

CONNECTIVITY CONSERVATION: forging the nexus between biodiversity protection and climate action in Australia

Policy Discussion Paper 1/23

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KEY POINTS

The purpose of this policy discussion paper is to provide a summary of the importance of connectivity conservation for protecting and restoring biodiversity and ecosystems in Australia, including supporting Australia's response to climate change. It also provides guidance on the implications of connectivity for Australia's national biodiversity plan and related policy areas. Key points include:

1. Maintaining and enhancing ecosystem integrity and resilience through connectivity is a key element in the Kunming-Montreal Global Biodiversity Framework adopted at CBD COP15. Goal A and Targets 2, 3 & 12 explicitly recognise the importance of ecological connectivity for achieving biodiversity objectives.
2. Decisions taken by the UNFCCC at COPs 25, 26 and 27 reinforce the importance of integrating climate and biodiversity action for climate mitigation and ensuring ecosystem integrity. Protecting and restoring ecosystem integrity is an essential prerequisite for the success of Australia's commitments under the Convention on Biodiversity and the UN Framework Convention on Climate Change.
3. Connectivity conservation is also critical for achieving Australia's national biodiversity plan and meeting Australia's new goals of 30 by 30, preventing new extinctions and a 43% reduction in carbon emissions by 2030, leading to net zero by 2050.
4. All ecosystems, especially carbon dense ecosystems such as native forests, are the only means by which carbon can be removed from the atmosphere and accumulate in relatively stable, long-term ecosystem carbon stores. Protecting these ecosystems, therefore, has significant mitigation benefit by preventing anthropogenic emissions and enabling ongoing removals through natural growth.
5. 'Conservation corridors' provide a framework for conservation planning and implementation efforts informed by connectivity conservation and characterised by a whole-of-landscape approach, the integration of protection and restoration actions, partnerships within and between sectors, and coordination of actions across tenures and jurisdictions. In Australia, most conservation corridors are community-led in partnership with governments and NGOs, Traditional Owners and cognate enterprises.
6. Community-based connectivity conservation initiatives provide important vehicles for building partnerships within and across sectors and for the whole-of-landscape and system approach needed to address the multiple and interacting threats of habitat fragmentation, loss and damage, invasive species, and climate change.
7. Australia has been culturally connected for millennia by Songlines and other culturally significant pathways, including trade routes, that remain of great importance to First Nations people and are a living part of Australia's cultural heritage. Restoration of these can be important for strengthening connection to culture and country.
8. A national system of conservation corridors, with the National Reserve System and other protected areas as the cornerstones, would provide the foundation for enabling strategic, community-led connectivity initiatives that combine to create impact at the regional and continental scales.
9. This new national system could be implemented through a National Conservation Corridors Framework in support of the Australian Government's National Climate Resilience and Adaptation Strategy to ensure respectful, considered and meaningful consultation with stakeholders and support the roll-out of integrated nature-based solutions – those based on native ecosystems – that address our climate, biodiversity, climate-resilient development and health challenges.
10. Conservation corridors help safeguard Australia's unique species and ecosystems, maintain and restore the ecological integrity, resilience and adaptive capacity of our landscapes, waterways and seascapes and mitigate the impacts of climate change by:
 - Promoting coordinated, multi-scale biodiversity outcomes across tenures (public, private, leasehold, Indigenous)
 - Addressing the major threats to biodiversity that cascade and compound across tenures.
 - Maintaining and improving ecosystem carbon sequestration and storage and water quality through improved conservation management, increased protection and encouraging assisted natural regeneration in degraded landscapes.
 - Strengthening the population viability and resilience of wildlife, particularly threatened species through maintaining critical habitat, including source habitats and refugia, and movement pathways, on all tenures.
 - Supporting the natural adaptive response of species to climate change, including supporting dispersal to new locations providing suitable habitat.
 - Maintaining the ecological processes that sustain ecosystem integrity, including long distance species migration and transfer of pollen and plant propagules between otherwise disconnected areas.
 - Supporting biodiversity recovery following mega-disturbances.

- Contributing to climate-resilient development, and
- Improving community health, wellbeing and resilience.

11. Robust, targeted and ongoing research is needed – including monitoring and evaluation of ecosystem condition – to support adaptive management in the face of a rapidly changing climate and other pressures and threatening processes.
12. There are important social and cultural benefits that arise from the approach. These include building capacity among local communities, creating awareness of the benefits from and threats to a healthy environment, and helping to cultivate the social mandate in support of strong biodiversity and climate action.

INTRODUCTION

As Australia begins the challenge of updating its national biodiversity plan to implement the new global biodiversity framework, connectivity conservation has a vital role to play as a critical strategy for meeting Australia's new goals of 30 by 30, net zero new extinctions and 43% reduction in carbon emissions by 2030 leading to net zero by 2050.

Connectivity features strongly in the Kunming-Montreal Global Biodiversity Framework under the Convention on Biological Diversity, specifically in:

- **Goal A** - The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050.
- **Target 2** - Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity
- **Target 3** - Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures.
- **Target 12** - Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas.
- Connectivity is also highlighted as important in relation to the associated **Monitoring framework**.

Implementation of targets 1-8, 10-12 and 19, 22 and 23 of the framework would all be enhanced through community led, connectivity conservation initiatives.

The United Nations Framework Convention on Climate Change (UNFCCC) 27th Conference of the Parties (COP 27) continued to build on the critically important theme of integrating climate and biodiversity action:

- The preamble of the cover decision (CMA.4) reaffirmed the Glasgow/Paris Agreement language on the importance of ensuring the integrity of all ecosystems, including in forests, and the protection of biodiversity. At the same time recognising the critical role of protecting, conserving and restoring water-related ecosystems to deliver climate adaptation benefits and co-benefits.
- A new overarching decision (CMA 4 para 1) underlines the urgent need to address, in a comprehensive and synergistic manner, the interlinked global crises of climate change and biodiversity loss in the broader context of achieving the United Nations Sustainable Development Goals (SDGs). It also highlighted the vital importance of protecting, conserving, restoring and sustainably using nature and ecosystems for effective and sustainable climate action, and
- The mitigation section of the COP 27 Cover text (CMA 4 para 30) reconfirmed the Glasgow text on the importance of protecting, conserving and restoring nature and ecosystems to achieve the Paris Agreement temperature goal.

WHAT IS CONNECTIVITY CONSERVATION?

Connectivity conservation is a well-established, science-based approach that counters site-based approaches to conservation that manage remnant individual patches and reserves as isolated "islands". This locks many species into an ever-tightening extinction vortex by cutting off vital movement and adaptation pathways. The 'connectivity' part of connectivity conservation refers to various kinds of connections, including (Mackey et al., 2010):

- The structural configuration of habitats or habitat patches in a landscape mosaic.
- The permeability of a landscape mosaic for dispersal and movement of a species.
- The presence or absence of barriers or impediments to the natural flux of water, nutrients, or wildfire experienced in a landscape.
- Landscape permeability with respect to meta-population dynamics.
- Gene flows associated with micro- and macro-evolutionary processes.

FROM A SPECIES PERSPECTIVE connectivity needs to be considered at multiple scales of space (i.e.,

geography) and time (such as seasonal changes) depending on the mobility and requirements of the taxa or functional guild, for example:

Long-distance biological movement –

many vertebrates and invertebrates have stages in their life cycles where they undertake large-scale movements. For example around half of Australia's land and freshwater birds are migratory – some move seasonally while others are eruptive or opportunistic (Gilmore et al., 2007). The patterns of these long-distance dispersive bird movements are complex in space and time, such as whole-of-east coast, intercontinental, inland circular and coast-inland migrations (Griffioen and Clarke, 2002). Some Australian birds are altitudinal migrants, with important implications for their responses to climate change.

Networks of micro-habitat refuges

and core habitats – many species are dependent upon spatially restricted or temporally variable habitats, as well as drought and wildfire refugia and source habitats that support a population surplus. For example 16,500 small patches of monsoon rainforests (0.4% of land area of Kimberley and the northern half of NT) provide habitat for 585 plant species; narrow riparian strips along major water courses of north Queensland support an unrepresentative high proportion of biodiversity; and waterfowl, honeyeaters and flying foxes migrate out during lean times, undertaking broad-scale dispersal to find food resources (Woinarski et al., 2005).

Meta-population dynamics – The dispersal of individual animals between populations distributed across a network of habitat patches in a landscape (or bioregion) is essential for maintaining genetic health, re-populating patches where resident populations are extirpated and for juvenile animals that need to disperse from sites whose carrying capacity has been reached into the surrounding landscape in search of suitable habitat (O'Brien et al., 2008). For threatened species, such as the greater glider, connecting the remaining patches of suitable habitat is critical for their persistence and ongoing population viability. Pollinators and seed dispersers, particularly flying-foxes, enable genetic flow between isolated plants and ecosystem fragments, improving resilience and adaptive capacity.

Island biogeography – The size of reserves and the total area of protected habitat has been shown to be critical for maintaining viable populations of species at a bioregional level. For example, island biogeography analysis in south-west WA showed reserves of the order of 30,000–94,000 ha are required to conserve most of the avifauna of the wheatbelt (Kitchener et

al., 1982) and 40,000 ha approximates the area of nature reserve likely to conserve that part of the regional assemblage of mammals in southern Western Australia liable to persist in the face of anthropogenic disturbances. Fragmentation and lack of connectivity results in a growing extinction debt in the remnant patches and reserves of inadequate size. Therefore, connecting new ecological plantings with restored and remnant habitat patches is a critical conservation priority in heavily cleared and fragmented landscapes.

FROM AN ECOSYSTEM PERSPECTIVE, connectivity considerations are related to ecological landscape processes and especially (Mackey et al., 2007):

Hydroecology describes the role native vegetation plays in regulating surface and subsurface hydrological flows and in turn, the importance of water availability for ecosystem productivity. In arid and monsoonal Australia, for example, groundwater recharge and discharge are critical for maintaining perennial springs and water holes, river base flows, and perennial stream flow that provide essential habitat refugia networks for wildlife.

Highly interactive species refers to the fact that species at any given trophic level can play a major role in regulating resource availability and population dynamics over species at other levels. Australian examples include the vital role of flying-foxes and honeyeaters as key pollinators (Paton et al., 2000) and mesopredators such as the dingo (Glen et al., 2007). Maintaining connectivity for such trophically interactive species – including protecting and restoring trophic levels in a food web on a landscape-wide basis – is a critical factor for effective conservation planning that is rarely considered.

Natural disturbance regimes of particular ecological importance in Australia are the natural patterns of wildfire and flooding which for tens of millions of years have been selective forces acting on the evolution of Australian species' adaptive traits, and are an important influence on the biological productivity, composition, and landscape patterning of ecosystems (Bradstock et al., 2002). We must now also consider anthropogenic exacerbation of disturbances and impacts through land clearing and other disruptive process, including climate change.

CORRIDORS, CONNECTIVITY AND ECOSYSTEM INTEGRITY

“Conservation corridors”, as defined here, provide a framework for conservation planning and implementation efforts informed by connectivity conservation science and characterised by a whole-of-landscape approach, the integration of

protection and restoration actions, partnerships within and between sectors, and coordination of actions across tenures. In Australia, conservation corridors are in the main community-led but often in partnership with governments and NGOs, Traditional Owners and cognate enterprises (e.g. native plant nurseries). Two long-standing continental-scale connectivity initiatives are Gondwana Link (<https://gondwanalink.org/>) in south-west WA and the Great Eastern Ranges (<https://ger.org.au/>) which works across eastern Australia. These are both led by non-government organisations, and funded through a variety of sources. Both work across a wide spectrum of affiliated groups, improve permeability across state borders and between regional natural resource management boundaries, have strong international connections, have made substantial

achievements in on-ground change and have been pivotal in the development of a range of improved implementation tools and techniques. This includes the establishment of biodiverse plantings and assisted natural regeneration that meets urgent ecological needs, but which also provides climate mitigation and adaptation, economic, cultural and social benefits.

The term “corridor” however, is used in a range of related contexts (**Table 1**):

- A **landscape corridor** is the principal geographic setting for a given conservation corridor initiative, however, initiatives can be so extensive that they encompass a number of landscape corridors and
- **Linear, habitat, dispersal** and **ecological corridors** are all components of a landscape corridor.

Type of corridor	Definition
Landscape corridor	The main geographic setting of a connectivity conservation initiative that maintains or establishes multidirectional connections over entire landscapes and can encompass up to thousands of square kilometres.
Biodiversity or biological corridor	Biodiversity or biological corridor synonymous with landscape corridor.
Linear corridor	Establishment or maintenance of relatively straight-line connections between larger habitat blocks and extend over distances of up to tens of kilometres. Typically, linear strips of native habitat linking two larger blocks of the same habitat.
Habitat corridor	Can be synonymous with linear corridors or refer to a corridor comprising spatially disjunct “stepping stone” habitats.
Dispersal corridor	Synonyms include movement corridors and wildlife corridors, i.e., corridors designed to promote the movements or migrations of specific species or guilds.
Ecological corridor	Corridors that aim to protect and restore ecological processes including those that sustain habitat resources.

Table 1. Definitions of the various ways in which the term “corridor” is used in connectivity conservation initiatives. Sources: (Mackey et al., 2010, Anderson and Jenkins, 2006)

Other components of a landscape corridor include:

- **stepping stones** which are geographically disjunct areas of suitable habitat for a species that provide resting, feeding or reproduction resources during a species migration or dispersal.
- **buffers** which are used to help secure the boundaries of protected areas and corridors through a combination of bush regeneration and conservation management practices, and
- the **matrix**, which refers to the surrounding landscape outside protected areas and remnant bush and bush regeneration sites, i.e. the land being used for agriculture, mining etc. (**Figure 1**)

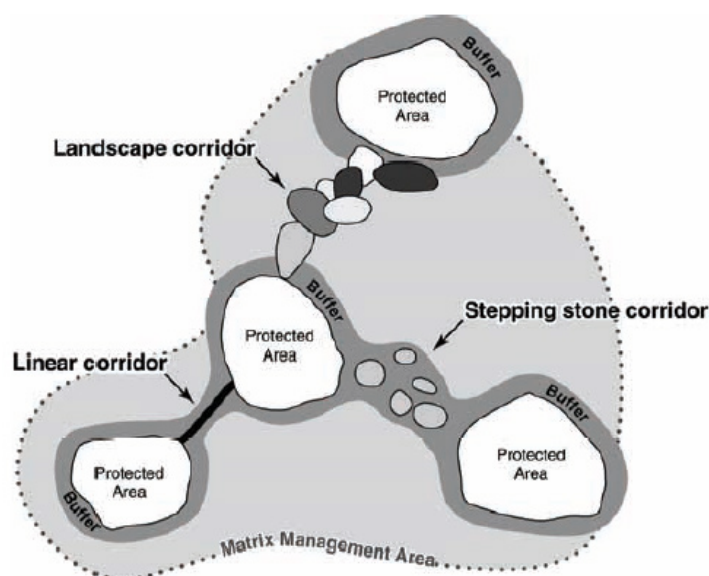


Figure 1. Some of the conceptual elements that comprise connectivity conservation spatial planning: core protected areas, the landscape-wide matrix management area, native vegetation that serves as stepping stones and linear corridors (Mackey et al., 2010) (Bennett, 2004).

CLIMATE CHANGE ADAPTATION AND CONNECTIVITY

We are already witnessing the severe impacts of human-influenced climate change on Australia's species and ecosystems (Mackey et al., 2022). However, it is critical for effective conservation planning to be based on an understanding of the multiple ways in which species and ecosystems respond to climate change and how these natural adaptations can be facilitated by connectivity conservation. There are six fundamental ways in which species are able to persist through climate change:

- **Long-distance dispersal** to locations that meet a species' physiological niche and habitat resource requirements. Given the extreme year-to-year variation in Australian rainfall and associated plant productivity, many Australian species are highly dispersive. They may be pre-adapted to rapid climate change (Smith and Smith 2012), highlighting the need to maintain ecological connectivity spatially and temporally.
- **Local adaptation** through microevolution in populations that possess modified or new traits that are better suited to the new conditions.
- **Phenotypic plasticity**, i.e., the natural variability in the physical expression of a species genome. For example, some plants can change their growth form from a tree to a bush in response to a shift in rainfall regimes.
- Contract to **climate refugia**, i.e., populations of a species become restricted to locations that retain at a local or topographic scale the required micro-climatic conditions that fall within the species physiological niche.
- Possessing a **wide fundamental niche** and being a **habitat generalist** means a species can successfully occupy a range of climatic conditions. For example, many Australian forest birds and mammals find suitable habitat in tropical, sub-tropical and temperate bioregions.

Connectivity conservation initiatives can support all of the potential species' responses to climate change through creating and protecting key conservation corridors. For example, landscape corridors can encompass the large scales needed to accommodate long-distance dispersal and the maintenance of genetic diversity in populations across a species' entire range. Protecting source habitats and refugia networks helps maintain a species' reproductive capacity and resilience.

However, understanding the ecological context of a given landscape is critical to identifying the appropriate connectivity strategies. For example, species that have narrow ranges, with limited dispersal capacity and are edaphic endemics – including those found in old climatically buffered

infertile landscapes (OCBILs) by proximity to ancient coastlines, with much of the Southwest Australian Floristic Region being one classic example – require connectivity conservation efforts that enable them to persist in situ in what are naturally fragmented and often small habitat patches (Hopper et al., 2021). However, while these landscapes contain what can be called OCBIL species – ones that have developed and lived in situ for millennia – they also contain more mobile species reliant on connectivity for their survival. The challenge here is to maintain the genetic heritage of ancient local endemics while restoring connectivity for those dispersive species, ensuring this does not accelerate invasion by recently introduced species, such as invasive weeds and predators.

Connectivity conservation also contributes more broadly to meeting climate adaptation needs. The IPCC 6th Assessment Report AR6 Working Group II on Impacts, vulnerability and Adaptation, including chapter 11 on Australia and New Zealand, provides useful insights into the importance of maintaining and enhancing ecosystem integrity for climate adaptation (IPCC, 2022), including that: safeguarding biodiversity and ecosystems is fundamentally important for achieving resilient climate development; building the resilience of biodiversity and supporting ecosystem integrity which maintains benefits for people, including livelihoods, human health and wellbeing and the provision of food, fibre and water, as well as contributing to disaster risk reduction and climate change adaptation and mitigation; and that protecting and restoring ecosystems is essential for maintaining and enhancing the resilience of the biosphere.

CLIMATE CHANGE MITIGATION AND CONNECTIVITY

Connectivity conservation initiatives provide a landscape-wide planning framework for the protection and restoration of ecosystems that supports both biodiversity and climate mitigation goals. All natural ecosystems, and especially carbon dense ecosystems such as native forests, are critical for climate change mitigation as they are the only means by which carbon can be removed from the atmosphere and accumulate in relatively stable, long-term carbon stocks (Keith et al., 2022). The mitigation value of protecting ecosystems from human land use impacts lies in the fact that significant and immediate anthropogenic emissions can be prevented and ongoing and additional removals achieved, through natural growth. For example, fostering recovery of degraded native forests allows their depleted ecosystem carbon stores to be replenished up to their natural carbon carrying capacity (Mackey et al., 2008) and their overall integrity and stability to be restored. This reduces the future risk of emissions associated with drought, fire, pests and disease.

The mitigation benefits of ecosystem protection and restoration were recognised in the IPCC 6th

Assessment Report, which states that among the mitigation options, the protection, improved management, and restoration of forests and other ecosystems (wetlands, savannas and grasslands) have the largest potential to reduce emissions and/or sequester carbon. Measures that 'protect' are ranked as having the single highest total mitigation and mitigation densities in the agriculture, forestry and land use (AFOLU) sector (Shukla and Al., 2022). They also have the greatest capacity to mitigate biodiversity loss and threatened species extinction. The IPCC 6th Assessment Report also recognised that carbon lost from carbon-dense ecosystems will likely be irrecoverable by 2050.

The critical factor in understanding the mitigation benefits of native forests and woodlands is that their carbon stocks are more dense, stable and long-lived compared to logged forests and plantations. This enhanced mitigation value is a product of their evolved biodiversity – the characteristic species, the genetic diversity they contain, and the complex food webs and synergistic community relations they form - which make them more resilient in the face of perturbations and ensures great adaptive capacity to accommodate environmental change, including human-induced climate change (Rogers et al., 2022). Protecting and restoring native ecosystems, therefore is a superior mitigation strategy compared to approaches that focus on establishing monocultures or non-ecological plantings (Mackey et al., 2020).

THREATS TO BIODIVERSITY AND CONNECTIVITY

Major conclusions from The Australian State of Environment Report for 2022 (CoA, 2022) include that:

- Habitat loss and degradation resulting from broad-scale clearing, logging, mining, urbanisation, transportation, energy production and agricultural activity is the primary reason for biodiversity loss and decline. Nearly 70% of Australian threatened taxa suffer from habitat loss and degradation - the most dominant mechanism by which species are threatened in Australia.
- Invasive species continue to be a major threat.
- Climate change and extreme weather events are becoming increasingly important as direct drivers of changes in biodiversity, with Australian ecosystems and associated species expected to continue to change substantially in response to threats like drought and fire that will increase in severity with climate change.
- Following the 2019–20 bushfire season, many species and ecosystems require rapid recovery interventions, mitigation of ongoing threats, and reassessment of their status.

These threats interact with each other resulting in compounding, cascading and aggregating impacts on species and ecosystems that cannot be contained by any single agency or within a given land tenure. Rather, their management requires a whole-of-landscape and systems approach and coordination of efforts across sectors and tenure – precisely the approach enabled through conservation corridors.

CONNECTIVITY AND TRADITIONAL KNOWLEDGE

There is increasing recognition in policy and practice of the practical conservation benefits to be derived from drawing upon both Traditional Knowledge and the information from modern scientific monitoring and assessment. This “two-toolbox” approach (Mackey and Claudie, 2015) is now being applied through programmes such as Indigenous Rangers, the co-management of protected areas, and conservation partnerships with First Nations organisations across Australia. From the perspective of connectivity, it is also important to acknowledge that Australia has been culturally connected for millennia by Songlines, trade routes and other culturally significant pathways. These remain of great importance to First Nations people and are a living part of Australia's cultural heritage. These often trace the journeys of ancestral spirits and contain information about the land, encoding the locations of resources across the landscape throughout the seasons and mapping sacred spaces and other notable places (Higgins, 2021). Rejuvenation and restoration of habitats along these ancient pathways have begun in some areas, are consistent with restoring ecological connectivity, and also provides multiple benefits to First Nations communities, such as employment and opportunities to reconnect with country and culture.

POLICY SOLUTIONS

A fundamental premise of connectivity conservation is that it provides a platform for actions that can improve the outlook for biodiversity and ecosystem integrity at the range of scales needed to respond to multiple threats. It deals with the causes of ecological decline and species loss rather than the symptoms. In addition to helping our unique species and ecosystems persist in the face of climate change and increasing land use pressures, ecosystem carbon sequestration and storage across landscapes is also protected and restored.

It is important that connectivity conservation planning and implementation be informed by robust, targeted and ongoing scientific research, including monitoring and evaluating ecosystem condition (Watson et al. 2017). This information supports the adaptive management now needed in the face of a rapidly changing climate and other compounding pressures and threatening processes.

Treating biodiversity as a potential co-benefit of climate action in the land has hidden the functional importance of biodiversity as a building block for success in long-term carbon retention. Climate action in the land sector that is not built on protecting and restoring biodiversity has a much higher risk of failure compared to actions based on an understanding of the functional role of biodiversity and how it underpins ecosystem integrity and stability (Rogers et al., 2022). Yet few mechanisms exist to foster holistic solutions to the linked global challenges we face. Government policy needs to recognise that the biodiversity and climate crises amplify each other and create new incentives which foster integrated action across land, forests and other terrestrial and coastal ecosystems.

Connectivity conservation helps curb the loss of Australia's unique species and ecosystems, maintains and restores the ecological integrity, resilience and adaptive capacity of our landscapes, waterways and seascapes. It makes a major contribution to the fight against climate change and mitigating its impacts by:

- Achieving coordinated, multi-scale climate and biodiversity outcomes across tenures (public, private, leasehold, Indigenous) and institutional boundaries.
- Addressing the major threats to biodiversity that cascade and compound across tenures.
- Maintaining and improving ecosystem carbon storage and water quality through protecting and encouraging assisted natural regeneration in degraded ecosystems.
- Strengthening the population viability and resilience of a range of wildlife, including many threatened species, through maintaining critical habitat networks on all tenures, including source habitats and refugia.
- Supporting the natural adaptive response of species to climate change including facilitating dispersal to new locations that provide suitable habitats and conditions (Watson and Watson 2015).
- Maintaining the ecological processes that sustain ecosystem integrity and the provision of ecosystem services.
- Supporting biodiversity recovery following mega-disturbances.

Connectivity conservation also contributes to climate-resilient development and community health and wellbeing. Many social and cultural benefits arise from the approach, including building and sustaining capacity among local communities, creating environmental awareness, and helping cultivate the social mandate in support of biodiversity and climate action. Connectivity conservation initiatives also enable individual and local efforts over time to be

understood in the context of wider and long-term endeavours, in turn fostering a sense of connection to and within community.

A national system of conservation corridors, with protected areas as the cornerstones, would provide the foundation for enabling strategic, community-led connectivity initiatives that combine to create impact at the local, regional and continental scales. This could be implemented through a National Conservation Corridors Framework in support of the National Climate Resilience and Adaptation Strategy. This would help ensure respectful, considered and meaningful consultation with stakeholders and support the roll-out of integrated nature-based solutions that address our climate, biodiversity and health challenges by:

- Ensuring that First Nations People are actively involved in the creation and implementation of the framework.
- Acknowledging, valuing and promoting the ecosystem service benefits to Australia of interconnected ecosystems on land and sea, including for climate mitigation and adaptation.
- Promoting strong integration of conservation corridors across government programs such as the National Reserve System and threatened species recovery plans and their inclusion in national environmental laws.
- Building upon the respective strengths of existing community-based frameworks including connectivity conservation initiatives, Landcare and regional NRM structures so that they complement and value-add each other.
- Recognising and providing funding to support established and emerging conservation corridors and related connectivity conservation initiatives with the necessary existing partner networks, ongoing projects and expertise to build on the foundations already in place, and
- Adopting guidelines for future funding programs that support the establishment of national, regional, and local-scale conservation corridors, including in areas where biodiversity is threatened by urban growth and where social inequality has impacted on both communities and wildlife.

A supportive and adequately resourced national policy framework is needed to ensure good governance and involve and empower landholders, regional communities, First Nations Peoples and other local groups to protect, connect and regenerate nature.

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CONNECTIVITY CONSERVATION:

a strategy to accelerate
effective action from the
practitioner's perspective.

Gondwana Link, the Great Eastern Ranges
Initiative and the National Landcare Network

Policy Discussion Paper 2/23

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INTRODUCTION

This paper draws upon our decades of experience in effective community led action across large landscapes. It complements and builds upon the policy discussion paper of Mackey et al¹ (2023) on the importance of connectivity conservation for protecting and restoring biodiversity and ecosystems in Australia, including as part of Australia's response to climate change.

Our aim is to promote discussion about where and how the Australian Government can be most effective in providing strategic support for additional initiatives that enhance the repair and restoration of the Australian environment, an endeavor that has gained extra importance following recent national commitments to global biodiversity framework goals. Our focus is on inclusive approaches that strengthen social fabric and community-based initiatives, particularly in rural areas.

Successive State of the Environment Reports have documented continuous decline in the ecological health of Australia². Yet few initiatives are demonstrating progress towards reversing that decline. Nevertheless, a range of government programs continue, the privately funded conservation sector has expanded rapidly, carbon offset programs have grown significantly, and Australia now has the prospect of significant private investment in the environment.

KEY POINTS

The strategies we propose will directly assist in the achievement of Australia's post 2020 biodiversity goals and targets and in meeting the national target of 43% reduction in carbon emissions by 2030 and net zero by 2050. They will correct some of the shortcomings identified in the review of *Australia's Biodiversity Conservation Strategy 2010–2030*³ and can strengthen our role in achieving the goals of the United Nations Decade of Ecosystem Restoration (2021–30)⁴.

The strategies we propose also align very closely with the 2021 ALP National Platform, which includes the statement:

“

Natural environment

Labor acknowledges that Australia's natural environment is in an overall state of decline and many of our unique species are threatened as never before by a combination of intensified climate change and loss of habitat.

It also notes the UN Secretary-General's view that nature-based solutions could provide one third of the net reductions in greenhouse gas emissions required to meet the goals of the Paris Agreement. For these purposes, Labor will revisit and reinvigorate historic programs initiated by previous Labor Governments.

It will:

- support the continued development of a comprehensive, adequate and representative National Reserve System, identifying as a priority those areas where the need to halt biodiversity loss is most urgent and also large intact areas that are still able to function in ecologically natural ways.
- work for the extension of Landcare programs which support environmental restoration and sustainable agriculture, mobilising volunteer effort but also assisting in the creation of employment at local and regional level; and
- implement a strategic, landscape-scale approach to managing biodiversity, having regard to the National Wildlife Corridor Plan which provides a framework for large landscape-scale connectivity conservation at regional and continental level.

”

To build and support the implementation of this platform, we propose five connectivity conservation strategies that meet the urgent need to accelerate ecological restoration in Australia. They are based upon an understanding that meaningful impact can only be achieved by scaling up well supported effort at the local community level. This is where the greatest operational efficiencies occur, where the practitioner knowledge has been accumulated over decades, where the local and regional sense of place ensures programs continue through any difficulties that arise, and where the geographical realities and community relationships support and encourage integrated effort in ways that are an essential complement to 'top-down' policies and programs. In our view these qualities have been well demonstrated through decades of work by landcare groups across Australia.

The strategies we propose are to:

1. Establish a **National Framework for Restoring Landscape Health** to promote connectivity conservation within and beyond regional boundaries, including cultural connectivity such as First Nation songlines. Its development would be guided by an advisory panel comprising practitioners, researchers, First Nations organizations and policy makers.
2. Establish a **National Community Connectivity Fund** to accelerate work already underway by including connectivity criteria in current grant programs and providing additional funds which support local community efforts to scale up their connectivity restoration programs.
3. Strengthen the community base required to maintain and re-establish connectivity networks across a multitude of landscapes through **increased funding for local Landcare groups**.

4. Secure and restore areas critical for landscape connectivity through a **'Sustainability Adjustment'** Program which would contribute to blended finance projects purchasing and restoring strategically placed parcels of land, including through the proposed Nature Repair Market.
5. **Build on the success of existing initiatives achieving long-term landscape scale connectivity conservation** by strengthening core funding and enabling a greater focus on the acceleration of on-ground work and a wider sharing of experience.

HISTORICAL CONTEXT

For many years the government and community conservation agenda has been dominated by six main approaches:

1. **Establishment of a 'Comprehensive Adequate and Representative' (CAR) protected area system**, largely managed by the States. Protected areas are an essential mechanism for conserving our natural ecosystems and wildlife, yet much biodiversity invariably remains unprotected and many reserves are not large enough or sufficiently inter-connected to be ecologically adequate in a time of climate change and global ecological decline. The need for more and better-connected protected areas was recognized at the recent COP15 in Montreal⁵ and the Australian Government's new commitment to conserving and connecting 30% of both terrestrial and marine ecosystems that followed was a positive step in the right direction. While necessary, protected areas alone are insufficient to conserve biodiversity and must be complemented by conservation action in the remaining 70%.
2. **Regulation of larger development proposals** through various State government environmental powers and the Commonwealth's EPBC Act – with recent commitments to strengthen the operation of the EPBC Act being very welcome. However, this activity is concerned with prevention of major individual acts of degradation and pollution, rather than the cumulative impacts from historical development and a variety of smaller proposals.
3. **Various arrangements which support scientific research**, largely theoretical and undertaken through disconnected academic ventures, with arguably less attention given to the mechanisms which deliver much needed technical and scientific support to practitioners. However, the science is clear and has been for decades - without the rapid implementation by practitioners of transformative approaches restoring habitat across whole landscapes, Australia will continue to lose species and the ecological services that healthy landscapes provide.
4. **Reactive and narrowly focused emergency actions focused on recovery of individual rare and endangered species**, with the Recovery Planning process tending to focus on services that provide species-specific actions rather than broader habitat restoration. There have been individual successes with this approach, but they come with high operating and maintenance costs, and will remain fragile until greater attention is given to essential habitat requirements and the restoration of broader ecological functions.
5. **Programs to mitigate dispersed examples of degradation and decline**, with funding largely delivered through the NRM region



Reforest Now, a Landcare NSW member group had just planted 23,258 rainforest trees in torrential rain over 3 days. Reforest Now has planted over 500,000 trees since 2019 and aiming to plant 300,000 rainforest trees of ~200 different species. The planting site runs along 7 kilometres of the Wilsons River in Clunes NSW, near Byron Bay. **Image credit** Paul Daley

structure. This approach dates back to the Howard Government but there seems to be little data available to demonstrate its effectiveness. While there have been some successes in treating some specific local instances of degradation, and possibly slowing the rate of overall decline, there is no evidence of progress in reversing the larger trends evident over the last two decades. Additionally, in some regions of Australia the federally funded NRM regional approach appears to have reduced local community capacity and action and enabled extensive cost shifting by State governments⁶.

6. Core funding provided directly to locally based caring for country programs developed and implemented by First Nations organizations.

This notably successful approach has produced widespread ecological, social and cultural benefits across large areas of Native Title lands in Australia, and was recognized as such in the 2021 State of Environment Report. The approach – of providing core funding to local communities working on locally agreed priorities – mirrors the original government support provided to Landcare groups in the 1980s and 1990s, a period of rapid growth in both the Landcare movement and its effectiveness across large areas⁷.

In the past few decades other significant changes have occurred:

- The privately funded conservation sector has expanded considerably, particularly through the growth of groups who secure private properties and manage them for conservation. They have increasingly established their own research and data collection capacity to support evidence-based decision making.
- Despite the growth in the overall number of locally based Landcare groups, their geographic coverage has reduced in agricultural and pastoral regions. This is a consequence of the centralising impact of the NRM region approach and of changes in funding arrangements. A significant number of agriculturally focused Landcare groups have been absorbed into the better funded industry groups, who have a much greater production focus than was the case during the establishment years of Landcare.
- There has been a reduction in the size and scope of many State government departments involved in land management. As a consequence, local groups are increasingly having to undertake land management tasks that were once undertaken by State agencies, while State agencies are now more policy-focused despite having less ability to ensure those policies are implemented.
- There has been an increased need for short term responses to increasingly frequent major natural disasters—drought, megafire

events, storm events and floods. They largely deal with the aftermath of such events, and greater attention needs to be paid to prevention through understanding and responding to the local, regional and global causes.

- A select few large landscape scale, cross-tenure, multi group initiatives have established and persisted, achieving measurable change. We particularly note the ongoing success of Gondwana Link, the Great Eastern Ranges Initiative and the Indigenous Desert Alliance. We deeply regret the loss of many other initiatives that worked at scale for some years but declined after the change of national government in 2013. These include the demise of the SA NatureLinks, Trans Australia Eco Links and Habitat 141 initiatives.
- As the impacts of climate change have become better known, Government has invested heavily in the energy transition. However, the funds available for nature-based solutions and the mitigation of ecological damage caused by climate change, have been static or reduced.

The narrow focus of successive governments on carbon sequestration in the land sector has largely missed a huge opportunity to bolster protection and restoration of native vegetation within an ecological context and strengthen long-term carbon retention. Policies and programs have ignored the most cost-effective and highest integrity climate mitigation strategy – protection and restoration of our most significant and resilient ecosystem carbon stocks. Connectivity conservation presents a climate mitigation advantage by ensuring biodiversity outcomes are the driver and ecological integrity is a key outcome. This provides increased stability, resilience and residence time for the carbon storage achieved and decreases the risk of future loss to the atmosphere. It also ensures higher levels of social acceptability.

AUSTRALIA'S INTERNATIONAL CONTEXT

Australia was the first country in the world to establish a connectivity conservation framework for landscape scale conservation. After the change of government in 2013, the framework National Wildlife Corridors Plan was abandoned, many previously established connectivity programs consequently lapsed and Australia now lags many jurisdictions, including the United States, in connectivity policy development and practice. Nevertheless, the ALP platform for nature conservation, if implemented well, would restore our capacity and standing⁸.

In October 2022 State and Commonwealth Environment Ministers agreed to set a national target of protecting 30% of Australia's land and 30% of our oceans by 2030. As part of achieving that goal, the Australian Government is currently

exploring the recognition of 'Other Effective Area-Based Conservation Measures' (OECMs)⁹, which are a defined category under the United Nations Convention on Biological Diversity (CBD) and recognised by the International Union for the Conservation of Nature (IUCN) who have produced guidelines on their establishment and operation¹⁰. Connectivity conservation initiatives can make a significant contribution to achieving valuable OECMs, perhaps particularly through the ability of reserve areas to meet CAR objectives. They are essential for improving the often neglected 'Adequate' and 'Comprehensive' elements of the CAR approach. Connectivity initiatives buffer and reconnect existing protected areas and have a major role to play in maintaining and enhancing the integrity, resilience, stability and adaptive capacity of those areas in the face of climate change.

The years 2021-2030 are the UN Decade of Ecosystem Restoration, established to prevent, halt, and reverse the loss of nature. The Gondwana Link program in Western Australia has been recognized by UNEP as one of the *Founding 50* implementers for the global effort. An Australian Restoration Decade Alliance, made up of 21 leading Australian organisations, including Gondwana Link and the Great Eastern Ranges Initiative, has been established to promote the Decade and to support information exchange between its members. A statement of agreement across members of the Alliance has been established¹¹.

Despite the UN Decade's significance and support on a global level we are unaware of any Australian Government programs that directly support it.

STRATEGY

We must address causes rather than the symptoms. Landscape scale protection and restoration initiatives provide the most effective pathway for the delivery of resilient, long-term nature-based solutions to mitigate and adapt to climate change and ecological decline. These solutions are best delivered through straightforward mechanisms that directly reverse the causes of decline. We are concerned that some mechanisms currently being proposed, such as the Nature Repair Bill, are unnecessarily interventionist and rely too heavily on unpredictable and largely untested market mechanisms.

We propose a five-point strategy which builds upon existing approaches to drive a rapid scaling up of locally led ecological initiatives that can reverse the current decline. The strategies recognise that well supported local community efforts are fundamental to achieving the levels of change required.

The strategies we propose are to:

1. **Provide guidance and promotion for connectivity conservation and cultural restoration efforts** by establishing an advisory panel of researchers, practitioners, First Nations organizations and, policy makers to determine national priorities and guidelines, identify national restoration priority areas and to promote the importance of restoring connectivity at a continental scale.



ReForest Now volunteer Tess celebrating the soil and volunteer impact for environmental restoration.
Image credit Franzi Kinzel.

2. **Accelerate work underway by including connectivity criteria** in current grant programs and establish a National Community Connectivity Fund specifically for local communities wishing to significantly scale up their efforts through strategically placed restoration and connectivity conservation projects.
3. **Strengthen the community base for connectivity efforts** by supporting active community based landcare groups focused on projects that repair past environmental damage and build resilience in both ecological and community infrastructure.
4. **Secure and restore areas critical for building connectivity** through a 'Sustainability Adjustment' program contributing to blended finance projects which purchase and restore strategically placed parcels of land essential for the re-establishment of connectivity between important areas of natural habitat, including Australia's conservation estate.
5. **Build on the success of existing long-term landscape scale connectivity conservation initiatives** by strengthening their core funding and enabling a greater focus on both increased on-ground achievements and a wider sharing of experience.

MORE DETAIL ON THE STRATEGY

1. Provide guidance and promotion for connectivity conservation

There is an urgent need to prioritise and support habitat restoration efforts across Australia, particularly those that can achieve habitat restoration at a nationally significant scale. Key elements of the science are already developed but need to be brought together with the practical knowledge of those who have already successfully operated programs and developed technical prowess.

It is of the greatest importance to work from the understanding that, ecologically, much of Australia (especially the semi-arid and arid biomes) is the land of 'boom and bust' wildlife movements and that ecological and evolutionary processes work at very large scales, well beyond the scope of a single landscape or region¹².

We propose establishment of a Landscape Health Advisory Group tasked with developing a National Framework for Restoring Landscape Health through respectful, considered and meaningful consultations. This would build on the 2012 National Wildlife Corridor Plan while also complementing the National Climate Resilience and Adaptation Strategy and the National Biodiversity Conservation Strategy. It would encourage the expansion of integrated nature and culture-based solutions for issues

of climate, biodiversity and health while addressing weaknesses identified through the Review of *Australia's Biodiversity Conservation Strategy 2010–2030*. It would also support the regional planning approach foreshadowed in the Government's *Nature Positive Plan*, released in December 2022.

Australia has been culturally connected for millennia by songlines and other culturally significant pathways that continue to be of great importance to First Nations people, and are a living part of Australia's cultural heritage. The physical restoration of these pathways supports First Nations aspirations by strengthening cultural and ecological connectivity. Significant pioneering efforts for the achievement of these objectives at scale are already underway across key landscapes. For instance, in the Cultural Corridors program underway in the Wudjari Nyungar section of Gondwana Link, the Wudjari people, represented by the Esperance Tjaltjraak Native Title Aboriginal Corporation, work cohesively across 1 million hectares of land in an area that is a mixture of farming and original habitat.

Development of a National Framework would enable:

- a. existing science and experience to be drawn together into a cohesive action plan that encompassed the ecological priorities and the practical realities applicable for the achievement of transformative change across multiple tenures;
- b. identification of an initial tranche of National Wildlife Connectivity Priority Areas, including (as appropriate) areas covered by programs already operating as well as other known strategic areas for wildlife migrations and key refugia and dispersal points;
- c. community nomination of National Wildlife Connectivity Priority Areas, and their assessment through processes to be established and applied by the Advisory Group;
- d. promotion of stronger integration of connectivity values across government programs and their inclusion in national environmental laws;
- e. a partnership with First Nations organizations to achieve synergies between the restoration of critical connectivity across habitats and, based on their knowledge, permission and guidance, the structural restoration of key storylines and songlines across Australia; and
- f. development of guidelines for future funding programs that support the establishment of national and regional-scale connectivity conservation areas, including in areas where biodiversity is threatened by urban growth and where social inequality has impacted on both urban communities and wildlife.

2. Accelerate work underway by including connectivity criteria

Despite the pivotal importance of connectivity for the protection of essential wildlife movement and the restoration of ecological function, work to improve habitats through habitat connectivity receives minimal attention in environmental grant rounds. We propose it be ranked as a priority criterion in all funding rounds for on-ground work, and that a specific National Community Connectivity Fund be established to direct funding to long-term community led initiatives.

The value of this approach was evidenced through the work of the earlier Commonwealth Biodiversity Fund, which attracted many ambitious proposals from a wide range of organisations and supported projects lasting up to 5 years. Successes included the establishment in Great Eastern Ranges of the Kanangra-Boyd to Wyangala Partnership in Central Western NSW and the Jaliigirr Biodiversity Alliance on the North Coast of NSW. They persist to this day as vibrant exemplars of connectivity conservation in practice.

A National Community Connectivity Fund would have a particular focus on the priority areas identified through the proposed Landscape Health Advisory Group, and support programs designed and implemented at a local level within a wider connectivity context (such as the Glideways and Flyways programs across the Great Eastern Ranges).

3. Strengthen the community base for connectivity efforts

Any growth in connectivity conservation in Australia, at macro and local scales, will rely heavily on the support and involvement of locally engaged communities who have maintained the capacity to undertake a wide range of projects that repair past environmental damage and build resilience in both ecological and community infrastructure.

The National Landcare Network, with the support and endorsement of its eight state member bodies and their thousands of members, has already made a funding submission to Government, seeking \$50 million per year over five years¹³. This support is essential underpinning for efforts to restore connectivity across a multitude of landscapes. Given Landcare's proven track record¹⁴, this investment would guarantee a return to regional communities of at least an additional \$350 million.

4. Sustainability Adjustment

Australia's farming areas were established long before the concept of sustainability was understood, particularly across landscapes. As a result, a number of ecologically critical areas have been irretrievably lost and, in many cases, marginal and degradation susceptible land which would have been better left uncleared has been unnecessarily damaged¹⁵.

This is particularly the case in areas like inland south-western Australia, where vast expanses of public land were rapidly alienated to agricultural use from the late 1950s onward, causing significant degradation, salinisation and ecological damage. In that region the



Tag along Tour Welcome: 'Noongar Elder Eugene Eades welcoming visitors with a smoking ceremony on the 800ha Nowanup property, where restoration plantings have connected the Corackerup Nature Reserve with linear habitats along Corackerup Creek, in the Fitz-Stirling section of Gondwana Link.' **Image credit** Michelle Stanley

restoration of 20,000ha of strategically placed land within a 20 million ha agricultural area, would fill critical habitat gaps and achieve 1000kms of connected and intact habitats – effectively across the climate gradient from the wet forests to the dry inland¹⁶.

Governments across Australia have previously operated rural adjustment programs for social and financial reasons, including one Gippsland program to rationalise land use that reduced damaging downstream flooding¹⁷. In Western Australia the provisions of the Rural Adjustment and Finance Corporation were used to provide adjustment incentives to landholders affected by significant clearing controls who were willing to sell their land for private conservation purposes¹⁸. Until recent years the Australian Government also successfully operated a National Reserves System (NRS) program that supported purchases of ecologically critical habitat by state conservation agencies and a range of private conservation interests. A combination of these approaches is required to realise the benefits of rationalising land uses to better meet a range of contemporary objectives.

A Sustainability Adjustment Program is proposed to provide Commonwealth Government support for the voluntary acquisition of land identified as high priority for ecologically critical linkages, or to buffer ecologically critical areas from damaging land uses.

The establishment and operation of this program would build on the strengths of both the previous Rural Adjustment and National Reserve Systems programs. It would possibly best operate similarly to the current Clean Energy Finance Corporation, but through a land-based approach. The program would contribute to blended finance strategies permitting the purchase and restoration of strategically placed land essential to the restoration of ecological and cultural connectivity at scale - strengthening the links between important areas of natural habitat. We envisage that at least some of this activity can be conducted on a 'revolving fund' basis, whereby properties are promptly secured from willing sellers at market prices and then on-sold to conservation interests. State-based models using this approach have operated well in some jurisdictions for many years.

A Sustainability Adjustment Program, operating in conjunction with the guidelines and geographic priorities identified in the proposed National Framework for Restoring Landscape Health, will also accelerate development of an active Nature Repair market in Australia.

There is also a possible role for the application of incentives for sustainability adjustment that encourage and enable the range of conservation land purchase and revegetation measures, already underway and funded through carbon credits, to focus on priority conservation areas

and away from high priority agricultural areas.

5. Through modest funding, build on the success of existing long-term landscape scale initiatives

Despite policy fluctuations over recent decades, the existing large-scale landscape repair programs have grown steadily, largely independent of government support. Gondwana Link and the Great Eastern Ranges Initiative provide invaluable foundations from which a larger and more robust national strategy can be built. They have already demonstrated considerable leverage capacity in attracting significant funding for on-ground works, tapping into the considerable public understanding and support for large scale connectivity restoration.

They have also demonstrated that substantial cost efficiencies can be achieved through focused and collaborative effort undertaken at the grass roots. Both programs operate very small core teams, who work with often precarious program funding, while focussing on building the capacity and involvement of their affiliated organisations to achieve on-ground change. And they have persisted through two decades of turbulent financial markets and political agendas.

Despite their lean budgets and success in attracting funding to vital projects, these initiatives have long struggled to achieve core funding for their overall programs. The Great Eastern Ranges program across eastern Australia operates over 3,600 kms with a core staff of 4 FTE while the Gondwana Link program operates over some 1000 kms with a core staff of 3 FTE. While this is commendable efficiency, core staff must spend considerable effort seeking funding and other resources to maintain their organisations. This detracts from their essential work supporting and inspiring collaborative efforts across their landscapes.

As an example of their leverage ability: from its very modest core annual budget of around \$340,000 Gondwana Link has directly facilitated over \$13 million into on-ground efforts over the past 18 months, with significant additional funds being secured by affiliated organisations. Great Eastern Ranges has achieved some \$5 million in cash and in-kind over the past two years, with over 80 per cent applied to on-ground activity.

It is proposed that the Commonwealth support a transition process, through a core fund of \$1.5 million per year over five years, which would enable these organisations to achieve rapid growth in their connectivity efforts, adopt more inclusive management structures and employ sufficient staff to remain sustainable.

They would then provide a body of practice and experience able to be drawn on to support the development of other large landscape approaches across Australia.

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Connecting the Dots

Achieving synergistic action for global biodiversity and climate goals utilising the Kunming-Montreal Global Biodiversity Framework

Technical Brief | UNFCCC COP 28
November 2023

Prepared by the World Commission on Protected Areas (WCPA) and the Climate Crisis Commission (CCC) of the International Union for the Conservation of Nature (IUCN)



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Introduction

Calls to integrate climate and biodiversity action have been mounting in the UNFCCC, culminating in key decisions at COP 27 (Decision 1/CP.27 para 1 and Decision 1/CMA.4 para. 1) that underlined **“the urgent need to address, in a comprehensive and synergistic manner, the interlinked global crises of climate change and biodiversity loss in the broader context of achieving the Sustainable Development Goals...”**. These decisions followed several relevant and important conclusions by IPCC AR 6 WGIII, notably that protection and restoration of natural ecosystems offers high mitigation potential with ‘protection offering the highest mitigation value of any action in the AFOLU (Agriculture, Forestry and Other Land Use) sector and that **‘high synergies with biodiversity exist in carbon dense ecosystems such as primary forests.’** (1)

The joint IPBES/IPCC workshop in 2021 (2), which revealed where synergies between biodiversity protection and climate mitigation lie, has yet to be built on, pointing to the need for either a joint IPBES/IPCC or joint CBD/UNFCCC SBSTA work programme (3). However, **the Kunming-Montreal Global Biodiversity Framework (K-M GBF) also provides a new opportunity to integrate climate and biodiversity action, support the rights and livelihoods of Indigenous peoples, and underpin climate resilient sustainable development.** Importantly, the UNFCCC can also embrace the GBF adopted by the CoP of the CBD in line with the mandates of the UNFCCC and the Paris Agreement.

This is feasible because an important area of overlap between the CBD, UNFCCC, and SDGs is their dependence on retaining and recovering the ecological integrity of ecosystems, or ecosystem integrity, which is in turn dependent on retaining and recovering biodiversity.

The UNFCCC/Paris Agreement Mandate on Ecosystem Integrity

During formulation of the Paris Agreement there were calls by many Parties to embrace holistic land sector climate solutions⁴ and ensure the Agreement's operational provisions support rights and protect biodiversity and ecosystem integrity. Ultimately the preamble to the Agreement reflected these calls and thus they are still applicable to all climate actions. Recent IPCC conclusions and UNFCCC COP decisions (5) make it an appropriate time to build on the language in the preamble and fully operationalize Article 5 of the Agreement.

We are at an important inflexion point for increased understanding that biodiversity is the foundation on which successful climate mitigation action in land, forests, and other ecosystems must be built in order to minimize the risk of losing ecosystem carbon to the atmosphere (6). This understanding has brought into sharp focus the relevance of biodiversity and ecosystem integrity for the conservation and enhancement of sinks and reservoirs of all terrestrial, coastal, and marine ecosystems (as per the preamble and in Article 5 of the Paris Agreement, which cross-references Article 4.1(d) of the UNFCCC)

Moreover, retaining and improving the adaptive capacity of ecosystems, including forests, in the face of climate and other anthropogenic pressures depends on maintaining their biodiversity to enable continuation of the foundational ecological and evolutionary processes (7).

Article 2 of the UNFCCC explicitly calls for retaining the adaptive capacity of natural ecosystems, stating that we must **“... achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.”** Article 7 of the Paris Agreement reinforces this adaptation objective.

IPCC AR6 WGII provided important insights into the potential role of the K-M GBF in helping to retain and improve the adaptive capacity of ecosystems, notably concluding:

“Safeguarding biodiversity and ecosystems is fundamental to climate resilient development, in light of the threats climate changes poses to them and their roles in adaptation and mitigation (very high confidence). Recent analyses, drawing on a range of lines of evidence, suggest that maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% -50% of Earth's land, freshwater, and ocean areas, including currently near-natural ecosystems. (SPM.D.4)” And:

"Protecting and restoring ecosystems is essential for maintaining and enhancing the resilience of the biosphere (very high confidence). Degradation and loss of ecosystems is also a cause of greenhouse gas emissions and is at increasing risk of being exacerbated by climate change impacts, including droughts and wildfire (high confidence). Climate resilient development avoids adaptation and mitigation measures that damage ecosystems (high confidence). Documented examples of adverse impacts of land-based measures intended as mitigation, when poorly implemented, include afforestation of grasslands, savannas and peatlands, and risks from bioenergy crops at large scale to water supply, food security and biodiversity (SPM.D.4.2)."

Maintaining biodiversity and associated natural processes is therefore key to on-going ecosystem integrity and provides the foundation for effective climate mitigation and adaptation in the biosphere and the provision of all ecosystem services, including carbon retention, on which humanity depends. (8)

The CBD Mandate on Ecological Integrity

The protection and recovery of biodiversity and ecological integrity are pillars of the K-M GBF and of central importance to the Convention on Biological Diversity as they underpin every ecosystem service on which humanity relies. (9)

While the entire K-M GBF framework would make a strong contribution to protecting and recovering ecological integrity and thus help protect and recover biosphere carbon reservoirs and maximize the resilience and adaptive capacity of ecosystems (10), several of the K-M GBF goals and targets are critically important for climate mitigation and adaptation and should be reflected in both Nationally Determined Contributions (NDCs) and National Biodiversity Strategy and Action Plans (NBSAPs). Goals A & B and Targets 1,2,3,4 & 8 are particularly relevant and outlined in Attachment A.

The effectiveness of climate mitigation and adaptation action in land, forests, and other ecosystems would be enhanced if, as a minimum, they were guided by and contributed to the K-M GBF goals and targets. With 30% of terrestrial and marine ecosystems needing to be protected through high quality conservation measures (Target 3) and a further 30% needing to be restored by 2030 (Target 2) in order to recover biodiversity and ecological integrity, it makes sense for these targets to inform climate action in land, forests, and other ecosystems.

Utilizing spatial planning (Target 1) to retain and recover areas of high ecological integrity, buffer and reconnect protected areas, and using new conservation tools such other effective area-based conservation measures (OECMs) (11) and connectivity conservation approaches (12) would deliver high synergies and lower-risk climate mitigation and adaption outcomes. The success of these approaches is closely linked to working with Indigenous and local communities to support and enhance climate resilient sustainable development, their rights, and cultural aspirations.

The importance of ecosystem integrity for carbon retention

Understanding the importance of biodiversity and ecosystem integrity for climate mitigation requires a deeper appreciation of the functional role of biodiversity in underpinning ecological processes and the provision of all ecosystem services including the ecosystem service of carbon retention. Ecosystem integrity affects the ability of all ecosystems to store carbon over long periods of time. (13)

The definition of ecosystem integrity adopted by the UN Statistical Commission in its System of Economic and Environmental Ecosystem Accounts is useful:

"The system's capacity to maintain composition, structure and function over time using processes and elements characteristic for its eco-region and within a natural range of variability. The system has the capacity for self-organisation, regeneration and adaptation by maintaining a diversity of organisms and their interrelationships to allow evolutionary processes for the ecosystem to persist over time at the landscape level. Ecosystem integrity encompasses the continuity and full character of a complex system."

Notably, the IPCC defined ecosystem integrity as "the ability of ecosystems to maintain key ecological processes, recover from disturbance, and adapt to new conditions" (IPCC AR6 WG11, SPM footnote 50). (14)

Actions that help retain and recover ecosystem integrity, including the protection and recovery of the natural composition, abundance, and structure of biodiversity, contribute to ecosystem integrity and underpin the critically important ecosystem service of carbon retention, reduce the risk of GHG release to the atmosphere, and improve the longevity of carbon storage. Improving ecosystem resilience and resistance to threats that are increasing with climate change will help to conserve and recover carbon reservoirs in the Biosphere and improve their adaptive capacity (15) — both key goals of the UNFCCC and Paris Agreement. Attachment B reveals how to reflect ecological integrity and its relevance for carbon retention in forests.

Conclusion

The ecosystem service of carbon retention, together with every other ecosystem service, is dependent on the protection and restoration of biodiversity. Given the functional roles of biodiversity in ecosystem processes, its protection and restoration is essential for conserving carbon reservoirs in the biosphere and achieving the mitigation goals of Article 4.1(d) of the UNFCCC and Article 5 of the Paris Agreement.

Implementing the GBF goals and targets will also improve the natural adaptive capacity of ecosystems and the services they provide, and are thus key to delivering the adaptation goals of Article 2 of the UNFCCC and Article 7 of the Paris Agreement.

Recommendations

1. **Recognize that ensuring the integrity of all ecosystems including forests and oceans, through improved protection, restoration, and conservation management is essential for achieving the goals of the CBD, UNFCCC, and the Paris Agreement**—providing immediate and cost-effective benefits for biodiversity, climate mitigation, adaptation, and the SDGs.
2. **Prioritise protection and conservation management of high integrity carbon dense ecosystems** like primary forests because their carbon stocks and biodiversity are irrecoverable by 2050, followed and supported by, restoration action that improves ecological integrity at a landscape scale.
3. **Utilise the K-M GBF to increase connections between key instruments and mechanisms** such as the NBSAPs of the CBD and the NDCs of the Paris Agreement.
4. **Adopt spatial planning approaches as called for in Target 1 of the K-M GBF**, in which to nest all of the GBF targets aimed at reducing biodiversity loss and improving ecological integrity.
5. **Recognise that the K-M GBF provides important tools for facilitating climate mitigation and adaptation.** Ensuring ecological “connectivity” at a landscape scale (Target 3 of the K-M GBF) will facilitate adaptation and improve ecological integrity and by buffering and reconnecting existing natural areas play an important role in enhancing and/or retaining ecological functions and services, including carbon retention.
6. **Reflect key principles of the K-M GBF** that encourage holistic action, support the rights and livelihoods of indigenous and local communities, and work with communities to deliver protection and restoration objectives essential for achieving long-term climate and biodiversity outcomes and climate resilient sustainable development.

The views expressed in this publication do not necessarily reflect those of IUCN or other participating organisations.

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Attachment A

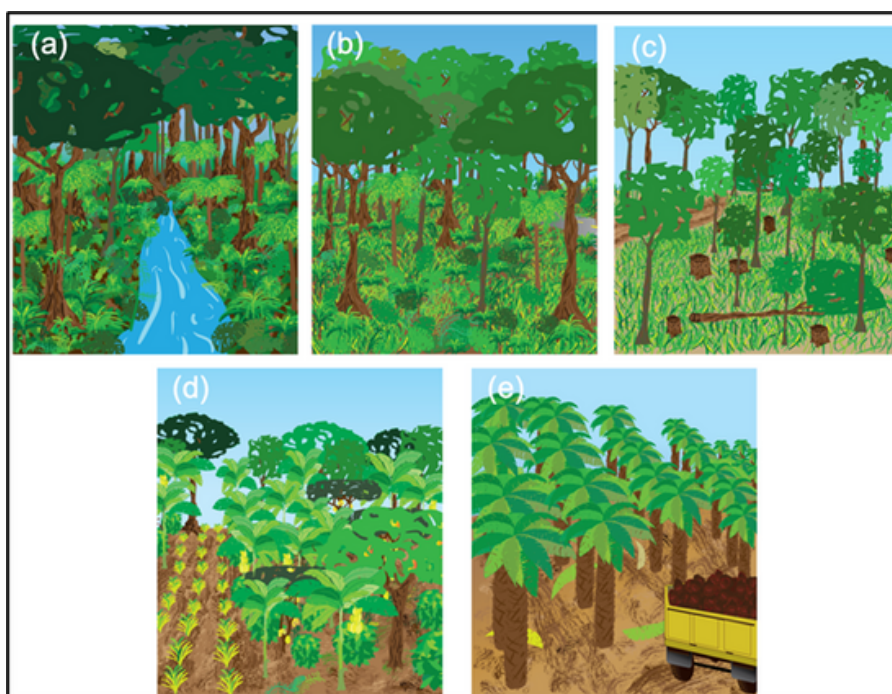
Strong and focused implementation of the Kunming-Montreal Global Biodiversity Framework is the best way to strengthen nature's contribution to the coupled climate and biodiversity crises. Goals and targets of particular importance for climate mitigation and adaption include:

- **Goal A** – “The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050...The genetic diversity within populations of wild and domesticated species is maintained, safeguarding their adaptive potential.”
- **Goal B** – “Biodiversity is sustainably used and managed and nature's contribution to people, including ecosystem functions and services are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.”
- **Target 1** – “Ensure that all areas are under participatory integrated biodiversity inclusive spatial planning and/or effective management processes addressing land and sea use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of indigenous peoples and local communities.”
- **Target 2** – “Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.”
- **Target 3** – “Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories.”
- **Target 4** – “Ensure urgent management actions to halt human induced extinction...to maintain genetic diversity (and) adaptive potential...”
- **Target 8** – “Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation and disaster risk reduction including through nature based solutions and/or ecosystem based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity.”

Attachment B

The significance of ecosystem integrity for carbon storage in Forests

Not all forests are equal in terms of their level of ecosystem integrity, carbon storage value, and how they are impacted by climate and other risks. **The figure illustrates these differences for five categories of forests:** (a) *primary forest*; (b) *secondary forest*; (c) *production forest*; (d) *agro-forestry*; and (e) *commercial plantation*. Higher integrity results in forests having more dense carbon stocks and greater stability, resilience and adaptive capacity in the face of escalating external pressures. The first table provides an overview of how these forest types differ in terms of their ecosystem integrity and the second table provides further details on the three key factors (structure, processes, stability).



Forest Type	Definition	Relative level of ecosystem integrity
(a) Primary Forest	Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed	High levels for all three factors
(b) Secondary Forest	Natural forests recovering from prior human land use impacts. Canopies dominated by pioneer and secondary growth tree species	Moderate depending on time since disturbance
(c) Production Forest	The consequence of conventional forest management for commodity production (e.g., timber, pulp). Forest predominantly composed of trees established through natural regeneration, but management favours commercially valuable canopy tree species	Low to moderate depending on intensity of logging regimes and biodiversity loss
(d) Agro-forestry	Some level of natural tree species is maintained with subsistence food or commercial crops grown (e.g., shade coffee). Swidden subsistence farming commonly used by traditional communities. Utilizes a mix of natural and assisted regeneration	Low to moderate given sufficient management inputs
(e) Commercial Plantations	Forest predominantly composed of trees established through planting and/or seeding and intensely managed for commodity production (timber, pulp, plant oil)	Low

Primary forest

- Naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed
- Likely to have never been commercially logged or intensely managed
- At a landscape level, can comprise early successional (seral) stage following natural disturbances
- More likely to contain full complement of evolved natural biodiversity
- Often the customary territories of Indigenous Peoples

<i>Dissipative structures</i>	<i>• Ecosystem processes</i>	<i>• Stability and risk profiles</i>	<i>• Ecosystem integrity level</i>
<ul style="list-style-type: none"> • Canopy trees dominated by large, old trees • In wet tropics, closed canopies • Dense soil organic stocks • Typically significant quantities of dead biomass 	<ul style="list-style-type: none"> • Fully self-generating (autopoiesis) • In temperate and boreal forests, includes seral stages following natural disturbances • Tight nutrient cycling with minimal leakage and/or erosion • Clean water supply 	<ul style="list-style-type: none"> • Highly resistant and/or resilient to extreme weather events • In boreal and temperate biomes, fire-adapted plant species • Rich biodiversity provides functional and phenotypic adaptive capacity 	<ul style="list-style-type: none"> • High levels for all three factors

Secondary forest

- Natural forests recovering from prior human land use impacts
- Canopies dominated by pioneer and secondary growth tree species
- If not subsequently disturbed by human land use, can continue to develop additional primary forest attributes over time

<i>• Dissipative structures</i>	<i>• Ecosystem processes</i>	<i>• Stability and risk profiles</i>	<i>Ecosystem integrity level</i>
<ul style="list-style-type: none"> • In wet tropics, canopy closure can occur within 1–2 decades • Aboveground living significantly less than primary forests • Some dead biomass may remain 	<ul style="list-style-type: none"> • Fully self-regenerating so long as primary propagules/seed stock are available • Soil carbon and nutrients stocks can be depleted due to past erosion and biomass removal 	<ul style="list-style-type: none"> • In temperate and boreal forests, increased exposure to wildfire and drought impacts due to more open canopy and drier forest interior • Reduced biodiversity impairs some key processes (e.g., pollination, top-down tropic control) 	<ul style="list-style-type: none"> • Moderate depending on time since disturbance

Production forest

- The consequence of conventional forest management for commodity production (e.g., timber, pulp)
- Forest predominantly composed of trees established through natural regeneration, but management favors commercially valuable canopy tree species

<i>• Dissipative structures</i>	<i>• Ecosystem processes</i>	<i>• Stability and risk profiles</i>	<i>Ecosystem integrity level</i>
<ul style="list-style-type: none"> • Logging regimes maintain a predominantly even-aged, younger age structure (~20–60 years) • Simplified vertical vegetation structure 	<ul style="list-style-type: none"> • Canopy tree species natural regenerated but some level of assisted regeneration common • Ongoing soil loss 	<ul style="list-style-type: none"> • More flammable forest conditions • Greater exposure to invasive species 	<ul style="list-style-type: none"> • Low to moderate depending on intensity of logging regimes and biodiversity loss

Agro-forestry (commercial, subsistence)

- Some level of natural tree species is maintained with subsistence food or commercial crops grown (e.g., shade coffee).
- Swidden subsistence farming commonly used by traditional communities
- Utilizes a mix of natural and assisted regeneration

<i>Dissipative structures</i>	<i>Ecosystem processes</i>	<i>Stability and risk profiles</i>	<i>Ecosystem integrity level</i>
<ul style="list-style-type: none"> • A curated canopy of trees, often remnant from primary forest or planted from local stock • Little if any understory • Ground cover are food crops 	<ul style="list-style-type: none"> • In tradition swidden system, closed nutrient cycle through use of natural regeneration • Canopy trees buffer food crops from extreme weather and help maintain soil moisture 	<ul style="list-style-type: none"> • Intensive small-scale management and modest level of biodiversity provides assisted resilience and adaptive capacity 	<ul style="list-style-type: none"> • Low to moderate given sufficient management inputs

Source:

Rogers B.M., Mackey B., Shestakova T.A., Keith H., Young V., Kormos C.F., DellaSala D.A., Dean J., Birdsey R., Bush G., Houghton R.A. and Moomaw W.R. (2022) Using ecosystem integrity to maximize climate mitigation and minimize risk in international forest policy. *Front. For. Glob. Change, Sec. Forest Management*. <https://doi.org/10.3389/ffgc.2022.929281>