Australian Government
Department of Sustainability, Environment,
Water, Population and Communities






National Wildlife Corridors Plan:

A framework for landscape-scale conservation

2012

Front cover (left to right): Farmer involved with the Environmental Stewardship Program to protect peppermint box woodland (Andrew Tatnell); Numbat (Alexander Dudley); Eucalyptus bark (Trevor Preston); A natural resource management officer sampling for macroinvertebrates at Eadine Springs (Michael Marriott); Swamp in Bawananga Indigenous Protected Area (Bruce Rose); Echidna (Trevor Preston).

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Back cover (left to right): Landcare group with children from a local primary school amongst recent tree plantings along the Campaspe River (John Baker); Yellow Water Lagoon, Cooinda (John Baker); Magpie geese in a paperbark swamp (Allan Fox); Koala (Theiss Services Pty Ltd); Riverine vegetation along the Robinson River (R.L. Barrett); Marking out and measuring a patch for identification of species (Dragi Markovic).

ISBN 978-1-921733-61-1

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FOREWORD

As Australians we deeply value our nation's unique and diverse natural environment.

However, our dependence on the environment has come at the cost of loss of habitat, decline in biodiversity and an increasingly fragmented natural landscape.

That's why the Gillard Labor Government committed to build a network of National Wildlife Corridors.

National Wildlife Corridors will lay a foundation for a new, collaborative, whole-of-landscape approach to conserving biodiversity. It's also designed to help strengthen the resilience in our native landscapes against climate change.

Sometimes the areas that are put into conservation from a connected landscape are so isolated that they lack the resilience that comes from a connected landscape.

You can look at a map of reserved areas and sometimes it looks like someone has dipped a toothbrush in paint and splattered different unconnected dots across the land.

Corridors are about connecting those dots; it's a way of improving resilience and ensuring that we are protecting nature in a way that preserves it for generations to come.

The National Wildlife Corridors Plan is an essential part of the Australian Government's environment policy. It gives effect to the Government's 2010 election commitment to build the resilience of our environment in the face of climate change and to take a more strategic, landscape-scale approach to managing biodiversity.

National Wildlife Corridors will be based on voluntary cooperation and the existing efforts of communities, landholders, governments and industry.

Any linking of the corridors will only be done through existing methods of putting land into conservation such as the work of Landcare volunteers, or when farmers have chosen to be part of environmental stewardship.

I wish to thank the Advisory Group and the Expert Working Groups who prepared the National Wildlife Corridors Plan.

The Hon. Tony Burke MP

Minister for Sustainability, Environment, Water, Population and Communities

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VISION

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

The National Wildlife Corridors Plan (Corridors Plan) is the Australian Government's framework to retain, restore and manage ecological connections in the Australian landscape. It lays the foundation for a new, collaborative, whole-of-landscape approach to biodiversity conservation, one based on voluntary cooperation and the efforts of communities, landholders, governments and industry. The role of the Australian Government is to enable and coordinate the efforts of all participants.

The Corridors Plan outlines the Australian Government's vision whereby a diversity of land tenures and land use types will contribute to wildlife corridors. It is designed to guide and support individuals, private landholders and managers, community groups, policy makers, planners and natural resource managers to develop and manage corridor initiatives. The rights landholders have under the law to control and enjoy their property, control access to their property and legally dispose of their property in part or in whole are not altered or affected by the Corridors Plan.

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.

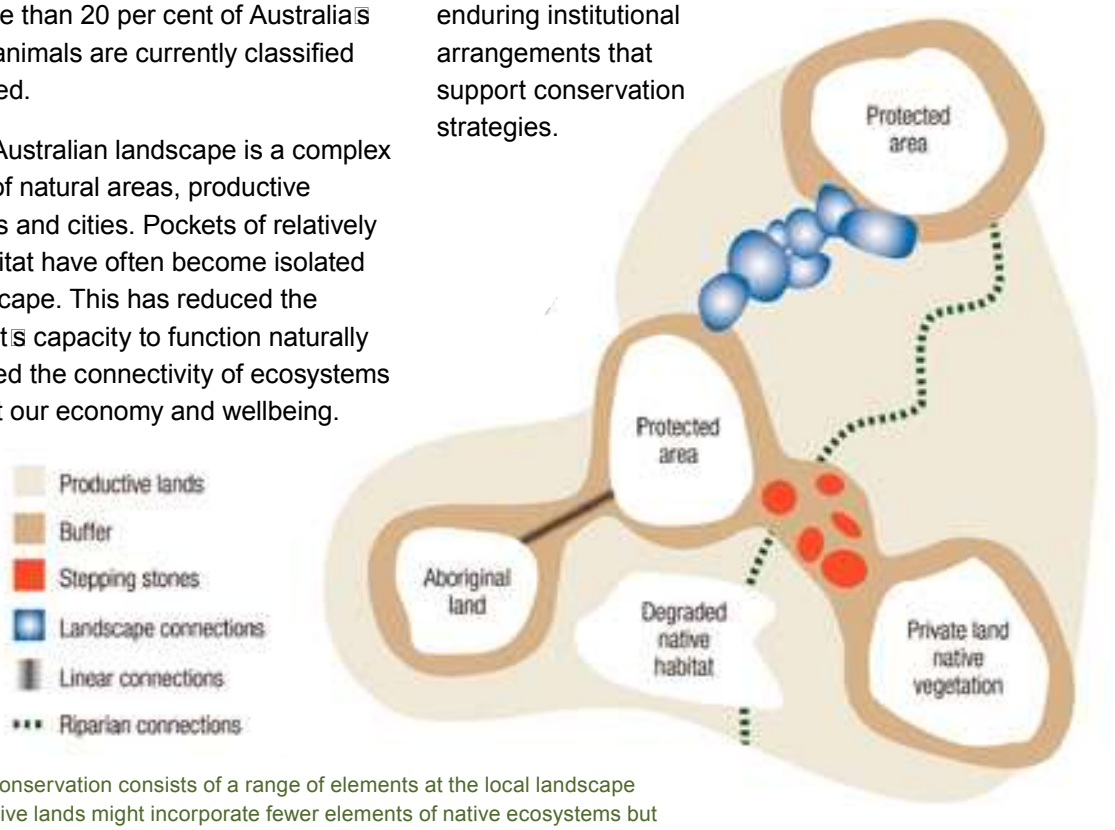
Healthy landscapes, such as a mature native forest, contain diverse species and structural features such as fallen wood, hollows and understorey vegetation that provide valuable habitat for many species.

PART 1
Why we need a National Wildlife Corridors Plan

Australia is one of the world's 17 mega-diverse nations: an estimated 10 per cent of all species on Earth occur on this continent. As a result of our long history of isolation as an island continent, as well as a stable geology and variable climate, most of our mammal, flowering plant, reptile and frog species are not found anywhere else. As Australia has developed, however, our natural environment has become increasingly fragmented and there has been significant loss of natural habitats and decline in many species. In some parts of Australia over 90 per cent of some ecological communities have been lost; in some parts 50 per cent of mammal species are extinct; overall, more than 20 per cent of Australia's plants and animals are currently classified as threatened.

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 ecosystems that support our economy and wellbeing.

The National Wildlife Corridors Plan (the Corridors Plan) reflects an understanding that communities can be inspired to work in cooperation with government and non-government organisations in support of a vision to protect our environment by improving 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 (see Figure 1). In turn, it is necessary to build enduring institutional arrangements that support conservation strategies.



Connectivity conservation consists of a range of elements at the local landscape scale. Productive lands might incorporate fewer elements of native ecosystems but often still contain valuable elements of connectivity and biodiversity, while some areas are of higher quality and more intact. Adapted from Bennett (2004).

Figure 1: Corridor components

The Corridors Plan represents the Australian Government's commitment to retain, restore 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. Through the Corridors Plan, cooperative, voluntary action on the part of all land managers to restore ecological connections throughout the landscape is supported – be it farm land, urban land, conservation areas or Indigenous land that is being managed.

Biodiversity conservation has traditionally focused on protecting large, representative ecosystems 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 private landholders across Australia have engaged in significant landscape restoration work, particularly during the past 30 years, and that a number of non-government, voluntary and government initiatives have pioneered the development of corridor conservation projects. The network of wildlife corridors developed under the Corridors Plan will build on this experience, as well as other successful environmental and natural resource management initiatives throughout the country.

Private land conservation

As important custodians of Australia's environment, private landholders can contribute to the development of wildlife corridors by retaining, restoring and managing 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 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 biodiversity and connectivity on their properties.

1.1 Wildlife corridors and climate change

Australia's climate is changing: average annual temperatures have increased by between 0.4 and 0.7°C since 1950; the decade to 2009 was Australia's warmest on record; and 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 alter 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 supplies, agriculture and urban environments. This will affect the wellbeing of Australia's unique native species, ecosystems and human population.

Fragmentation of our landscapes reduces the capacity of species and ecosystems 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 independent review of the *Environment Protection and Biodiversity Conservation Act 1999* suggested that, in the light of climate change, future biodiversity management should focus on improvement of ecosystem resilience and the connectivity of fragmented ecosystems, 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 suggested that policy frameworks be re-oriented through the introduction of integrated regional approaches to biodiversity management.

Wildlife corridors are one of the most effective tools available for conserving biodiversity and preparing landscapes for climate change. They can help insure against climatic uncertainty through the conservation of a diversity of species

and provision of alternative pathways for species movement and adaptation. Naturally connected landscapes and ecosystems are generally healthier and can store carbon more effectively than degraded landscapes. Establishing a network of wildlife corridors can help create and protect natural stores of carbon in the environment and contribute to mitigating the effects of climate change. By coordinating investment at the national scale, the Corridors Plan will support improvement in the resilience of our landscapes and better prepare land managers for altered climatic conditions.

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

Landscape resilience

Resilience is the ability of individuals or groups of people, native species, ecosystems or landscapes to withstand or recover from an impact or other shock and quickly restore core functions and capacities.

Landscapes are complex because they are made up of many interacting parts with flows of energy, water and nutrients between them. Application of 'resilience thinking' at the landscape scale means that we look at our landscapes as dynamic systems with interacting human and ecological components.

Management for resilience requires the promotion of diversity and flexibility in landscape systems and the improvement of the capacity to adapt and change. It is necessary to identify the most important variables controlling landscape function and the thresholds within which a system can continue to function in a similar way. If a threshold, or 'tipping point', is crossed the system might enter a new, irreversible state. A powerful example is the lost resilience of formerly productive lands that have become salinised. Recovery, where possible, takes significant resources and time.

Knowledge of a system's tipping points helps planners and managers ensure that their interventions support landscape resilience.

Climate change and adaptation

The present distribution of species and ecosystems in Australia is related to both current climatic conditions and past climates. One of the possible responses to climate change is for species to relocate as climatic envelopes shrink, expand or change location. This can happen at various scales of space and time and could create novel ecosystems with new combinations of species. For example, it is thought that some species will colonise new areas at higher elevations or in the cooler edges of their ranges, although this is likely to occur at the expense of other species. Some species might adapt to new conditions *in situ*, developing new characteristics and behaviour suited to their changed surroundings. This may be more successful where populations are connected and so have greater genetic resources to call on. The capacity of most species to tolerate or adapt to changed conditions or change their location is not yet known and is difficult to predict because of the many interactions involved. Nevertheless, substantial shifts in species and ecosystem distribution, as well as adaptation and development of new species, have occurred with past climate change.

A change of location is most likely to be a successful strategy for highly mobile species, such as marine species and some birds. In general, species that have specialised requirements, narrow physiological tolerances and geographic ranges, limited mobility, 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 trying to maintain 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, 2009b).

1.2 The purpose and role of wildlife corridors

The Corridors Plan recognises that the scale and spread of our response to biodiversity loss must be increased if we are to match the extent of threats to the condition of our natural environment in the long term. It incorporates strategies for restoring forms of natural connection and interaction across the entire landscape. The progressive implementation of corridors is proposed to occur at different scales from large expanses of intact native vegetation or river systems and floodplains on one hand to 'stepping stones' of habitat patches and scattered paddock trees linked across productive landscapes on the other.

Corridors can also be created by adjusting land use practices so that vital ecological functions are repaired and retained and connectivity is restored (see Figure 2).

The Corridors Plan recognises the crucial function of connectivity for wildlife corridors – that is, the characteristics that make the landscape habitable for communities of plants and animals, allowing their movement, adaptation and evolution.

Connectivity can be understood at four levels:

1. *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 animals and the transfer of plants through seeds and pollen.

2. *Habitat connectivity* refers to the connections between patches of habitat that are suitable for a 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.

3. *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 the landscape.

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

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

Intact, healthy and connected landscapes provide opportunities for wildlife to interact naturally and share genes. Genetic diversity in a population is likely to assist its adaptation to a changing climate.

Hospitable or hostile: landscapes from an animal's perspective

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

Landscape permeability is a term used to describe how hospitable land might be for a particular species. For example, many rainforest birds will cross only short gaps between dense patches of vegetation. For these birds, a permeable landscape might contain 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 fishway on the Macquarie River.

A hospitable, or permeable, landscape for migrating fish might 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 system more hospitable for fish and other aquatic animals.

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. Landscapes converted for agricultural or urban development can, however, maintain their permeability for many species if trees, rocky outcrops and other stepping stones between larger areas of habitat remain in good condition.

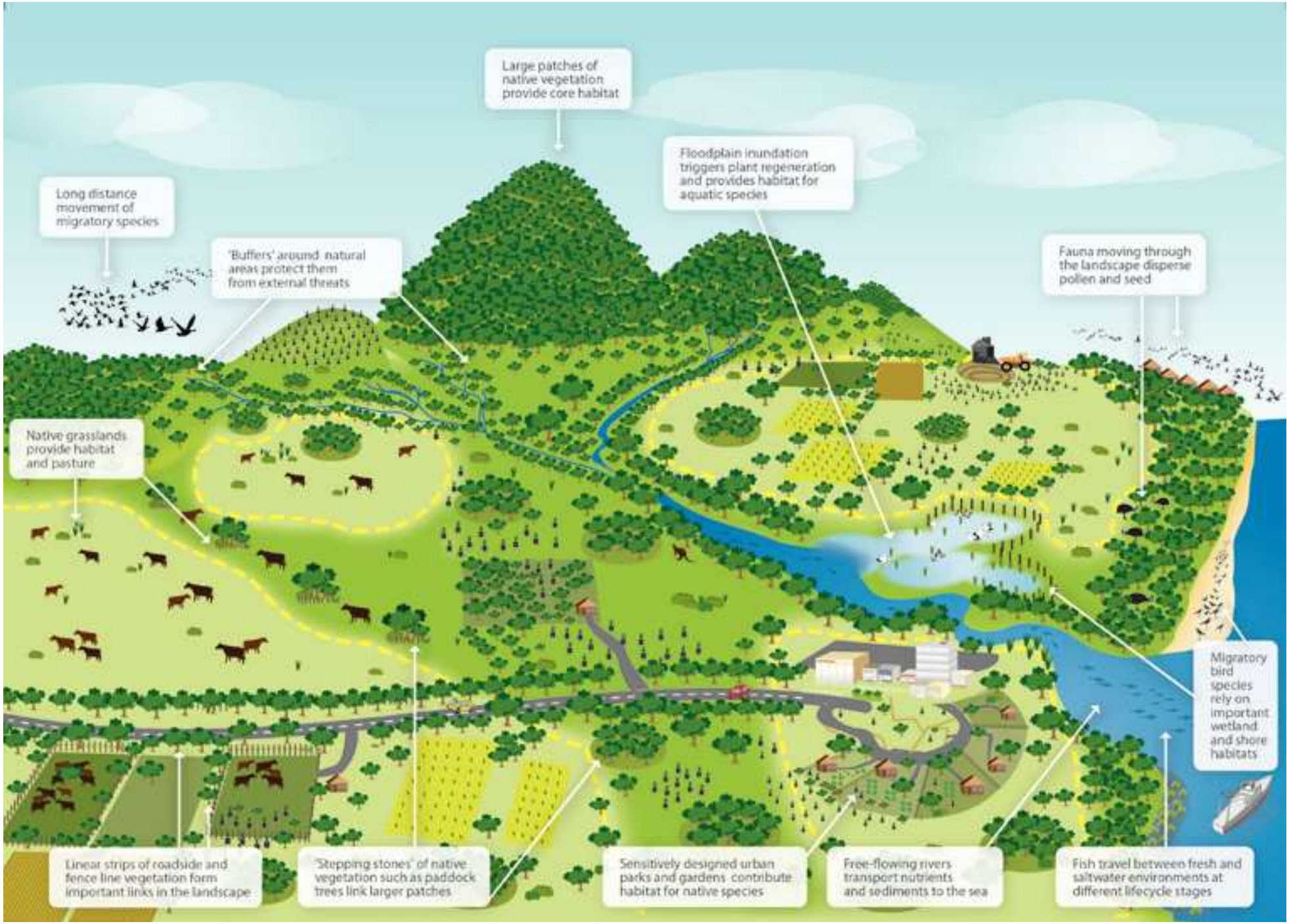


Figure 2: Elements of connectivity within the landscape

1.3 The objectives of the National Wildlife Corridors Plan

The Corridors Plan is a long-term strategy designed to retain and restore ecological connectivity and facilitate connectivity conservation. Existing and new corridor initiatives at continental, regional and local scales will all contribute to a network of wildlife corridors. Some of these initiatives might also be designated as National Wildlife Corridors. The Corridors Plan will support and encourage the establishment of this network in order to achieve six primary objectives, as follows.

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 maintaining 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 can inhibit ecological processes and limit the capacity of animals 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 may have 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 store 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.

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.

Enhance the resilience of Australia's landscapes and their 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. Rapid climate change will, however, challenge the resilience and adaptive capacities of many plants and animals. If large, well-connected populations of Australia's plants and animals are conserved, their resilience in the face of climate change might increase, making them better able to adapt or move across the landscape in search of food, breeding habitat or suitable microclimates.

Support the global and national movement of animals

Migration and nomadic movement to find resources such as food and breeding habitat are common features of Australia's native animals. Many of these 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 managing and protecting Australia's iconic landscapes and Indigenous and non-Indigenous cultures and heritage

Cultural history often mirrors natural history with important connections between people and places being retained over generations. Indigenous and non-Indigenous Australians' cultural connections with landscapes, plants and animals 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 being passed from generation to generation over tens of thousands of years. Indigenous pathways, songlines and traditional 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 participation in wildlife corridors and connectivity conservation

Strong connections with natural places can be inspired by the opportunities offered to communities for participation in visionary wildlife corridor projects. Good conservation calls for consistent and sensitive land and resource management in 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 Corridors Plan.

The National Wildlife Corridors Plan will give local communities the opportunity to participate in wildlife corridor projects to progress their vision for their local area.

1.4 Guiding principles for wildlife corridor design and implementation

The following principles underpin the Australian Government's vision for the Corridors Plan and provide a guide to retain, restore and manage connectivity and resilience in Australian landscapes.

Building wildlife corridors across Australian landscapes is a cooperative endeavour

Successful corridor development depends on the establishment of arrangements for long-term planning and management. It requires collaborative and coordinated efforts by non-government organisations, regional natural resource management organisations, the private sector, the community and governments. Corridor practitioners need to plan and allocate resources effectively 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 broader social and economic needs.

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. These benefits can include rural and regional employment opportunities in natural resource management and tourism, as well as the enhancement of ecosystem services such as water supplies that benefit agricultural productivity and support domestic needs.

Healthy, functioning landscapes require connectivity at a variety of scales

Different species require different scales of connectivity. For example, native bees might need flowering plants to be closely spaced in order to collect nectar and pollen, whereas koalas have territories that can span hundreds of hectares of healthy, connected vegetation. For this reason the design, conservation and management of connectivity at multiple scales – from local and regional to national-scale corridor initiatives – is crucial to establishing successful wildlife corridors.

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 retaining, restoring and managing 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 can 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 mosaic of land tenures and land uses present in Australia's landscapes will contribute to wildlife corridors without affecting the rights attached to private property.

Wildlife corridors in regional Australia can provide economic and social benefits for rural communities, such as employment in natural resource management.

Fenceline or roadside vegetation can help wildlife to move through 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

A range of evidence and expertise will be drawn on in determining the design and placement of corridor initiatives. Scientific research provides a basis for recommendations about the location, design and management of corridors. This will be supported by Indigenous and community knowledge derived from an intimate understanding of the local and regional environment. Corridors established under the Corridors Plan will take into account this research and knowledge, as well as existing government and non-government connectivity initiatives and management practices.

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 the capacity of native species to adapt or 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.

Indigenous fire management practices and other traditional knowledge, developed over thousands of years, can inform the development and management of wildlife corridors.

Corridor design recognises and manages for potential risks such as those posed by invasive species and fire

Natural connectivity in landscapes may help to 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 recover from bushfire and drought. Some species, however, have remained protected by virtue of their isolation. Corridor design must take account of 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. Case studies have shown, however, that some of the most serious invasive species – for example, 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 intact native vegetation are likely to be better protected against invasion and might help to reduce the overall dispersal of invasive species. Nonetheless, corridor building activities in some locations could increase the risks of damage or dispersal of some invasive species. Specific management regimes and initiatives to control invasive plant and animal species are an essential component of corridor design.

International connectivity initiatives

Some of the best-known international corridor initiatives have been designed to accommodate 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 habitats 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 the socio-economic opportunities and benefits associated with 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, and payments for environmental services such as carbon sequestration and water provision are an increasingly important part of local income streams.

1.5 A network of wildlife corridors

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

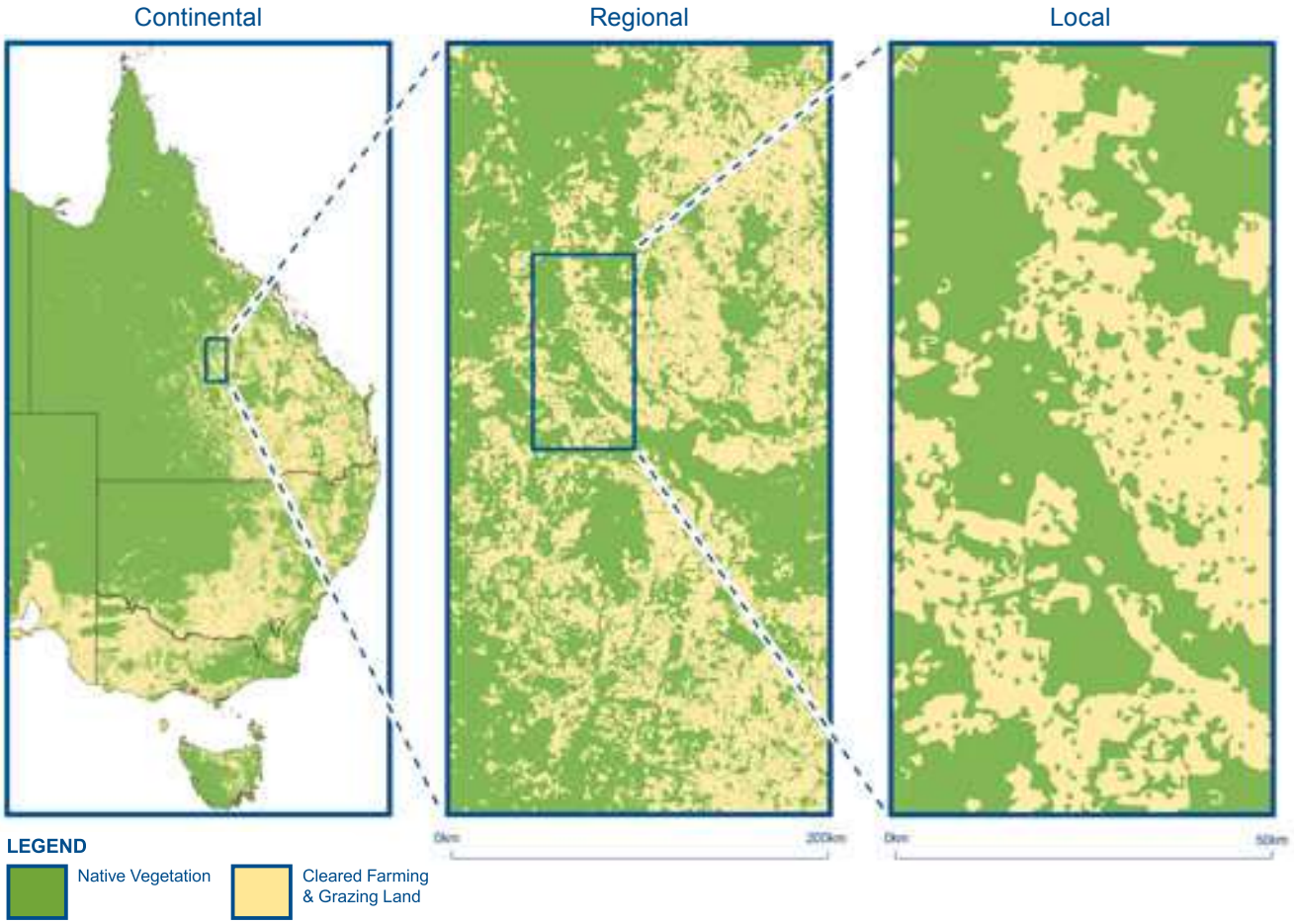
A network of wildlife corridors needs to be developed across the continent at a range of scales. It will consist of national-, regional- and local-scale corridors (see Figure 3). Implementation of the Corridors Plan will support the progressive development of such a network in several ways:

- by identifying National Wildlife Corridors to create major landscape links
- by enhancing existing major corridor initiatives
- by supporting local- and regional-scale corridor initiatives.

National Wildlife Corridors established through the Corridors Plan will be the 'spines', or 'building blocks', for the network. Existing major corridor initiatives already operate in this manner. Corridors at all scales will extend the network of connectivity conservation across the landscape.

Without in any way affecting personal property rights or government regulation, the network of wildlife corridors will retain, manage and restore all four aspects of connectivity across a variety of land uses, landscapes and ecosystems. It will connect habitat patches within and across borders, along rainfall and altitudinal gradients, and stretch across Australia.

As the network 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.



Corridors will be developed at a variety of scales. Local action to retain, 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.

Figure 3: Corridor scales

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, their effectiveness being dependent on the ecological context. Planning can help with developing priorities for management that suit 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 spread across patches of remnant habitat. In more remote regions, where land use is less intensive, natural systems have remained more intact. In spite of this, intensification of land use resulting from a range of developments – such as mining, urbanisation and intensive agriculture – often has adverse effects on the natural environment.

Different management strategies are needed for different landscapes, and in each case management across tenures and land uses is needed in order to manage 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, retention and maintenance of existing connectivity are likely to be the focus of activities.

Management actions such as the construction of underpasses beneath roads can help wildlife to move more freely.

Corridors in fragmented landscapes

Much of the native vegetation in Australia's agricultural zones has become fragmented as land use has intensified, yet these landscapes also contain some of our most valuable areas of remnant habitat. Although this remnant habitat might not be formally protected, it has often been managed and maintained by private landholders. In fragmented landscapes, paddock trees, riparian zones, and remnant 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 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 retaining and managing connectivity because of their relative remoteness, their inaccessibility, and limited resources and community capacity. Large-scale action can, however, occur with the involvement of a small number of landholders. A range of opportunities exist for land that is not primarily managed for conservation to contribute to building landscape connections. For example, land managed for defence training, unallocated crown land and roadside reserves often hold important conservation values that can be managed in a way that is complementary to other land purposes. Many large areas of remote Australia are managed and owned by Indigenous groups: their 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 Queensland Wet Tropics provide important opportunities for conservation.

Corridors in urban and peri-urban landscapes

Our urban and peri-urban areas are highly modified landscapes that nevertheless have scattered areas of native habitats and 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 support 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 lead to raised awareness and greater engagement of diverse communities in conservation and management activities.

Wildlife corridors in and adjacent to our cities and towns help protect wildlife and improve community wellbeing.

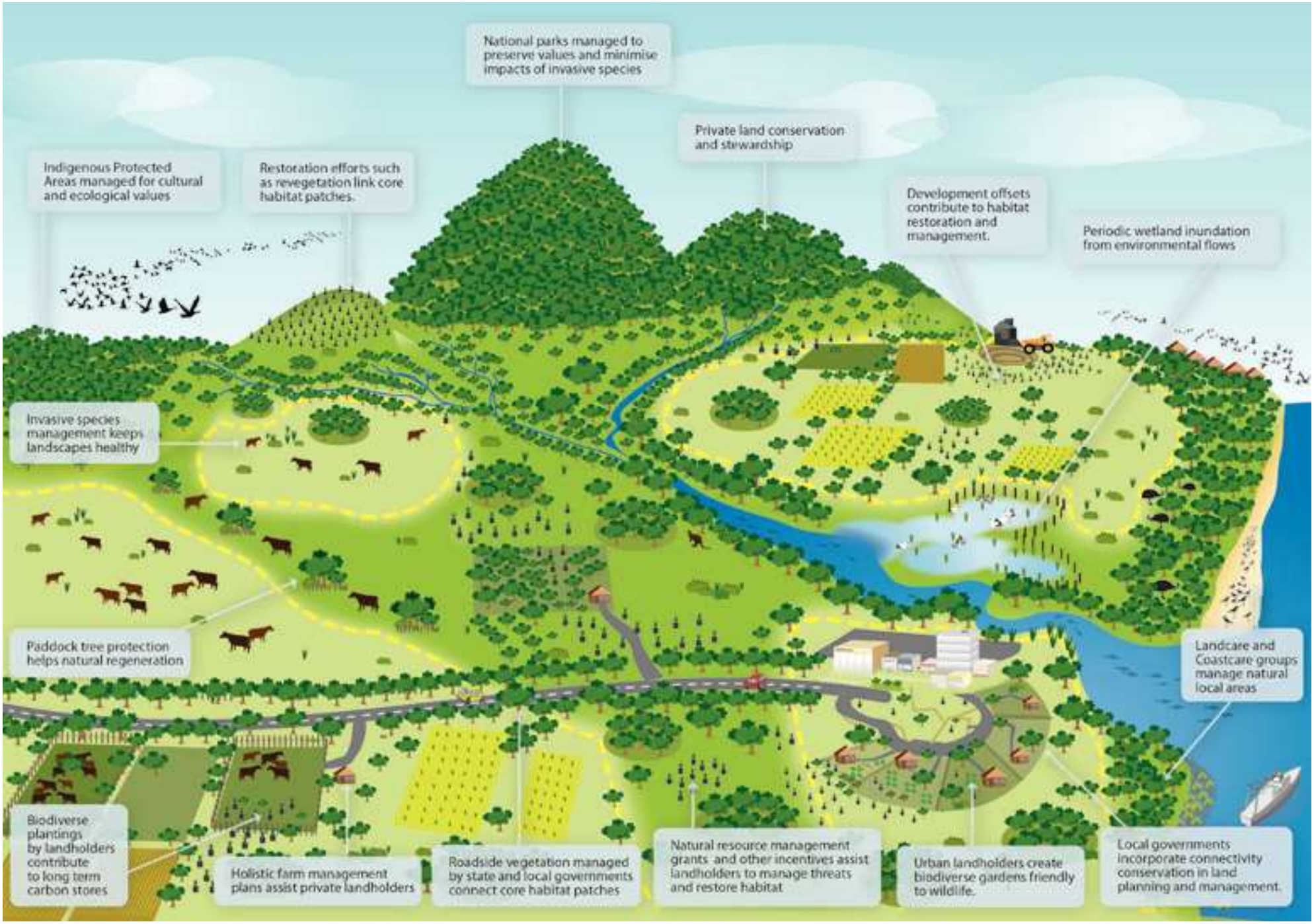


Figure 4: Some examples of management activities related to corridor building

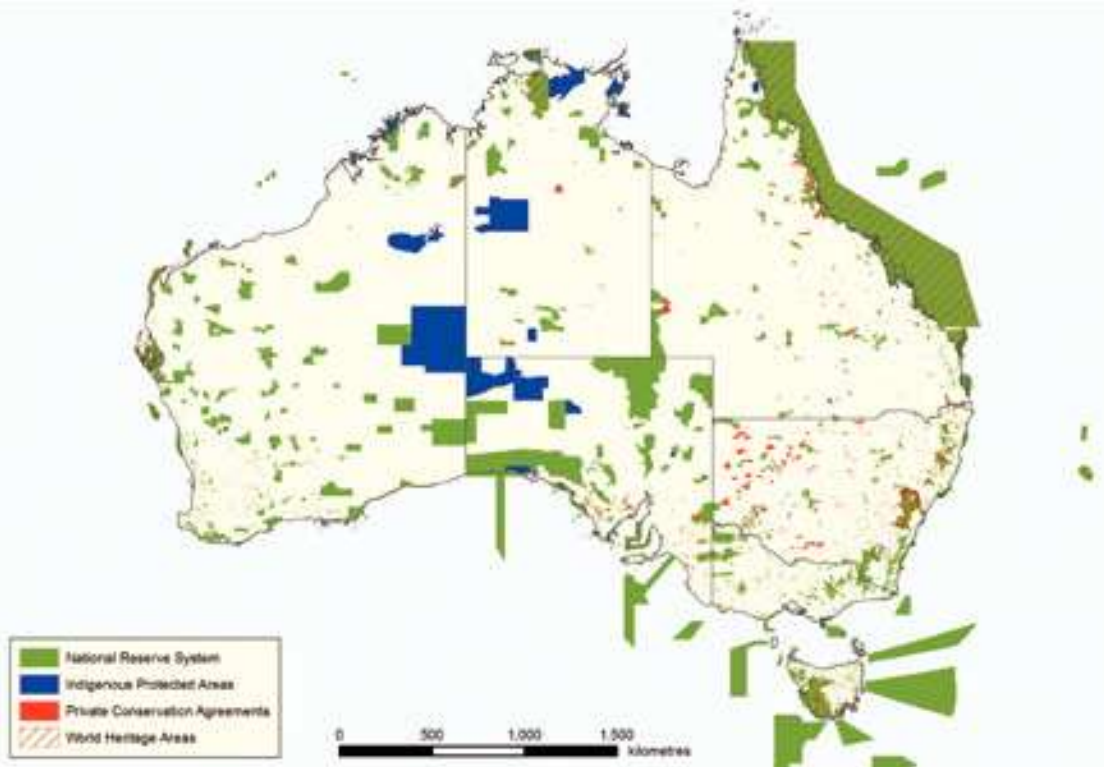
1.7 Foundation stones: places, people and processes

The foundation stones of the network of wildlife corridors are places, people and processes. Physical attributes of the landscape such as protected areas, remnant vegetation and hydrological systems can be used as starting points in the development of wildlife corridors. People with expertise and experience in land management and a commitment to restoration can contribute to forming effective collaborations essential to corridor development. Processes of relevance include adaptive management, action planning and capacity building, all of which can be used to effectively plan, construct and manage a corridor.

In Australia many large patches of native vegetation are protected as part of the National Reserve System, through regulation or the custodianship of private landholders. Significant tracts of land are not being managed specifically for conservation yet still retain important remnant habitat and provide valuable ecosystem services, such as areas of native vegetation that are used for grazing. Sustainable management of these areas can provide benefits for both biodiversity and production. Habitat areas that are in good condition are better able to respond to disturbances such as wildfire and extreme weather events and provide anchors of connectivity in 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 covers approximately 13 per cent of the Australian continent and is a pillar of Australia's biodiversity conservation efforts (see Figure 5). Both public and private lands contribute to the National Reserve System, with government agencies, private landholders and non-government organisations managing land for conservation purposes. Some of these protected areas have, however, become isolated in the landscape, which can reduce their resilience. A network of corridors will help to build connections between protected areas and other private and public lands in the surrounding landscape.



Commonwealth of Australia Protected Areas Database (2010).

Figure 5: The National Reserve System, World Heritage Areas and areas subject to private conservation agreements

Indigenous Protected Areas

There are more than 40 Indigenous Protected Areas in Australia that account for approximately 23 per cent of the National Reserve System. Indigenous Protected Areas are managed for a variety of purposes, such as cultural uses, the conservation of plants, animals and habitats, 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 areas.

World Heritage Areas

World Heritage Areas are listed under the World Heritage Convention, which identifies sites of global importance and outstanding natural or cultural value for both current and future generations. Australia has 25 World Heritage Areas listed for their natural values. These provide many benefits, including increased tourist visitation and employment opportunities through ongoing management and protection. 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's many wetlands that are recognised under international treaties such as the Ramsar Convention and are afforded protection under the *Environment Protection and Biodiversity Conservation Act 1999* are called 'Wetlands of National and International Importance'. Maintaining connectivity between these wetlands through seasonal water flows and networks of riparian vegetation is essential if we are to sustain these areas, which contain important habitats for migratory species and are centres of biological diversity.

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.

Private land conservation

Much of Australia's highest quality remnant native habitat is on private land. These valuable areas have often been afforded both formal and informal protection by the good custodianship of private landholders, who are well aware of the benefits of retaining, restoring and managing remnant native habitat. These can include direct benefits for production, such as shelter and shade for stock; maintenance of soil structure and prevention of dryland salinity and rising water tables; prevention of soil erosion by wind and water; and provision of habitat for native animals. Remnant native habitat also provides an amenity that is valued by landholders.

As well as conserving remnant habitat, private landholders are instrumental in increasing the area of native vegetation in the landscape by replanting areas that have previously been cleared or allowing such areas to regenerate naturally. These landholders often engage in activities without support from government.

Private landholders may voluntarily incorporate and manage areas of remnant and revegetated native habitat as part of wildlife corridor initiatives in their region. For example, they might choose to become involved in a variety of conservation programs and incentives, such as the Environmental Stewardship Program, Landcare projects, conservation covenants, voluntary conservation agreements and farm management plans. A number of properties throughout Australia are also managed for conservation purposes by private land trusts and non-government organisations. Some of these private properties are also part of the National Reserve System.

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 such as river systems and migratory bird flyways provide important natural connections. In particular, the presence and movement of water are essential to the function of landscapes, supporting ecological processes and meeting human needs. Watercourses are clear examples of connected networks, from small creeks and temporary wetlands to large river systems that flow across the country, either permanently or after heavy rains. Many organisms depend on the movement of water down these watercourses or across floodplains because this provides opportunities to breed and disperse. Less visible but equally important is groundwater, which can support ecological communities even when the surface is dry. Maintaining natural flows of both surface and groundwater systems is crucial to maintaining healthy landscapes, particularly as climates change.

Natural networks also provide the basis for many traditional Indigenous pathways, such as songlines and trading routes, which for millennia have connected communities through trade and seasonal travel. Many of these routes followed watercourses or linked water points. European explorers also took advantage of these pathways, some of which developed into the travelling stock route network.

In some locations corridors can provide opportunities for strengthening or re-establishing cultural connections with landscapes, as shown by the role Gondwana Link has played in facilitating renewed connections to country for Noongar people. Areas of high ecological value across Australia are often places where substantial Indigenous knowledge and expertise

in ecological management still exist. Arrangements such as Indigenous Land Use Agreements, joint management strategies and policies, and participation through management or advisory committees are some of the ways in which Indigenous knowledge and values can contribute to land management in wildlife corridors.

Existing major corridor initiatives

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

The following six corridor initiatives are considered important foundation stones for the network of wildlife corridors:

- Gondwana Link
- the Great Eastern Ranges Initiative
- Habitat 141°
- NatureLinks
- Trans-Australia Eco-Link
- Tasmanian Midlandscapes.

These initiatives have been established through the cooperative action of a range of parties from state governments to non-government organisations and industry, local communities and individuals on the basis of their biodiversity values, existing conservation work and conservation and community needs. The Appendix provides information about these important corridor initiatives.

Regional natural resource management arrangements

Regional arrangements for managing the environment have been established in Australia through the development of 56 natural resource management (NRM) regions, each supported by ongoing organisational capacity. One of the primary roles of the regional NRM organisations is to facilitate and update regional NRM plans on behalf of the region. This is done through technical analysis and consultation with non-government organisations, governments, industry, landholders, the wider regional community and adjacent regional NRM organisations. NRM plans have a central role in identifying and assigning priority to the locations and kinds of management activities to be taken up by their regional communities and providing a blueprint for implementing sustainable resource management for the community.

An important role for these regional NRM organisations is the identification of corridor opportunities where targeted management and other action will restore and repair degraded habitats, protect those in good condition and manage threats (including from climate change), thus strengthening the connectivity of native habitats and ecosystems.

Community development and support of corridors

Community partnerships and collaboration between different interest groups are vital to the development of the network of wildlife corridors and to successes at the landscape scale. In many existing wildlife

corridors, non-government organisations play the main role in raising awareness about opportunities for conservation action, assisting in skills development in the community, forming partnerships with other agencies and groups, and encouraging community commitment to conservation goals over a long period.

Individuals, state, territory and local 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, individuals and more than 40 organisations including coal, energy and tourism industries, agricultural and equine enterprises, and community groups are participating in the development of local wildlife corridors. For large projects that build wildlife corridors at a variety of scales and involve a diverse array of stakeholders, effective partnerships and governance arrangements are important.

Protection and 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.

PART 2
Building a national network of wildlife corridors

The National Wildlife Corridors Plan (the Corridors Plan) draws on the Australian Government's experience in developing and implementing a number of important environmental management initiatives:

- the National Reserve System and Indigenous Protected Areas
- Caring for our Country
- Working on Country, including 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*.

These initiatives provide the policy context, outline program objectives that guide investments, and identify the information and research platforms through which a network of wildlife corridor initiatives might be designed and managed.

The Corridors Plan sets out a framework to guide the development of corridors at all scales. By implementing the guiding principles, communities and organisations will be able to develop effective corridors that will begin to meet the objectives of the Corridors Plan. In doing so, local communities will be contributing to building a network of wildlife corridors.

Development of the network of corridors will also be supported by a range of scientific approaches and technical tools. Among these are new methods for analysis of the distribution of species, the genetic make-up of populations and broader ecological functions across landscapes. Science can also provide essential information on the ecological requirements, tolerances and interactions of key species. In addition, remote sensing and other spatial analysis approaches will support the progressive design, management and evaluation of corridors.

Where communities believe their corridor initiative meets established criteria used for declaring National Wildlife Corridors, they will be able to nominate that corridor under the process established by the Corridors Plan.

2.1 The five-point plan of action

The Australian Government's vision for an enduring network of wildlife corridors will be implemented gradually. The following five-point plan of action will help deliver the vision:

1. developing and supporting corridor initiatives
2. establishing enduring institutional arrangements
3. promoting strategic investment in corridors
4. working with key stakeholders and supporting regional natural resource management (NRM) planning
5. monitoring, evaluating and reporting.

High quality, long-term monitoring and evaluation is an important part of the National Wildlife Corridors Plan.

1. Developing and supporting corridor initiatives

The prospects for establishing wildlife corridors are good in the largely intact northern savannah lands and river systems and in areas of especially high biodiversity in more fragmented landscapes – for example, in south-west Western Australia; along the Great Divide of eastern Australia, from Atherton in Queensland to the Grampians in Victoria; and in coastal southern Queensland. Corridors also have an important role in Australia's river and wetland systems – for example, those in the Murray–Darling Basin, the Cooper and Diamantina Rivers of the Channel Country, and the Peel–Harvey system of south-western Australia.

In the near-intact regions – such as in the Kimberley and in Cape York – coordinated action by Traditional Owners, pastoralists, mining and extractive companies, regional NRM organisations, non-government organisations (NGOs) and government agencies can dramatically improve connectivity over very large tracts of relatively intact native vegetation. Indigenous knowledge and practice are often crucial to the success of strategies for fire, water and invasive species management that are combined to restore ecological integrity. In these landscapes the cultural connections to country through songlines and traditional stories are particularly important.

Opportunities for peri-urban corridor initiatives exist at the perimeter of areas of rapidly growing population, such as the Swan coastal plain around Perth and the coastal region around Brisbane, from Noosa to Ballina. Corridors can complement existing state and local government

environmental management plans by linking fast-growing urban and coastal areas with the surrounding natural environment. This will improve connectivity in these densely populated areas and help to restore and manage the natural and recreational values that communities enjoy.

In fragmented landscapes such as the Murray–Darling Basin each river catchment presents potential for connectivity restoration. For example, the Edward–Wakool system is an anabranch of the Murray River containing complex systems of interconnected streams, wetlands and billabongs interspersed with intensive irrigated agriculture. Recent Commonwealth purchases of environmental water have created opportunities to restore wetlands and riparian vegetation in this region. Regional NRM organisations, government agencies, industry bodies and community organisations are working in collaboration with local landholders and farmers to restore environmental flows and ecological connections across the Basin and more widely.

Examples such as these show that connectivity and corridor projects can differ in their physical scale and their ecological, social and development context. The diverse situations, focus and governance arrangements applying to these examples illustrate the wide range of corridors that can be developed under the principles in the Corridors Plan.

Creating National Wildlife Corridors

As noted in Section 1.5, the network of wildlife corridors will be underpinned by the creation of National Wildlife Corridors. Partnerships of interested stakeholders will be able to nominate existing or new corridors for national recognition.

Nominations will need to meet criteria that establish the corridors' ecological integrity and contribution to landscape-scale connectivity, their alignment and integration across different land uses, and their capacity to generate social and economic benefits. They will also need to demonstrate a broad base of community support and the existence of effective and enduring governance arrangements. Details of the criteria and nomination process will be available at **www.environment.gov.au/biodiversity/wildlife-corridors/index.html**.

The declaration of a National Wildlife Corridor area will be administrative, for the purpose of assigning priority to and guiding investment opportunities and will not result in any additional restrictions on property rights or land uses.

The broad steps in the nomination and declaration process are as follows:

Step 1: Themes

- The Minister may determine a conservation theme at the beginning of a National Wildlife Corridor nomination round. (This step is optional.)

Step 2: Nominations

- Nominations will be invited from the public and an independent council will be established to undertake assessments.

Step 3: Assessment

- Nominations will be assessed against the published criteria developed by the council. Supporting information will also be made available on the Department of Sustainability, Environment, Water, Population and Communities website.
- The council will advise the Minister on suitable proposals for National Wildlife Corridors.

Step 4: Declarations

- The Minister may declare the area to be a National Wildlife Corridor; declare the area with amendments to be a National Wildlife Corridor; refer the nomination for further advice and/or public consultation, including consideration of a modified nomination; or reject the nomination.
- The Minister's decisions will be publicly announced.

Step 5: Review and reporting

- Each year the council will provide to the Minister a review of the progress of the Corridors Plan and the establishment of National Wildlife Corridors.
- The council will also carry out a review of the Corridors Plan and the nomination and declaration process for National Wildlife Corridors every three years and provide a report to the Minister.

2. Establishing enduring institutional arrangements

Establishment of an independent council will support the effective, long-term implementation of the Corridors Plan and ensure that the declaration of National Wildlife Corridors is based on robust and independent assessment. In performing its task, the council would endeavour to reflect community values and encourage a whole-of-landscape approach to corridor design and management, consistent with the objectives and principles of the Corridors Plan.

Successful implementation of the Corridors Plan will also depend on other permanent institutional arrangements, such as those applying to regional NRM organisations and local government. Section 1.7 discusses the importance of local and regional institutions in the design, establishment and management of corridors.

3. Promoting strategic investment in corridors

Corridors established according to the guiding principles outlined in the Corridors Plan will encapsulate, at appropriate scales, the areas where investment should deliver the greatest improvement in connectivity conservation in different landscapes. Implementation of the Corridors Plan

Community support and participation is an important part of the National Wildlife Corridors Plan.

should also encourage innovation in the design, establishment and management of corridors, including in the range and types of partnerships and collaborations developed to create a successful corridor.

National Wildlife Corridors might be given higher priority for funding under Australian Government programs. Other public and private organisations are encouraged to consider declared National Wildlife Corridors and other connectivity conservation opportunities when developing priorities for investments for conservation outcomes.

By identifying areas where investment will deliver specific connectivity conservation outcomes, declarations of National Wildlife Corridors will also support the implementation of a range of other conservation activities, such as sustainable agriculture and land management, biodiversity offsets and conservation covenants.

4. Working with stakeholders and supporting regional natural resource management planning

Regional NRM planning provides opportunities for collaboration between local communities, landholders, regional NRM organisations, NGOs, governments and industry partners. Regional NRM organisations are crucial to this process because they are brokers of regional planning (see Section 1.7 for more information). Aligning corridor development with regional NRM planning will encourage the creation of partnerships to build and support enduring corridors.

The Australian Government will support access to information about corridor design and planning through the Department of Sustainability, Environment, Water, Population and Communities website and other publications – see **www.environment.gov.au/biodiversity/wildlife-corridors/index.html**. The prospects for establishing wildlife corridors are good.

5. Monitoring, evaluating and reporting

The council will report on progress with the Corridors Plan and National Wildlife Corridors, annually.

The effectiveness of the Corridors Plan can be determined only if there is a system in place to monitor outcomes. High-quality long-term monitoring and evaluation will provide evidence about the appropriateness, effectiveness, efficiency and legacy of investments. This in turn will allow corridor managers to continuously adapt their management practices and generate a body of empirical knowledge about the impacts and effectiveness of particular management regimes.

New corridor initiatives should identify suitable indicators for accurately measuring progress at various spatial scales. The ability to collect, collate and interpret data in a consistent way is another important consideration in corridor monitoring strategies. A consistent monitoring approach will also make it more likely that information can be aggregated: this will help with tracking changes in ecological connectivity and function at greater spatial scales.
The Australian Government will develop guidelines and make available information on monitoring, evaluation and reporting. This will help individuals and organisations engaged in corridor initiatives to effectively design and carry out monitoring programs.

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 success of the network of wildlife corridors will depend on collaboration to ensure effective planning, management and performance reporting across jurisdictions and regions. New governance arrangements might be established or existing governance arrangements might be used where practicable. For example, regional NRM organisations can be well placed to coordinate corridor projects with a variety of partners. Organisations managing existing corridor initiatives might also broker new collaborative arrangements. Partnerships could involve state, territory and local governments, conservation groups, NGOs, private landholders, industry, philanthropic organisations, businesses, and Indigenous and community groups.

Corridor initiatives – including the six major existing corridors listed in Section 1.7 and described in the Appendix – are managed under diverse governance arrangements that have evolved over time and reflect the initiatives' different histories and the characteristics of their lead organisations. Some of the projects developed by NGOs have become incorporated bodies in their own right and maintain governing boards or councils, whereas some operate under less formal partnership agreements.

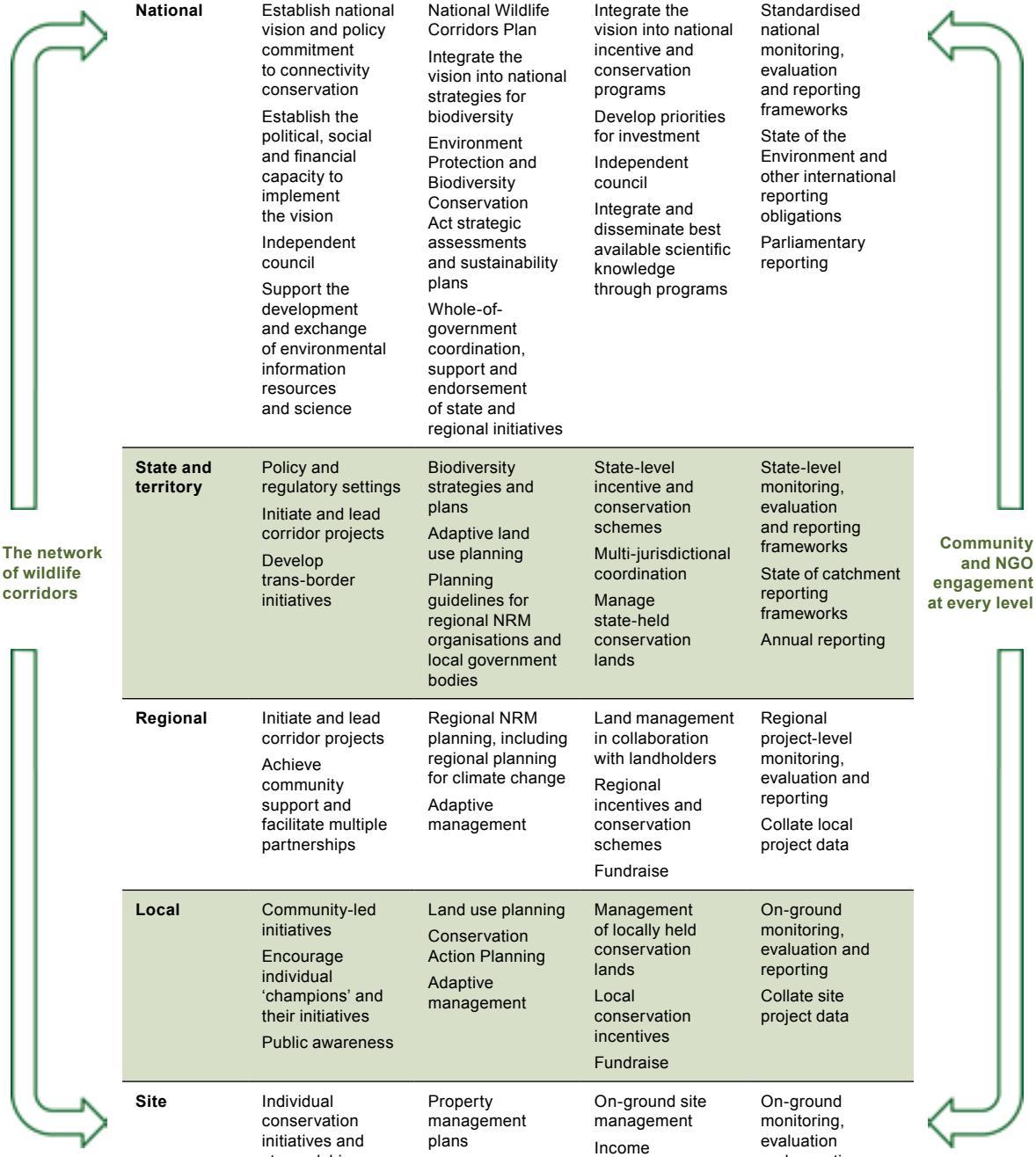
Future corridor initiatives will need to have governance arrangements suited to their scale and their varying administrative and funding requirements. It should be noted, though, that formalised governance arrangements help project proponents when seeking funding from both government and private sources and can give investors

confidence. The following features are common to the most successful corridor projects:

- *Accountability* – being answerable for decisions and having meaningful mechanisms for ensuring adherence to all applicable standards. Monitoring and evaluation should be incorporated in all corridor planning.
- *Transparency* – having clear roles and responsibilities, clear procedures for making decisions, and the skills necessary for effective management.
- *Integrity* – acting impartially and ethically and not misusing information acquired through a position of trust.
- *Efficiency* – ensuring the best use of resources and minimising the cost of administrative arrangements.
- *Flexibility* – ensuring that administrative and other governance systems remain capable of responding quickly and effectively to new information, unexpected events and changing priorities.
- *Leadership* – achieving a commitment to good governance through leadership at all levels and all spatial scales. Leaders should work collaboratively and seek to increase the capacity of future leaders. They should also look for innovative ways to respond to new and existing challenges.
- *Engagement* – engaging with stakeholders and cultivating enduring partnerships.
- *Social cohesion* – supporting inclusive social networks that foster community development and build social capital across working landscapes.

Proponents of future corridor initiatives are encouraged to consider incorporating these features in their governance arrangements.

A partnership approach that involves collaborative arrangements will assist with 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 (see Figure 6). These roles and responsibilities can be considered to cover several kinds of activities – leading, planning, implementing and evaluating. Many activities are carried out at more than one scale. For example, on-ground collection of monitoring information at site level and regionally can allow activities to be evaluated and adapted. At larger spatial scales information might be aggregated for analysis and evaluation against regional and national objectives.



Governance scale	Management functions			
	Lead	**Plan**	**Implement**	**Evaluate**
National	Establish national vision and policy commitment to connectivity conservation Establish the political, social and financial capacity to implement the vision Independent council Support the development and exchange of environmental information resources and science	National Wildlife Corridors Plan Integrate the vision into national strategies for biodiversity Environment Protection and Biodiversity Conservation 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 Develop priorities for investment Independent council Integrate and disseminate best available scientific knowledge through programs	Standardised national monitoring, evaluation and reporting frameworks State of the 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 Adaptive land use planning Planning guidelines for regional NRM organisations and local government bodies	State-level incentive and conservation schemes Multi-jurisdictional coordination Manage state-held conservation lands	State-level 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 Adaptive management	Land management in collaboration with landholders Regional incentives and conservation schemes Fundraise	Regional project-level monitoring, evaluation and reporting Collate local project data
Local	Community-led initiatives Encourage individual 'champions' and their initiatives Public awareness	Land use planning Conservation Action Planning Adaptive management	Management of locally held conservation lands Local conservation incentives Fundraise	On-ground monitoring, evaluation and reporting Collate site project data
Site	Individual conservation initiatives and stewardship Lead by example	Property management plans Local knowledge and expertise	On-ground site management Income diversification and investment strategies	On-ground monitoring, evaluation and reporting

Adapted from Worboys *et al.* (2010).

Figure 6: A collaborative governance and management framework

Information about the Corridors Plan is regularly published on the Department of Sustainability, Environment, Water, Population and Communities website **www.environment.gov.au/biodiversity/wildlife-corridors/index.html**.

APPENDIX
Existing major corridor initiatives

Gondwana Link

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

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, climatic 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. Approximately 17 per cent of Gondwana Link is part of the National Reserve System, and more than 40 per cent of the area is also recognised with National Heritage listing.

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 under way in the Great Western Woodlands.

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 such as 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 consisting of members from its lead contributing organisations. It encompasses regional centres such as Albany and smaller towns that depend on tourism to locations such as the Stirling Ranges and the 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 aim of the Great Eastern Ranges Initiative is to protect and connect native ecosystems along the 3600 kilometres of the Great Dividing Range and Eastern Escarpment from central Victoria to far north Queensland. A high proportion of Australia's total population lives within 100 kilometres

of the Great Eastern Ranges corridor, including the residents of Sydney, Melbourne, Canberra, Brisbane and major regional centres who rely on the catchments of the Great Eastern Ranges for their water supply.

The Great Eastern Ranges region is very important 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 in 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. Thirty-four per cent of the land in the region is part of the formal National Reserve System, providing a substantial base for conservation efforts.

The Great Eastern Ranges Initiative aims to reconnect fragmented habitats across land uses and complement the conservation work done in formal protected areas in order to respond to climate change threats. To date, the on-ground activity has concentrated on five priority partnership regions, developed through a conservation planning process along a 1200 kilometre stretch in New South Wales: the Border Ranges straddle the New South Wales Queensland state border and support particularly high levels of biodiversity; at the head of the Hunter Valley and in the Southern Highlands region project partners are working to restore localities with a high degree of landscape fragmentation; and the projects called Kosciusko to Coast and Slopes to Summit seek to build landscape-scale connectivity between the alpine region and adjacent geographical areas.

The initiative is led by a consortium of non-government organisations and the New South Wales 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 Great Eastern Ranges corridor. Leadership at the regional level is provided by a working group in each priority area. Landholders and industry groups are among the participants. The Great Eastern Ranges vision has always been to work along the length of the ranges almost the entire length of Australia east coast. While the on-ground work to date has concentrated in New South Wales, there is great enthusiasm for involvement in Victoria, Queensland and the Australian Capital Territory. Additional commitments have recently been made by government and non-government organisations in anticipation of achieving the broader Great Eastern Ranges vision.
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, across the borders of South Australia, New South Wales and Victoria. The project area covers 18 million hectares, stretching 700 kilometres from north to south.

The region ecosystems include grassy woodlands, red gum forests, heath and mallee, and landforms range 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. Approximately 27 per cent of the project area is protected in the National Reserve System. Over 50 per cent of the native vegetation in the area has been cleared, particularly in areas such as the Wimmera, where there is intensive agriculture. Climate change is likely to result in drier conditions and more frequent and intense bushfires across the region.

The Habitat 141° initiative is well established, with conservation action planning progressively being run across the project's nine zones. Contributing organisations have bought properties for conservation, and revegetation has begun on a large scale, over one million trees planted or grown from direct seeding. Hindmarsh Landcare Network, one of the contributing organisations, has linked protected areas such as the Big and Little Deserts. Ecological monitoring is supporting the development of management approaches for key environmental assets.

Partners in Habitat 141° include non-government organisations such as Greening Australia, The Wilderness Society, the Victorian Trust for Nature, catchment management authorities, and Victorian and South Australian 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 involves a council, an executive committee and working groups. The region is predominantly agricultural, with irrigated agriculture and grazing being major economic forces. Much of the land is privately owned. Large regional centres such as Ballarat and Mount Gambier 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.

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.

About 26 per cent of NatureLinks is part of the National Reserve System. The Nantawarrina and Yalata Indigenous Protected Areas and parts of Maralinga Tjarutja lands, Mamungari Conservation Park and Witjira National Park are managed by Traditional Owners. The ecological

condition of the landscapes varies substantially. In the highly modified corridor areas, such as Cape Borda to Barossa, restoration and revegetation projects are improving connectivity and increasing the resilience of the area. Invasive pest management is a 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, methods such as Conservation Action Planning are being used to coordinate efforts.

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 north to Port Augusta in the south. 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 aim of the project is to provide refuge for flora and fauna, protecting them from threats such as fire, feral animals, drought and climate change.

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 savannah, arid shrublands, woodlands and stony country. The various ecosystems provide habitat for a range of nationally threatened and endemic animals and plants. Fourteen per cent of the Northern Territory area is in the National Reserve System, including Litchfield, Gregory, Nitmiluk and West MacDonnell 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.

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 wetland systems are relatively undisturbed. Nevertheless, in the arid parts of the corridor, as elsewhere in 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.

The initiative aims to increase the extent of protected areas as well as develop mechanisms 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 2500 square kilometres of land has been dedicated to conservation management in the first year of the program.

The South Australian and Northern Territory Governments are each committing funds towards establishing the Eco-Link. The main land uses in the corridor area are conservation and grazing. Darwin, Alice Springs and Port Augusta are important 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** and **www.greeningnt.nt.gov.au/ecolinks/eco**.

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 threats to biodiversity and connect major conservation areas in eastern and western Tasmania, protecting up to 64 000 hectares of land that is crucial to conservation.

The climate of the Midlands is relatively dry: 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. Only 6 per cent of the Midlandscapes region is protected as part of the National Reserve System, but it is surrounded by important conservation areas. 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.

Eight targets have been identified by Midlandscapes as priorities for management 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 the involvement of 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. The protected area network and other existing vegetation remnants can be supported by being buffered and connected.

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 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**.

GLOSSARY

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

Anabranch a diverging branch of a river that rejoins the river downstream.

Biodiversity 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
- *ecosystem diversity* the variety of habitats, ecological communities and ecological processes.

Buffer a protective barrier around a core habitat area. It 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 the damage caused when high-quality habitat is surrounded by strongly contrasting land types (also known as 'edge effects').

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

Clean Energy Future plan the Australian Government's plan for reducing carbon dioxide emissions and re-investing funds raised to support further emission 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 an area in which the prevailing climate supports the set of environmental conditions a species might need in order to survive. If climate change occurs the area supporting these conditions might change over time.

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

- *landscape connectivity* the physical connection between areas with vegetation cover across a landscape
- *habitat connectivity* the connection between patches of habitat suitable to a 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 and 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, and threats and their causes and is used to develop strategies to abate threats, maintain or restore condition, implement action 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.

Ecosystem – a complex network or interconnected system or a biological community of interacting organisms and their physical environment; for example, combinations of plant, animal and other organisms in communities and their non-living environment (soil, water, climate, and so on) 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 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 – the Australian Government's primary legislation to protect and conserve biodiversity. It provides a legal framework to protect and manage nationally and internationally important plants, animals, ecological communities and heritage places and 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 **www.environment.gov.au/epbc/ index.html**.

Environmental Stewardship Program – part of the broader Caring for our Country program. It offers private land managers the opportunity to enter long-term contracts with the Australian Government to manage, protect and rehabilitate particular ecological communities on their own land. Funding is provided for 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.

Hydrological systems – networks of water in the environment, including inputs such as rain or snow, 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 Australians.

Invasive species a species occurring beyond its accepted normal distribution and that threatens valued environmental, agricultural, marine or social resources as a result of the damage it causes.

Landscape the relationship between people and place. It includes both the natural components of the environment (such as the geology, ecology, soils, climate, animals and plants) and the social and cultural components (such as the historical and current impacts of land use, human settlement, enclosure and other interventions).

Landholder an individual or legal entity that owns, leases or otherwise controls access to a property or parcel of land. It includes a range of entities, such as farmers, irrigators, croppers, miners, Aboriginal and Torres Strait Islander people, owners of lifestyle blocks, governments and public and private organisations.

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 and includes the following initiatives: the Carbon Farming Initiative, the Regional Natural Resource Management Planning for Climate Change Fund, Carbon Farming Futures, the Indigenous Carbon Farming Fund, Carbon Farming Skills, the Biodiversity Fund, and 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**.

National Environmental Research Program an Australian Government program that supports environmental research with the aim of improving our 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**.

National Plan for Environmental Information an Australian Government initiative to coordinate and prioritise 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 data sets. See **www.bom.gov.au/environment**.

National Reserve System Australia's network of formally protected areas that conserve examples of landscapes, native plants and animals. The reserve system is made up of more than 9000 protected areas, such as 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, in search of resources. This movement can be regular, often seasonal and repeatedly using similar routes, when it is described as migration. Alternatively, it can be more opportunistic, seeking occasionally available resources such as temporary wetlands; this is known as nomadic movement.

Non-government organisations this includes environmental organisations, philanthropic organisations, peak bodies and other organisations not controlled by government that represent discrete sectors of the community or industry.

Regional natural resource management organisations the 56 regional organisations recognised by the Australian Government and established by state and territory governments as either statutory or non-statutory bodies to coordinate and implement regional NRM planning. Within their regions they facilitate improved natural resource management through the provision of services to their local communities.

Peri-urban landscapes found at the expanding margins of urban areas. They can have characteristics both of urban and rural areas.

Resilience the ability of individuals or groups of individuals, species, ecosystems or landscapes to withstand or recover from an impact or other shock and quickly restore essential functions and capacities. In ecology, this can involve the way animals and plants deal with biodiversity loss, droughts, floods and fires, for example. In society, it can involve social processes for dealing with changes in population, employment, income, natural resource management and natural disasters.

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

Refugium 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 might 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 vegetation that differs from that in 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, usually provided by the 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**).

Sustainability – concerns 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 – connections across the landscape between habitat patches used by organisms. Such corridors represent one way of achieving various types of connectivity across landscapes, meeting the diverse needs of organisms at multiple scales. They 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, Working on Country supports projects that incorporate Indigenous traditional knowledge in managing and protecting land and sea country. The initiative includes the 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**.

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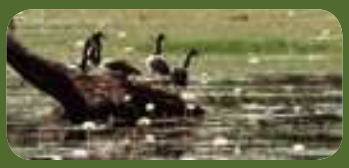

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