dovers	Fenner School of Environment and Society, ANU
Debra Goostrey	Urban Development Institute of Australia
Melissa George	Indigenous Advisory Committee
Brett de Hayr	National Landcare Facilitator
Dr Judy Henderson	Northern Rivers Catchment Management Authority
Doug Humann	Bush Heritage Australia
Angus Hume	Natural resource management/agriculture advisor
Vicki-Jo Russell	Australian Landcare Council
Dr Paul Sinclair	Australian Conservation Foundation
Felicity Wishart	The Wilderness Society
Deborah Kerr	National Farmers' Federation

Terms of Reference and administrative arrangements for the National Wildlife Corridors Advisory Group

Introduction

The National Wildlife Corridors Advisory Group, (the Advisory Group), established by the Australian Minister for Sustainability, Environment, Water, Population and Communities (the Minister), will provide advice on the design and approaches to implementing the 2010 election commitment for the three year, $10 million National Wildlife Corridors Plan (NWCP).

Role

The functions of the Advisory Group are to:

1 Advise on the direction and scope of the National Wildlife Corridors Plan

2 Facilitate the planning and drafting of the Plan and associated products, including prioritisation mechanisms for determining corridors and potential pilot regions

3 Provide informed appraisals and advice on information requirements for implementing connectivity conservation on a national scale

4 Provide advice on communications opportunities and strategic engagement of stakeholders including Landcare groups, State and local government, Indigenous organisations, environment and natural resource management groups, and farming, conservation, tourism and other industry organisations

5 Identify and manage specific tasks to be undertaken by Expert Working Groups in support of functions 1 to 4 above and consistent with the scope of the Expert Working Groups as described in Annex 1 to these Terms of Reference.

Powers and Responsibility

The Advisory Group has no executive powers or decision-making authority. It functions in a review and advisory role to the Australian Government.

Meeting support

Secretariat support and meeting logistics will be administered by DSEWPaC.

Appendix D: National Wildlife Corridors Plan Expert Working Groups

Social and Institutional Opportunities Expert Working Group

Name	Affiliation	
Professor Steve Dovers	Fenner School of Environment and Society, ANU	Chair
Dr Graeme Worboys	IUCN Vice Chair - World Commission on Protected Areas	Co-Chair
Dr Paul Sinclair	Australian Conservation Foundation	
Dr John Williams	NSW NRC Commissioner	
Dr Patrick Dodson	The Kimberley Institute	

Spatial, Climate Change and Biodiversity Analysis Expert Working Group

Name	Affiliation	
Dr Judy Henderson	Northern Rivers Catchment Management Authority	Chair
Professor Hugh Possingham	University of Queensland	Co-Chair
Professor Brendan Mackey	Griffith University	
Dr Simon Ferrier	CSIRO Ecosystem Sciences	
Ian Pulsford	Independent Consultant	

Terms of Reference and Administrative Arrangements for the National Wildlife Corridors Expert Working Groups

Introduction

The National Wildlife Corridors Expert Working Groups (the Expert Working Groups) will support the work of the National Wildlife Corridors Advisory Group (the Advisory Group) as described in the Advisory Group Terms of Reference.

There will be two Expert Working Groups (in the first instance):

1) Expert Working Group on Wildlife Corridor Principles and Design

2) Expert Working Group on Socio-economic Aspects of Wildlife Corridors

Role

Under the direction of the Advisory Group, the Expert Working Groups will:

1 provide rigorous appraisal, analysis and advice on current research and other information relevant to their theme area

2 assess and advise on the application of this information to the scope, design, and implementation of the National Wildlife Corridors Plan

3 provide advice on strategic engagement of stakeholders including Landcare groups, state and local government, Indigenous organisations, natural resource management groups and farming, conservation, tourism and other industry organisations

4 by invitation, participate in workshops and other forums and provide other support to the Advisory Group as needed.

Membership

Expert Working Group membership (including Chair) should be no more than five, drawn from the Advisory Group and from external national experts as required. The Expert Working Group chairs should be a member of the Advisory Group.

Powers and Responsibility

The Expert Working Groups have no executive powers or decision-making authority. They function in analysis, review and advisory role. They are directed by, and report to, the Advisory Group.

Meetings

The Expert Working Groups will meet as required by the Advisory Group. Secretariat support and meeting logistics will be administered by DSEWPaC.

Photo Credits

Front cover (left to right): Inspecting a property near Mount Pleasant South Australia (John Baker);Two Mountain Pygmy Possums (Linda Broom); Patch burning, Walalkara Indigenous Protected Area (Bruce Rose)

Internal images (in order): Forest on Dungrove Farm, Tasmania (Nick Rains); Looking at a map (Lyle Radford); Bird habitat within farmland (Rob Blakers); Magpie geese in paperbark swamp (Allan Fox); Looking for Warru (Anika Dent); Natural vegetation roadside corridors overlapping onto farmland (John Baker); Fire management (Yirralka Rangers); Ploughing the fields for future crops (Michelle McAulay); Junction of two rivers (David Eastburn); View towards Springbrook NP (left), Mt Warning NP (middle) and Lamington NP (right) (Paul Candlin); Aerial view of the Kimberley Rangelands (Dragi Markovic); Koala (Thiess Services Pty Ltd); Landowner planting native trees on his rural property (Georgia Curry); Yellow Water Lagoon, Cooinda (John Baker); Revegetation site on a farm (Michael Marriott)