

Goulburn Broken Catchment Draft Biodiversity Strategy



2016 - 2021

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Acknowledgement of Traditional Owners

The Goulburn Broken Catchment Management Authority and its partners acknowledge the Traditional Owners of land, the Yorta Yorta Nations, Taungurung Clans and other custodians, in the Goulburn Broken Catchment and strongly respect the rich culture and intrinsic connection Traditional Owners have to the land – past, present and into the future.

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Foreword

The Goulburn Broken Catchment's 205,000 people enjoy widely varying landscapes and environments, from snow-covered Alps to red gum floodplains, and from mixed cropping and grazing farms to irrigated pastures, orchards and dairy farms. The rich biodiversity underpins the resilience of our intimately connected systems of people and nature – our 'social-ecological systems'.

All of our environment and people are benefiting from increased opportunities for our traditional owners, the Taungurung and Yorta Yorta clans, who have a rich culture that is intrinsically connected to natural systems.

The strategy provides a regional perspective for implementing a twenty-year plan, *Protecting Victoria's Environment – Biodiversity 2036*, being developed by the Department of Land, Water and Planning. Geographic priorities identified in this catchment-based strategy complement those in the draft state plan, and regionally-identified climate change adaptation priority areas.

This strategy's priorities and actions are informing holistic plans for the Catchment's six social-ecological systems, and will inform the renewal of the Regional Catchment Strategy in 2019.

This Strategy provides an opportunity for government and other organisations to work closely with private landholders, the custodians of many of our most precious ecosystems, to build resilience and understand key thresholds. Many species of native flora and fauna have become extinct since European settlement and several are at the threshold of extinction because of historic activities such as large-scale clearing of native vegetation and current critical issues including climate change and rapid changes in land and water use. After the millennium drought, the driest period on record, the message is clear: leadership is required to equip people, enterprises and environments to adapt to these changes.

Our catchment contains the largest quality River Red Gum forests with associated wetlands and cultural sites in Victoria. Parks Victoria is leading the consultation and planning with the community and interested organisations for their protection. As part of the plan, cultural sites, management of tourism and recreation will be considered. The plan will enable significant opportunities for improving biodiversity outcomes and for involving traditional owners in management.

The environment and people in many parts of the Goulburn Broken Catchment have been severely impacted by unprecedented fires and floods in recent years. For example, more than one-third of the Catchment's woody native vegetation has been burnt in various bush fires since 2006.

Large changes to our 270,000 hectares of irrigation farm enterprises and rural communities continue as a result of water reform, reduced water availability, irrigation modernisation, and changing markets. The Victorian and Australian Governments \$2 billion investment to upgrade

and rationalise irrigation water delivery systems is resulting in water savings for the benefit of irrigators and the environment. The Murray-Darling Basin Authority has set sustainable diversion limits to protect river systems, including the Barmah-Millewa Forest and the Lower Goulburn Floodplain as 2 of 18 key environmental icon sites.

This update of the Biodiversity Strategy is the next step in understanding the impact of these changes in our journey towards improving the resilience of the social-ecological systems that make up the Goulburn Broken Catchment. It provides the greatest opportunity to provide habitat for flora and fauna and to provide the ecosystem services for more immediate human needs, such as the filtering of water, the pollinating of crops and the provision of aesthetically pleasing places to live, work and play. We are only just starting to understand what climate change may mean and the potential mega change to the longer term survival of species and associated systems.

Thank you to all of the dedicated people within various organisations who helped prepare this updated Strategy over the past year, especially Carla Miles, Melanie Haddow and Jenny Wilson of the Goulburn Broken CMA, and Rod McLennan and Associates.

We look forward to working with our many partner organisations and individuals in implementing this Strategy to help safeguard the future of the Catchment's biodiversity.



Murray Chapman
Chair
Goulburn Broken
Catchment Management
Authority



Chris Norman
CEO
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Executive Summary

This updated Biodiversity Strategy for the Goulburn Broken Catchment builds on three previous versions prepared over the past 20 years. This 2016 version factors in reviews of previous strategies (including targets), current regional drivers of change, and state and national government policies and strategies.

The Strategy identifies initiatives under 5-year strategic directions for achieving a 15-year vision. The Strategy informs the Goulburn Broken CMA and partners' annual investment plans, and is a reference point for adapting management to changed circumstances.

This update provides a more explicit framework for applying 'resilience thinking', including a systems-approach and adaptive management, and identifies priorities across various scales. This update also provides flexibility for stakeholders to interpret, implement and review strategic initiatives, recognising that a variety of actions can contribute.

As with other sub-strategies of the Goulburn Broken Catchment Management Authority's (CMA) Regional Catchment Strategy (RCS), this Biodiversity Strategy was prepared with partners and the community.

Where are we at?

Traditional Owners' biodiversity knowledge is being increasingly incorporated into management, through such processes as co-management of large areas of public land (since 2004), and participation in works crews.

Since the early 1990s, the uptake of environmental works has increased significantly, including the integration of biodiversity into farming-systems and water-regimes of rivers, streams and wetlands. There has been an increase in positive action by the community following increased acceptance of the challenge to improve the condition of biodiversity. There has also been strong progress in implementing the 2010 update of the Biodiversity Strategy (Miles 2015). However, many species continue to be at a threshold level of existence, largely as a legacy of the introduction of agriculture (and associated broad-scale clearing of native vegetation) and the development of water resources.

Although there is increased acceptance of the need to improve biodiversity condition, the recent trend in native vegetation extent, a critical attribute of biodiversity, is away from the long-term target. Native vegetation clearing controls had a significant impact when first introduced in the late 1980s, but incremental loss of native vegetation, activities such as fire management, and ongoing changes to regulations, including associated accounting and offset programs, are major challenges that have not been completely met.

While community and individual landholders are willing to manage biodiversity by revegetating and other measures, achievements are limited because of restricted levels funding.

The link between resilient agriculture and biodiversity is clear. Biodiversity programs aimed at supporting private landholders in the Catchment are integrated with farming systems, so that ecosystem services from nature benefit agricultural production, and that land management practices are sympathetic to nature. Biodiversity is no longer considered in isolation when management decisions are made. Consistent with the Goulburn Broken RCS 2013-2019 (GBCMA 2013), biodiversity is an important part of complex systems of people and nature, and the focus for management is on the resilience of such 'social-ecological systems' (SESs).

The RCS identifies six different SESs within the Goulburn Broken Catchment. This Biodiversity Strategy guides the identification of thresholds for biodiversity in each SES that underpin management decisions. SESs and their biodiversity are affected to different degrees by various drivers of change, including:

- Climate change, which is resulting in more frequent extreme events, such as droughts, fires, extreme heat, and floods, and responses to it such as planned fuel-reduction burning.

- Rapid changes in the use and management of land and water, which are impacting on policy mechanisms and tools used to achieve biodiversity outcomes. (Rural landholders are custodians of much of the Catchment’s biodiversity, with the use of land and water being a significant determinant of biodiversity condition.) As properties undergo change, such as irrigation reconfiguration or subdivision of peri-urban areas, risks and opportunities are presented for biodiversity.
- Changing structure and function of government agencies, creating the need for different styles of partnership, including those with public land managers. There is growing concern about public land management and changes to native vegetation management regulations.

What are we aiming for?

The long-term vision for biodiversity in the Goulburn Broken Catchment is:

Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity

This complements the Goulburn Broken RCS’s vision for the Catchment, which is: *Healthy, resilient and increasingly productive landscapes supporting vibrant communities.*

Long-term targets to achieve the biodiversity vision are:

1. Increase the extent of native vegetation in fragmented landscapes by 70,000ha by 2030.
2. Improve the quality of 90% of existing habitat by 10% by 2030.
3. Increase the population viability of 20 threatened species by 2030.

These targets provide a platform to monitor progress, evaluate programs and identify knowledge gaps. They are reported against using scientific data and assumptions, which are continually refined using best available information. Native vegetation targets are measurable critical attributes of biodiversity. Targets for other elements of biodiversity, such as soil biota, will be pursued as more information becomes available for setting meaningful and measurable targets.

Aquatic, riparian and wetland biodiversity is a strong focus of the Goulburn Broken Waterway Strategy 2014-2022 and a key focus of this Strategy is to continue to strengthen the links between the ‘Land and Biodiversity’ and ‘River and Wetland Health’ programs of the Goulburn Broken CMA.

This Strategy recognises the importance of presenting information according to the scale of decision-making. While the Australian and Victorian Government investment priorities influence decision-making at the catchment scale, this Strategy includes processes for identifying biodiversity priorities at the catchment, SES, landscape and site scales.

Spatial priorities of three separate approaches that apply at the catchment scale strongly correlate: the Department of Environment, Land, Water and Planning’s ‘NaturePrint’, a state-wide model of priorities (DELWP 2016a); Goulburn Broken CMA’s biogeographic zones (GBCMA 2010a), which have been reviewed; and Goulburn Broken CMA’s priority areas for climate change adaptation (GBCMA 2016b).

Prioritisation at the landscape scale is being piloted in the Agricultural Floodplains SES and Biodiversity Action Planning remains a useful tool to identify sites of high value.

How will we get there?

The strategic framework (see figure below) represents the relationship between the vision and actions. Each of the five columns (strategic directions) are addressed as sections within the Strategy. Examples of actions are included (Appendix 7), and these will be modified and added to in annual investment plans.

Strategic directions, initiatives and actions in this Strategy have been based on a review of the previous Strategy and according to a list of ecological and institutional principles, which includes a strong emphasis on a ‘resilience approach’ and the associated adaptive management.

20-50 YEARS	VISION	VISION Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity				
	INDICATORS OF VISION ACHIEVEMENT	ECOLOGICAL OUTCOMES				
		<ul style="list-style-type: none"> Protected and secured habitat Viability of threatened species 		<ul style="list-style-type: none"> High quality habitat Adaptive Habitat 		<ul style="list-style-type: none"> Landscape and habitat connectivity Representation of habitat types
		BIODIVERSITY TARGET THEMES				
	Native vegetation extent	Habitat quality		Threatened species		
5-6 YEARS	STRATEGIC DIRECTIONS	STRATEGIC DIRECTIONS				
	INDICATORS OF STRATEGIC DIRECTIONS	Anticipate and adapt to change	Strengthen partnerships	Invest wisely	Build on ecological infrastructure	Legitimise biodiversity conservation
		30% increase on 2015-16 investment in biodiversity conservation	Roles of key partners in biodiversity management are agreed at State, catchment and local scales	Consistent reporting of onground actions and assumed long-term changes	4 large-scale projects underway that link large remnants	A much larger proportion of the Catchment's land (public and private) is managed for biodiversity conservation
		Reviews of the Biodiversity Strategy and annual investment priorities	5 cross-tenure projects where multiple partners agree to achieve benefits for biodiversity	80% of biodiversity research projects link to Outcomes = Outputs x Assumptions	90% of biodiversity agreements between landholders and the GB CMA are in high priority areas	
		3 examples of proactive planning and quick responses to changed circumstances	1200 agreements between landholders and the GB CMA	Data collected at all scales is linked to the Biodiversity Strategy's priorities	10,000 hectares of biodiversity outputs delivered by GB CMA and partners	Increased community support for ecosystem management as being vital for long-term human benefit
3 examples of onground changes that address climate change	Indigenous people trained and employed as part of biodiversity projects					
STRATEGIC INITIATIVES	Create processes that encourage proactive planning and quick responses	Continue to strengthen partnerships between individuals, community and industry groups, and agencies, including Traditional Owners and public land managers	Improve the science behind decisions through better understanding underlying assumptions	Develop icon projects, improving terrestrial and aquatic ecological function and climate change adaptation	Strengthen and communicate duty of care for biodiversity conservation	
	Support landholders who are changing their land use			Implement stewardship programs that target large-scale landscape protection, restoration and connectivity to priority areas	Increase opportunities for landholders to act as biodiversity stewards through appropriate mechanisms and support	
	Manage risks and capture opportunities for climate change	Develop large-scale, multi-partner and multi-tenure projects where appropriate	Develop priorities at various scales of planning and integration	Maintain resilient ecosystems and help others transform appropriately in response to drivers such as climate change	Influence government planning policy, including municipal planning schemes and state legislation and policy	
	ACTIONS	SEE APPENDIX 7 OF STRATEGY FOR DETAILED ACTIONS				

Evaluation and adaptation

As the drivers of biodiversity change shift rapidly and the information-base for decision-making continually improves, implementation of this Strategy will be evaluated regularly so that new knowledge is included in implementation programs. There will be annual reviews of listed actions and continuous improvement from better understanding of the impact of actions on biodiversity condition change.

1. Introduction

The Goulburn Broken Catchment Management Authority (Goulburn Broken CMA) is a statutory authority established under the *Catchment and Land Protection Act 1994* as the peak natural resource management (NRM) organisation for the Goulburn Broken Catchment. It is responsible for coordinating the development and implementation of a *Regional Catchment Strategy* (RCS) in partnership with the community, all tiers of government and research and funding organisations.

This is the 4th major version of the RCS sub-strategy developed for biodiversity at the catchment-scale in the Goulburn Broken Catchment (previous strategies: GBCMA 2003a, McLennan *et al.* 2004 and GBCMA 2010a).

Sub-strategies have been critical in Goulburn Broken Catchment NRM decision-making for more than two decades. They are usually whole-of-Catchment scale, focusing on assets, threats or supporting themes. Because the context behind each sub-strategy varies and is continuously changing, sub-strategies are renewed according to their own context, independent of the over-arching RCS renewal cycle. Sub-strategies are developed in consultation with government and community organisations and individuals, providing details for investment plans and priorities.

This Strategy has evolved from a comprehensive review of the *Biodiversity Strategy for the Goulburn Broken Catchment 2010-2015* (Miles 2015). The review found that the Strategy had been robust, valuable, and that it should be updated, consistent with the Goulburn Broken CMA's commitment to continuous improvement. The CMA values being able to demonstrate to investors the links between project proposals and strategic planning at the catchment-scale.

A Biodiversity Strategy Working Group made up of key stakeholders has been involved in the Strategy review and update.

This Strategy accepts the environment is changing and decision-making needs to adapt accordingly. To address uncertainty, this Strategy promotes a highly adaptive and flexible approach, targeting investment, yet building diverse actions, and working with partners and land managers to find solutions within a broad framework.

The main shift in emphasis for the Strategy is making application of resilience thinking more explicit. Like previous strategies, it considers new information and tools particularly for climate change, responds to changing drivers including policy and legislation, and provides a base for biodiversity to be incorporated across smaller planning units such as social-ecological systems and landscapes.

This Strategy allows for flexibility for all stakeholders to interpret, implement and review strategic initiatives as various actions are implemented against strategic initiatives. Detailed actions are included in Appendix 7, however annual planning processes will ensure these are reviewed and updated as appropriate.

1.1 Strategy purpose

This Strategy has a 15-year vision and targets, and five-year strategic priorities (for the period 2016-2021), which support the strategic priorities of the Goulburn Broken RCS 2013-2019.

The **vision for biodiversity** in the Goulburn Broken Catchment is:

Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity.

This complements the **Goulburn Broken RCS's 50-year vision** for the Catchment, which is:

Healthy, resilient and increasingly productive landscapes supporting vibrant communities.

This Strategy:

1. provides a vision for biodiversity in the Goulburn Broken Catchment based on multi-organisation involvement and collective agreement;
2. promotes the fundamental importance of biodiversity conservation;
3. provides technical information, clear priorities and practical directions for biodiversity at a catchment scale, which can also be used and interpreted for planning at a local scale;
4. promotes an integrated and coordinated approach to biodiversity conservation in the Goulburn Broken Catchment, as part of a resilience planning framework;

5. provides a reference point for engaging stakeholders;
6. sets future directions in a way that aligns with, or provides flexibility to meet government and other stakeholder priorities and engender confidence in the ability to do so;
7. aims to attract increased investment into conserving biodiversity in the Goulburn Broken Catchment;
8. provides a framework for adaptive management; and
9. drives the Goulburn Broken CMA's investment planning (development of biodiversity projects) and biodiversity staff work plans.

1.2 Strategy scope

This Strategy describes the general direction for biodiversity management in the Goulburn Broken Catchment over the next five years. It is not a detailed action plan, nor is it intended as a community document. However, the importance of the community in delivering the objectives is recognised and a "Summary for the Community" will be developed and local plans for each social-ecological system (SES) identified in the Goulburn Broken RCS will localise the directions in this Strategy.

The Strategy considers other regional, state and national policies and strategies and the Goulburn Broken CMA works effectively to align regional NRM strategies and annual funding proposals with the priorities of the Victorian and Australian Governments (see section 2.2 and Appendix 1 for detail).

While regulation is one policy instrument relevant to the implementation of this Strategy, it is beyond the scope of this Strategy to comprehensively address native vegetation regulation issues. It does however acknowledge the issues and identify how best the Goulburn Broken CMA and partners can influence improved policy outcomes.

This Strategy provides a 'tenure-blind' vision for biodiversity in the Catchment. It will be important during implementation to identify specific actions for the range of land managers, both private and public. Much of the remnant habitat in the Catchment is on public land (about one third of Catchment) but most threatened species and ecological communities depend on private land. As the Goulburn Broken CMA has no jurisdiction over either, it plays a crucial co-ordinating and influencing role.

While this Strategy has a strong focus on terrestrial biodiversity it does acknowledge aquatic biodiversity values and promotes a systems-based approach to management.

It acknowledges the importance of soil biodiversity in supporting healthy systems, and the synergies between agricultural productivity and biodiversity. Below-ground flora and fauna represent one of the most species-rich components of terrestrial ecosystems and there is a strong link between above-ground and below-ground biodiversity. Unfortunately knowledge in this area remains relatively low (GBCMA 2015c). Appendix 1 describes the relationship of this Strategy with other relevant strategies, including the draft Goulburn Broken Land Health Statement 2014-2018 (GBCMA 2014b).

1.3 Whose strategy?

This is an inclusive strategy for those with a stake in biodiversity conservation in the Goulburn Broken Catchment, including the major organisations involved in planning and implementing biodiversity management programs.

Stakeholders and this Strategy's relevance to them are outlined below in Table 1.

Table 1: Strategy stakeholders and relevance of this Strategy to them

Stakeholder	Relevance of strategy
Broad community	Illustrates the vision for the Goulburn Broken Catchment's biodiversity, identifying priority zones and strategic actions. Does not provide specific actions or advice for on-ground management.
Traditional Owner Groups	Provides a catchment-wide vision for biodiversity upon which to integrate traditional owner knowledge and involvement. An opportunity to strengthen outcomes in whole-of-government programs.
Private landholders	Provides guiding principles for biodiversity conservation and regional priorities, to which landholders can contribute.
Public land managers e.g., Parks Victoria, Department of Environment, Land, Water and Planning (DELWP)	Provides a catchment-wide, tenure-blind view of biodiversity goals and opportunities for future collaboration between the key NRM organisations.
DELWP, Region	Communicates a shared view of priority biodiversity actions for the Goulburn Broken Catchment and opportunities for further regional collaboration and integration between the Goulburn Broken CMA and DELWP.
Incentive delivery staff (agency and community)	Provides a vision and central focus for any staff that may be involved in delivering biodiversity and land management projects, to enable coordinated and informed sub-catchment and site planning, and implementation.
Local Government	Provides a catchment-wide perspective on biodiversity priorities to enable effective collaboration with local government staff and councillors. Provides opportunities for alignment with local government strategic planning.
Statutory bodies/utilities	Provides guiding principles for biodiversity conservation and regional priorities to which utilities can contribute.
Goulburn Broken CMA	A key strategic document for biodiversity planning and implementation, including Local Planning across SESs. It will be a key document for informing the mid-term review of the Goulburn Broken RCS and is therefore highly relevant to the Goulburn Broken CMA Board.
State Government (includes DELWP - policy groups)	Provides a regional framework for implementing state-wide policies, strategic objectives and investment frameworks, including translation of State priorities to the regional level and describes regional process issues (such as engagement) required.
Australian Government	Communicates regional priorities and alignment with nation-wide priorities
Community networks/group	Catchment-wide priorities that can be considered for biodiversity planning and implementation at the local level
Researchers	Identifies knowledge gaps and research priorities from an implementers viewpoint

1.4 Strategy principles

The following principles underpin this Strategy and its implementation.

Ecological

- Ecosystems, communities and species are managed to ensure resilience across landscapes.
- Areas that have the 'ecological infrastructure' (rivers, wetlands, creek systems, and healthy ecosystems) will be the basis for protection and restoration priorities. Connectivity will need to be increased to promote movement-based ecological processes like migration and range shifts (Prober *et al.* 2015).
- Ecological thresholds need to be identified, managed and monitored.
- Climate change and its interactions with other threats is a significant risk to biodiversity, and it is important to identify, manage and protect refugia across a range of areas. Priorities should be based on increasing ecosystem function and diversity and managing change in ecosystem services.
- The 'net gain' principle is applied, whereby long-term declines in biodiversity are reversed, leading to strategic improvements, where gains are greater than losses.

'Resilience' is the capacity of a system to absorb disturbance and reorganise while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et al., 2004). Ecosystem resilience needs to be considered alongside a complex, evolving, integrated socio-ecological system in which humans are a part of nature (Wolfenden et al., 2007).

"Resilience thinking and behaviour is not a new concept to Yorta Yorta and other Traditional Owners... Resilience was a non-negotiable requirement for survival of the Yorta Yorta people and their culture." (YYNAC, 2012)

Institutional

- The environment must not be separated from people when decisions are made: recognition of the importance of the community in achieving biodiversity outcomes is crucial and support must be provided to landholders as active environmental stewards.
- The achievement of biodiversity outcomes relies on strong partnerships with other Goulburn Broken CMA programs, government agencies, Traditional Owner groups, community NRM groups, research institutions and private and public land managers.
- Effective calls on allocating scarce resources are needed to get the balance right between saving species vulnerable to extinction and preventing more common species from becoming threatened.
- Targets help to evaluate progress, adapt to change and improve actions.
- Resilience thinking underpins actions and recognises that:
 - landscapes change, often from changing social and ecological interactions and our decision-making needs to keep up;
 - planning should identify key attributes, feedbacks, and thresholds to improve intervention strategies
 - large uncertainties are inherent and accepted parts of planning, to be managed by a highly adaptive and flexible approach including working with a range of partners and land managers to find solutions.

1.5 Submissions and comments on the draft Strategy

To be updated: key themes that emerge from feedback following release of the Draft Strategy.

Part A - WHERE ARE WE AT?

2. The Goulburn Broken Catchment's biodiversity

The Goulburn Broken Catchment boasts a diversity of ecosystems, including snow-covered Alps, montane and sclerophyll forests, granitic outcrops, gentle sloping plains, Box woodlands and River Red Gum floodplains, amongst irrigated pastures and orchards, mixed cropping and grazing farms and many other land uses. Average annual rainfall varies substantially, from 1,600 mm in the high country of the south east to 400 mm in the north west.

These varied landscapes are home to a diversity of native plants and animals, several of which occur nowhere else in the world. They form the Catchment's cultural and spiritual identity, contributing to health and wellbeing.

2.1 Condition of the Catchment's biodiversity

Aboriginal people manage and care for their Country using a system of NRM that kept country and people healthy for thousands of years (YYNAC 2012). Since European settlement, the ecology of the Catchment has been transformed with more than 60 per cent of vegetation cleared for agriculture since the late 1800s, particularly in the fertile plains and low hills (DSE 2007b; DSE 2007c). This has resulted in changes to ecosystem processes and the extinction of several species of native flora and fauna, with many others threatened with extinction (GBCMA 2015b). Configuration of native vegetation is largely fragmented across the Catchment, with most remaining native vegetation on public land, which covers one-third of the Catchment. Variation in biodiversity condition across the Catchment is usually related to past activities, especially the clearing of native vegetation. Native vegetation extent, including diversity, is particularly important because it underpins most of the Catchment's species diversity (GBCMA 2013).

The *Victorian Catchment Condition Report* (Victorian Catchment Management Council 2002, 2007, 2012) rates the Goulburn Broken Catchment's biodiversity as variable, from poor to good condition. The Goulburn Broken CMA rated the general condition of biodiversity as poor in 1990 and again in 2015 (GBCMA 2015b). At a finer scale, some aspects of biodiversity are improving and some are declining (see GBCMA 2010a and GBCMA 2007).

Understanding current condition, acknowledging the highly modified nature of social-ecological systems, means management of biodiversity can be focused on increasing the resilience of ecosystems within identified thresholds by adapting to drivers of change, consistent with this Strategy's vision: *Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity.*

A major driver of the condition of biodiversity is climate change, which will result in an increase in the frequency of extreme events, such as bushfire, extreme heat and drought, and together with the large scale and frequency of planned fuel-reduction burning, is a concern.

Reduced water availability and increased temperature will drive how biodiversity responds to climate change. Predicting how populations, species and communities will respond is challenging as each is likely to react differently. Almost all biodiversity will be affected by climate change but some areas of the Catchment will be more affected – alpine areas and freshwater systems are likely the most vulnerable. The Mountain Pygmy-possum has already been identified to be at risk from climate change. Increased temperatures may affect the survival and breeding of native fish since they can have very specific temperature requirements. Fish that may be most at risk include those that live in specialised habitats, mostly eat invertebrates, are small and do not produce many young (CSIRO 2015). A project to model the impacts of climate change on fish in Victoria found that species occurring in the Catchment predicted to

"Biodiversity encompasses all the components of the living world: the numbers and variety of plants, animals and other living things, including micro-organisms, across our land, rivers, coast and ocean. It includes the diversity of their genetic information, the habitats and ecosystems within which they live, and their connections with other life forms and the natural world" (DELWP, 2016a).

"For Yorta Yorta people, the land and the world view in which they live is an extension of themselves. The land and water is the embodiment of their identity and existence, as river based people, passed on by the great creation spirit Biami." Dr Wayne Atkinson, from YYNAC 2012.

substantially decline include River Blackfish, Two-spined Blackfish, Macquarie Perch plus exotic species Rainbow and Brown Trout. A small number of native species such as the Australian Smelt were predicted to increase in range (Bond *et al.* 2010). Changes to water flows and availability resulting in increased salinity or black water and low oxygen events can rapidly change fish diversity and survival. Changes to rainfall and temperature may affect inter-relationships between flora and fauna e.g. occurrence of flowering and pollinator emergence and seed production – an important dietary requirement of many animals. Migratory birds are changing their behaviour with some becoming year-round residents, increasing competition for food and other resources (CSIRO 2015). See Appendix 4 for more detail. The Goulburn Broken CMA and its partners have developed a Climate Change Adaptation Plan for NRM in the Catchment that identifies focus areas for adaptation and management options (GBCMA 2016b). See sections 4 and 5 and Appendix 4 for more detail.

Other pressures on biodiversity condition include: the continued decline in threatened species as the ‘extinction debt’ from past clearing is realised; continued habitat loss through permitted and illegal clearing of native vegetation; weed invasion; high water tables; habitat loss through, for example, logs used for firewood and ‘cleaning up’ by landholders (removing important leaf litter and fallen logs); and the inability of flora and fauna to move through fragmented landscapes, creating genetic bottlenecks and loss of sub-populations.

Table 2: Summary of biodiversity statistics, Goulburn Broken Catchment

Biodiversity asset	Status
Native vegetation	<ul style="list-style-type: none"> • More than 70% of the Catchment has been cleared, mainly in bioregions most suited to intensive agriculture, such as the Victorian Riverina. • Declines in extent have largely stabilised, with incremental losses still occurring countered by large-scale revegetating and grazing management, especially in recent years (see Appendix 2). • There are 3,061 native species of which 385 (13%) are threatened (DELWP 2016b) • 64% of ecological vegetation classes are listed as Endangered or Vulnerable (DSE 2007d)
Wetlands	<ul style="list-style-type: none"> • Since 2009, Index of Wetland Condition assessments have been conducted at 116 wetlands across the Catchment. Most are in good (38%) and moderate (40%) condition and a small proportion are in excellent (6%), poor (15%) and very poor (2%) condition. Assessment results indicate that wetlands on public land are generally in better condition than those on private land, although there are still examples of wetlands in good condition on private land (GBCMA 2014a).
Rivers and streams	<ul style="list-style-type: none"> • 22% (1,645 km) of the Catchment’s 7,336 km of streams and waterways are rated as poor / very poor, 62% (4,534 km) rated as moderate and 15% (1,107 km) rated as good / excellent. [NOTE: These statistics are based on the Index of Stream Condition in 2010 (DELWP 2010) and do not include a full assessment of waterways across the Catchment.]
Native fauna	<ul style="list-style-type: none"> • 546 species of vertebrate fauna of which 136 (25%) are threatened (DELWP 2016b) • There are an unknown (but very large) number of invertebrates • Many species exist in areas that are below minimum threshold habitat levels. Natural and/or human-induced events could cause their extinction within the Catchment.
Soil biodiversity	<ul style="list-style-type: none"> • Below-ground flora and fauna represents one of the most species rich components of terrestrial ecosystems and there is a strong link between above ground and below ground biodiversity. Healthy remnants and biodiverse soils go hand in hand. However, we know very little of how best to manage for healthy and biodiverse soils.

2.2 Drivers of change to biodiversity

Large declines in the condition of biodiversity since European settlement can be traced to a relatively small number of causes at any one time, but they compound and interact in complex ways. Examples of major changes affecting biodiversity since European settlement in the 1820s include the opening up of land for purchase in the 1860s, the introduction of the rabbit in the 1860s (and subsequently of myxomatosis in the 1950s), and the decade-long drought of the early 2000s.

2.2.1 Climate change

Climate change in the Murray Darling Basin is expected to make average temperatures warmer in all seasons with hotter and more frequent hot days, longer warm spells, fewer frosts, less rainfall during the cool season, increased intensity of heavy rainfall events and a harsher fire-weather climate (Timbal *et al.* 2015). Most major pressures on biodiversity condition in the Goulburn Broken Catchment will be influenced by climate change in a negative way, including change in fire regimes and management, extreme weather and climate events, invasive plants and animals and irrigation. Changes in rainfall regime and increased temperature are expected to become major pressures on biodiversity condition under climate change (GBCMA 2016b). Significant climate events are already impacting biodiversity condition in the Catchment including:

- Extreme drought resulting in exceptionally low stream flows and historically low water allocations from 2002 to 2009
- The Black Saturday bushfires in 2009 that impacted 185 000 hectares (or 7%) of the Catchment
- Floods in 2010, 2011, 2012 and 2013 that improved the condition of floodplain systems but had other adverse effects particular on people.
- Bushfires in 2013 in the Wunghnu-Numurkah and Kilmore regions affecting approximately 9,700 hectares and 3,400 hectares of the Catchment respectively, and more than 14,000ha near Stewarton, Boweya and Creighton's Creek in mid-December 2014.

The nature of current climate change adaptation actions are largely incremental in nature, either doing more of what is being done to manage existing pressures or making incremental modifications to the existing suite of management actions. Incremental adaptations are likely to be at least partly effective responses to climate change in the short to medium term (5 to 20 years). Climate change projections suggest little change in annual or seasonal rainfall and only modest increases in temperature (~1°C) over this period. These changes may push some aspects of climate variability (particularly extreme high temperatures) outside historic ranges and may affect particularly sensitive natural systems. The condition of biodiversity may be more influenced by non-climate change pressures over this timeframe (GBCMA 2016b).

The climate is projected to change profoundly over the 50 year timeframe of the Goulburn Broken RCS vision, particularly under a high emissions pathway. Under such circumstances, climate change is likely to exert increasing influence on the condition of natural resource systems. It is likely that at least some of the impacts of climate change will not be able to be mitigated through incremental modifications to conventional responses. Transformational responses to climate change may be required, for example, intensive management to prevent incursion or spread of alien, highly flammable species in areas where native vegetation species are changing from those that are fire-resistant to those that are fire-resilient due to increasing frequency and intensity of bushfires. This is an option to maintain the evolutionary character of fire-resistant communities, even if the particular species constituting those communities change with the climate (GBCMA 2016b, Prober *et al.* 2015).

The Goulburn Broken CMA (GBCMA 2016b) has identified natural resource vulnerability to climate change and associated adaptation focus areas and management options. The adaptation priority assessment has been tailored to focus on biodiversity to inform spatial prioritisation in this Strategy (see section 4 and Appendix 4). Climate change adaptation options and associated management tools have been considered in this Strategy's strategic directions

"Evidence over the last decade has shown that ecological change in response to climate change is unavoidable and will be widespread and substantial"
(Williams *et al.* 2014).

"The scope of the challenge of adapting biodiversity management to climate change is shaped by the magnitude and extent of future climate change across Australian landscapes and by our ability to predict the associated ecological changes. Biodiversity managers will also need to consider the interactions with other processes that threaten the resilience of biodiversity, including how future societies themselves shape the landscape. Future natural resource management (NRM) plans will then need to allow for extensive changes in biodiversity that are not entirely predictable. Plans may need to focus on supporting biodiversity through these changes, including adjusting objectives to better cater for climate change."
(Williams *et al.* 2014)

'Anticipate and adapt to change' and 'Build on ecological infrastructure' (see Section 5). Future updates to this Strategy will continue to consider the effectiveness of climate change adaptation actions.

2.2.2 Land and water use and management

Collectively, rural landholders are custodians of much of the Catchment's biodiversity, with the use of land and water being a significant determinant of biodiversity condition. The continuing rapid changes in land and water use across the Catchment therefore create the need for changed policy mechanisms and other tools to achieve biodiversity outcomes.

Land-use changes include changes from low intensity to high intensity production, from large farms to small lifestyle properties, and clearing of native vegetation for infrastructure expansion. These changes will continue in response to short and long-term pressures. Short-term pressures include events such as a rapid change in commodity prices, drought, fire, flood, and the global financial crisis. Long-term pressures include ageing farmers, gender imbalance and increasing competition for land and other resources, both within the farming sector and between the farming sector, and other parts of the economy, including between farming and lifestyle land use (GBCMA 2013).

Ongoing population growth and migration into and within the Catchment will continue to drive demand for land to meet urban housing and lifestyle living needs, which also requires expanded infrastructure such as transport and communication networks (GBCMA 2013). The proximity to Melbourne has attracted 'tree changers' and commuters to the south of the Catchment, resulting in a significant increase in 'lifestylers,' who have differing intentions for their land and capacity to manage it (Barr 2003).

Changing water availability and security is dramatically affecting land use and the structure of rural communities and industries in parts of the Catchment. As land owners look for different avenues of income, there is an opportunity for biodiversity conservation to become part of any new or changed farm business. The emerging diverse land-use pattern in the Shepparton Irrigation Region is creating a new set of risks and opportunities for natural resources, including biodiversity (SIRPPIC 2015).

Land and water use and management change has been considered in this Strategy's strategic directions of 'Anticipate and adapt to change' and 'Strengthen partnerships' (see section 5).

2.2.3 Policy reform and change

The **Goulburn Broken RCS** (updated in 2013) builds on almost 30 years of lessons and achievements in integrated catchment management that has given the Goulburn Broken Catchment's communities significant experience and understanding of the management approaches that will make a difference (GBCMA 2013).

The approach to catchment management has evolved from a focus on the single threat of salinity in the 1980s to integrated catchment management (salinity, water quality, biodiversity) in the mid-1990s to a focus on valuing outcomes such as ecosystem services (e.g. clean water and air, productive soils). The focus now is on maintaining the resilience of social-ecological systems (SEs) so they continue to deliver critical services and values for people and nature (GBCMA 2013). **SES local plans** have been developed to articulate local vision, key drivers and priority actions aligned to the Goulburn Broken RCS. The Plans are adaptive in nature and will be regularly updated to reflect drivers

"Involvement by the community in catchment management is broad based. It is estimated that for every \$1 spent by government in catchment management, at least another \$1.50 (and as high as \$4) is spent by the Catchment community. In addition to the effort undertaken by individual landholders on private land across the Catchment, a variety of networks and groups achieve catchment outcomes on private and public land. The Catchment also boasts a strong history of community leadership in responding to important catchment threats and issues."
(GBCMA 2013)

Victoria in Future 2015 (DELWP 2015) projections indicate that Victoria will grow by 1.9 million people between 2014 and 2031 (at a rate of 1.6% per annum) and is expected to increase by another 2.3 million people by 2051 (at a rate of 1.3% per annum). The population of Greater Melbourne is projected to increase from 4.4 million in 2014 to 7.8 million in 2051. Over this period the population of Victoria's regions is expected to grow from 1.4 million to 2.2 million.

and priorities and respond to RCS sub-strategies such as this one. The establishment of the local planning process has enabled a platform for a range of tailored actions to be developed and implemented which consider the varied demographics, knowledge and expectations of the community.

There has been significant change in the agencies and groups the Goulburn Broken CMA partners with to coordinate and deliver biodiversity programs, particularly due to the **various restructures of government departments since 2010**. This has resulted in new or stronger partnerships forming with other providers, particularly community NRM groups, Traditional Owner groups and local government. It has also facilitated further integration between Goulburn Broken CMA programs and presented opportunities for cross-border partnerships with other regional NRM groups. It has, however, limited opportunities for the Goulburn Broken CMA to engage with public land managers to help improve understanding of policy change and whole-of-catchment biodiversity outcomes, and has introduced changes to coordinated implementation.

In December 2013 a planning scheme amendment was gazetted to implement **reforms to Victoria's Native Vegetation Permitted Clearing Regulations**. These reforms and new policy guidelines - *Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines* replaced *Victoria's Native Vegetation Management – A Framework for Action 2002* including reference to the regional Native Vegetation Plans (GBCMA 2003).

The Goulburn Broken CMA and its stakeholders have identified and communicated to DELWP significant concerns with the Guidelines, particularly in relation to; the abandonment of regional priorities, values and guidelines; lack of monitoring, compliance and reporting; unclear decision making guidelines and poor community understanding of the Guidelines (e.g. exemptions); an inconsistent scoring system; use of inaccurate modelling; the loss of like-for-like values; and minimal enforcement of the no net loss principles of avoid, minimise and offset.

A **review of Victoria's 'Native Vegetation Permitted Clearing Regulations'** is currently being undertaken by DELWP to "ensure that they sensibly protect native vegetation". The Goulburn Broken CMA and partners have participated in public consultation and will continue to advocate for a native vegetation regulatory system that provides a solid scientific framework to achieve regional and state targets to conserve significant biodiversity values.

Strengthening and communicating duty of care for biodiversity management has been challenging with the changes to the native vegetation regulations and competing agricultural development e.g. landholder incentives for irrigation efficiency upgrades. Despite this, there have been positive messages from the community (e.g. during local planning workshops in 2013/14) about the need for improved land and biodiversity outcomes for future generations.

There is growing community concern about **public land management**, particularly regarding sustainable forestry, fuel-reduction burning practices and pest animals (e.g. deer). For example, communities in the Southern Forests (e.g. Rubicon Forest Protection Group) and Strathbogie Ranges (e.g. Strathbogie Sustainable Forestry Group) have established action groups to advocate for better management of public land. The Victorian Government has changed its hectare target **approach to bushfire fuel management on public land** to a risk reduction target (DELWP 2016c). Studies on the effect of fire on biodiversity in the Mallee, Gippsland and North East regions of Victoria indicate that, due to the broad spectrum of responses of flora and fauna species and habitat values to fire regime, there are benefits to biodiversity of managing landscapes in a mosaic of fire age classes (Avitabile 2014, Muir *et al.* 2015). However, understanding remains limited and more investigation needs to occur.

There are several emerging policy directions, which are outlined in Appendix 1. These include:

- A Draft State Biodiversity Plan '**Protecting Victoria's Environment – Biodiversity 2036**' (DELWP 2016a)
- **Our Catchment Our Communities Strategy** (DELWP 2016d)
- **The Water for Victoria discussion paper** (DELWP 2016e)
- **River Red Gum Parks Management Plan** (Parks Victoria 2015).

2.3 Progress in implementing long-term strategies

The Goulburn Broken Catchment community has been implementing long-term strategies for biodiversity for more than two decades.

Since the early 1990s, the uptake of environmental works has increased significantly, including the integration of biodiversity into farming-systems and water-regimes of rivers, streams and wetlands. There has been an increase in positive action in recent decades following increased acceptance of the challenge to improve the condition of biodiversity. The final review of the Biodiversity Strategy for the Goulburn Broken Catchment, 2010-2015 (Miles 2015), shows strong progress in implementing strategic initiatives and actions.

One of the measures of success is annually determining progress towards long-term resource condition targets (see section 3.3 and Goulburn Broken CMA Annual Reports). The Goulburn Broken CMA reports annually on activities carried out in the Catchment, and the (on-ground) outputs generated by these activities (e.g. see Figure 1). Output reporting is linked to progress towards targets using assumptions about how much each output contributes to the outcome using the equation: $Outputs \times Assumptions = Outcomes$ (targets). Figure 2 shows progress against the native vegetation extent target since 2000.

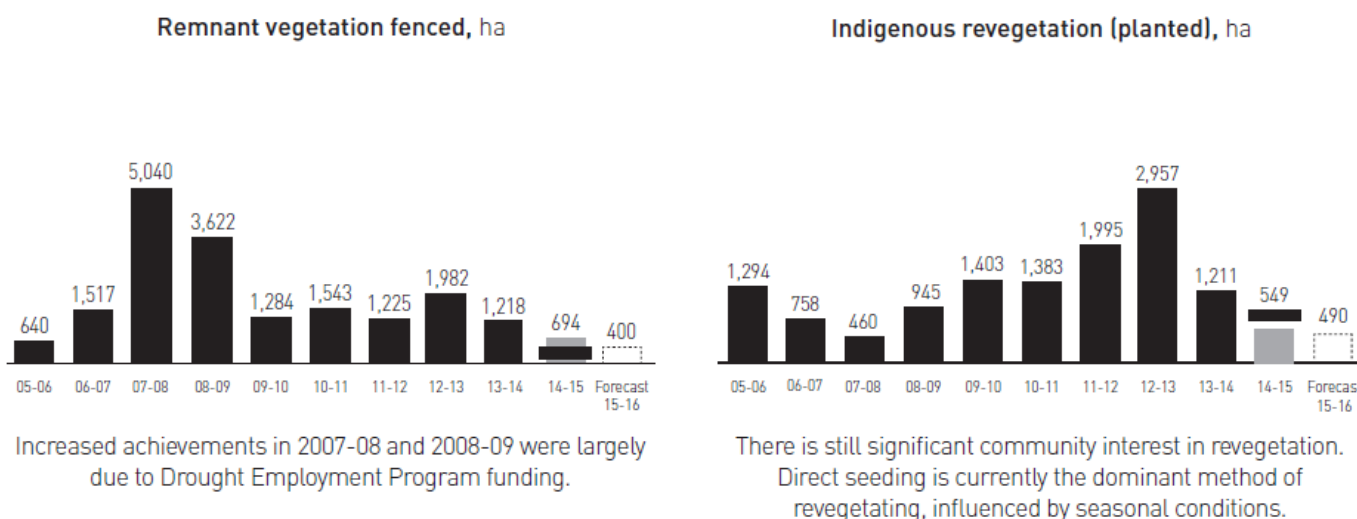
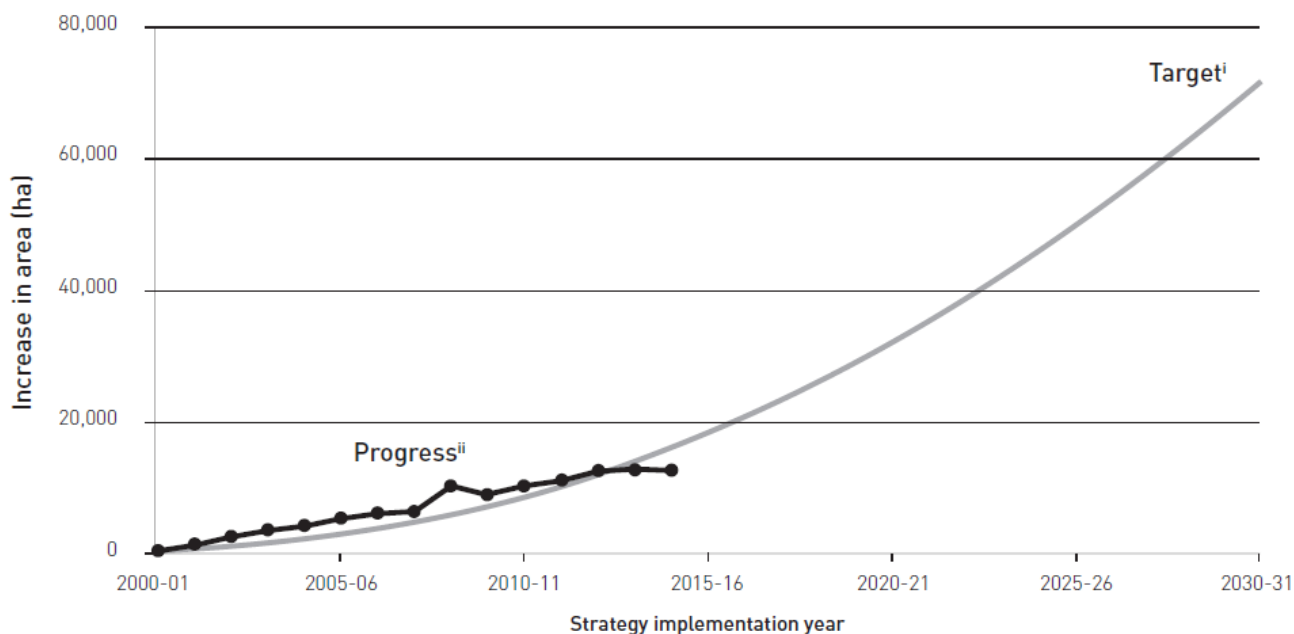


Figure 1: On-ground works achieved from complementary programs, 2005-06 to 2014-15 (from GBCMA 2015b)

Progress towards native vegetation extent targetⁱ, increase in area, hectares



- i. Resource condition target [revised 2009]: Increase the extent of native vegetation in fragmented landscapes by 70,000 hectares by 2030 to restore threatened Ecological Vegetation Classes and to improve landscape connectivity. Note that native vegetation extent is just one indicator of biodiversity. Other indicators such as native vegetation quality are more difficult to measure and it is probable that the trend may not be as positive as it is for native vegetation extent.
- ii. Based on assumptions of gains in vegetation (such as revegetation and natural regeneration) and losses of vegetation (such as legal and illegal clearing). Vegetation burnt by major fires in natural areas is not included as a loss of extent, as it is assumed the area burnt will regenerate by 2030. However, direct vegetation removal associated with fires, such as removal of 'high risk' trees on roadsides and private land or death of scattered paddock trees from fire, is assumed as a loss in the net outcome in the year of the fire (for example, the 2009 Black Saturday fires, the 2014 Wunghnu fires and the 2015 Lake Rowan, Stewarton, and Strathbogies fires), and includes an ongoing loss due to fire suppression activities. Detailed explanation of these assumptions can be found in the Goulburn Broken CMA's Biodiversity Monitoring Action Plan upon request.

Figure 2: Progress against native vegetation extent target (GBCMA 2015b). The graph provides a general depiction of progress given best available knowledge.

While acknowledging uncertainty, recent progress is trending away from the target. The amount of revegetation possible is currently restricted by funding and not by the communities' or individual landholders' desire to revegetate. The higher gain in 2008 reflects the significant one-off gain associated with the decommissioning of Lake Mokoan in 2008 – one of the biggest wetland restoration projects in the nation's history. The trend suggests the 2030 target won't be met without increased investment in restoring large areas in the Catchment and reduced clearing rates.

This Strategy reflects revised assumptions of progress in native vegetation extent. This has resulted in less gains being achieved than reported in previous years, although gaps in data availability create assumption uncertainty. Most assumption changes are related to losses of native vegetation through incremental clearing (permitted and illegal) and fire suppression activities, rather than reduced outputs being achieved by the Goulburn Broken CMA and partners.

Native vegetation clearing controls had a significant impact when first introduced in the late 1980s, but incremental loss of native vegetation, ongoing changes to regulations, including associated accounting and offset programs, are major challenges flagged in various strategies since 1990 that remain incomplete.

Case Study: Bats, Birds and Gliders – What do they have in common? The answer is.... Tree hollows.

By Janice Mentiplay-Smith, Goulburn Broken CMA



Conservation Management Networks (CMNs) have had a long history with nest boxes. Since 2009 nearly 1,400 nest boxes have been built and installed across the Broken Boosey and Whroo Goldfields CMNs for a variety of native fauna that depend on nesting hollows to survive. This includes nest boxes for the endangered brush-tailed phascogales and squirrel gliders, the threatened turquoise parrots, and sugar gliders and microbats. Normally, these critters would nest in deep, safe and dry hollows that take hundreds of years to develop in dead or living trees, but these are no longer in plentiful supply, due to land clearing, large scale timber removal and activities like gold mining. As hollows take so long to form, usually through a long process of decay due to termites or the slow nibbling of fungi, our native critters are in danger of becoming extinct or locally extinct. They can't afford to wait!

The CMNs' nest box programs address our native fauna's critical need for safe nesting hollows. Without a nesting hollow, sugar gliders and brush-tailed phascogales could possibly survive and manage to breed by living in a log on the ground, or behind a piece of bark, but this is a precarious situation, and may only result in a couple of young surviving cat or fox predation. Nest boxes provide a great alternative, and the fact they are used so quickly means that there is a big shortage of accommodation in our forests. The CMN marsupial nest box program has been extremely successful, with a 51% occupancy/use rate recorded in 2015 in the Whroo Goldfields CMN, mostly used by sugar gliders and brush-tailed phascogales. In 2016, nest boxes in the Broken Boosey CMN revealed they are home to feather-tailed gliders, ring-tailed possums, bats, Peron's tree frogs, brush-tailed possums and antechinus. This shows the variety of animals dependant on tree hollows, and how important it is to provide this vital habitat.

Turquoise parrots need deep, hollow 'spouts' (branches) to nest in, which are also few and far between. The Broken Boosey CMN's projects 'Practical Parrot Action' and 'Bed and Breakfast for the Birds', as well as a project funded by Nestle, focus on engaging community involvement and interest and building, installing and monitoring nearly 200 specifically designed nest boxes for the turquoise parrot. In 2015 success was ours – turquoise parrots had begun to use the boxes, raising and fledging chicks; a great result for this beautiful threatened species, and the Conservation Management Network.

Part B – WHAT ARE WE AIMING FOR?

3. Biodiversity outcomes

This section presents a framework for the biodiversity outcomes aspired to through this Strategy. Section 5 and Figure 4 expand this framework, showing how longer-term aspirations will be progressed in a 5-year timeframe. The review and update of this framework has considered contemporary principles and approaches for biodiversity adaptation planning, including a Goulburn Broken Catchment case study (Prober *et al.* 2015).

A vision provides a desired image for biodiversity in the long term. Ecological outcomes help to tease apart the vision. Finally, to help measure these outcomes, targets are used to quantify, where possible, an end state for key elements of biodiversity. Together, outcomes and targets are indicators of progress towards the vision (see Table 3).

Table 3: Strategic hierarchy for long-term biodiversity planning in the Goulburn Broken Catchment

Hierarchy	Context	
Vision	Defines overarching, long-term outcome for biodiversity in the Goulburn Broken Catchment	<i>Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity</i>
Ecological outcomes	<p>Assist in development and articulation of the vision.</p> <p>Based on expert and local knowledge, national and state biodiversity priorities (Barlow <i>et al.</i> 2007, Miles 2009, GBCMA 2010a) and literature on ecological processes and biodiversity planning (e.g. Lindenmayer and Fischer (2006); McGregor <i>et al.</i> 2008; Bennett <i>et al.</i> 2009; Prober <i>et al.</i> 2015).</p>	<ul style="list-style-type: none"> • <i>Protected and secured habitat</i> • <i>Landscape and habitat connectivity</i> • <i>Ecological processes, energy and gene flow optimised</i> • <i>High quality habitat</i> • <i>Viability of threatened species increased; and</i> • <i>Adequate representation of habitats</i> • <i>Habitat adapts according to regularly considered values and capacity to influence change</i>
Long-term biophysical targets	A way of defining/quantifying the type, amount and distribution of biodiversity assets that need to be conserved to achieve the vision. These are based on known thresholds for a range of biodiversity attributes, balanced with social and economic feasibility.	<p>Key target themes which are quantifiable surrogates for ecological outcomes (e.g. ecosystem function and conservation of soil biota) and for reporting progress:</p> <ul style="list-style-type: none"> • <i>Native vegetation extent;</i> • <i>Habitat quality; and</i> • <i>Threatened species.</i>

3.1 Biodiversity Vision, 2050

Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity

The following description is based on what land management and biodiversity outcomes would look like if the vision was fully realised in 2050.

Vision description

The community of the Goulburn Broken Catchment has been a proud participant in the international galvanising movement to abate global warming. The pathway to achieving this has changed the way we relate to the land, how we manage our natural resources, the scale at which we farm, and the development and trade of new commodities. Because of this, the Catchment is nationally renowned for its grand mountain ranges, its expansive floodplains, the flocking of large populations of water birds to congregate in its ephemeral wetlands, the abundance of native fauna and seasonal wildflowers; all of which are intractably linked to our national icon – the mighty Murray River. As the Murray winds its way to demarcate the north of the Catchment, it meets its largest tributary – the Goulburn River. As with all the rivers in the Catchment, the natural flooding regime, the ecological needs of the surrounding floodplain, and the health of the river underpin the way we manage and relate to these national treasures. The health of the surrounding land, its capacity and its associated land use is highly productive and sustainable as a result.

The Goulburn Broken Catchment is renowned for its diversity of landscapes, from alpine environments, to granite ranges, rolling woodlands and vast plains. Within each of these landscapes ongoing land management promotes their unique natural features, where land managers are astute to the needs of the local flora and fauna and work within the limitations of the productive capacity of the land. The intrinsic environmental values are appreciated and the whole community is contributing to the cost of maintaining these values. Local communities are strong, resilient and vibrant, with local economies built on the features of the natural environment – tourism, local food production, community supported agriculture, biodiversity credits, and native vegetation carbon sequestration.

A significant portion of public land within the Catchment is managed for conservation, with any products resulting from these lands carefully selected for their value-added potential (e.g. bush tucker, craft timber, medicines). Plantations that support a vibrant forestry industry are built on an integrated approach of meeting carbon-trading agreements and biodiversity credits.

With an engaged community fully aware of the inter-dependence of society and environment, the functioning of our natural ecosystems is highly valued and much better understood by the scientific and local community. Private landholders are well supported and resourced to manage biodiversity and other ecosystem services as an integral part of the farming environment.

3.2 Biodiversity thresholds and targets

Thresholds and the functioning of the Catchment are key considerations of the Goulburn Broken CMA's 'resilience approach' (described in section 2.2.3).

To be effective and efficient, and in context of all the challenges described in Section 2.2, interventions must be targeted at attributes that are critical to the functioning of a system's complex connections of people and nature, and where the functioning of the system is at risk because the attributes are threatening to breach tipping points or thresholds.

Focusing on the attributes that are critical fosters shared understanding of trade-offs and multiple benefits when choosing interventions: most interventions usually impact on several critical attributes because of the highly connected nature of the dynamic working landscape of people and nature (see the example in section 6.3.3).

Long-term targets for critical attributes direct action and are reference points for reviewing progress (see section 2.3 and 3.3).

Thresholds have been considered in the Goulburn Broken Catchment since salinity and water quality plans were developed in the late 1980s and early 1990s. Thresholds have featured in biodiversity planning since targets were set as part of native vegetation planning in the late 1990s.

Although biophysical targets in this Strategy factor in the broader context of social and economic considerations at the whole-of-Goulburn Broken Catchment scale, finer scale direction will be achieved at the scale of SESs when all critical attributes are considered in detail simultaneously.

The status of native vegetation is the most important indicator of progress in managing terrestrial biodiversity because it:

- is a critical part of habitat (related to the ecological outcomes to be achieved in Table 3 above and native vegetation is widely accepted as a surrogate in biodiversity planning)
- influences soil health (and vice versa);
- is measurable in a reasonable timeframe and there is science that we can use to extrapolate how fauna are likely to respond to changes in native vegetation extent and quality;
- is obvious to land managers, who are largely responsible for it; and
- relatively easy for land managers to do something about (easiest part of biodiversity to manipulate).

Clearing of native vegetation leads to the loss of habitat for many flora and fauna species, particularly those of conservation concern. Numerous studies have found that loss of native vegetation results in reduced species richness (e.g., Reid 2000; Fahrig 2003; Radford *et al.* 2005).

Table 4 (below) lists thresholds that are considered for target-setting and might be useful for local planning. These biodiversity thresholds are based on science and generally remain constant across the Catchment. However, there are differences between each SES in terms of proximity to breaching thresholds, which lead to different attribute and intervention priorities across the Catchment (see Table 5).

As each SES has a unique identity, some thresholds will be more relevant in particular SESs than in others. For example, each SES has different revegetation requirements to achieve a “resilient” SES, based on where they sit in relation to identified thresholds for native vegetation extent and what level of resilience is considered feasible.

The explicit listing of a threshold does not suggest that clearing of native vegetation, for example, can occur in an SES that is well-above the threshold. For example, the Southern Forests SES would experience significant and undesirable transformation if native vegetation extent reduced to 30 per cent, and this would not be consistent with this Strategy’s principle of net gain. Therefore, the local plan for the Southern Forests might focus on different biodiversity thresholds, or alternative thresholds such as the area of Catchment vegetated for providing catchment health and water filtration. Thresholds at the SES scale will be considered alongside broader social and ecological attributes according to the vision and identified drivers of change for each SES.

In the Agricultural Floodplains, native vegetation extent was identified as a critical attribute and the following target was formulated, considering the catchment-scale biodiversity thresholds and other social and economic factors: By 2030, the extent of native vegetation will be increased by 2% in nine focus landscapes (a total of 300 hectares per year). Targets may or may not be included in other SES local plans as they are further developed with their communities.

Table 4: Native vegetation and habitat attributes of biodiversity that are most important to the Goulburn Broken Catchment (and associated thresholds)

Attribute	Threshold	Assumptions	Example references
Native vegetation extent			
Percentage remaining across landscape (and remaining of each habitat type)	<30% (ecosystem/landscape function starts to decline) <10% (exponential loss of species, extinction)	<ol style="list-style-type: none"> 1. There is a positive association between native vegetation extent and landscape function 2. There is a positive association between native vegetation extent and biodiversity 3. Species richness at a landscape scale is strongly dependent on the amount of vegetation cover. 4. At least 10% tree cover is a minimum goal for an infrastructure of natural vegetation in rural landscapes to prevent species decline and loss 5. The negative effects of patch size and isolation occur when a landscape consists of only 10-30% of the original habitat 6. The extent of habitat is usually a dominant influence on the occurrence of single species or the richness of assemblages defined by habitat type 	<ol style="list-style-type: none"> 1. Forman 1995 2. Hargis et al. 1998; MacNally 1999, Bennett and Ford 1997; Garrett and Crowley 2000; Barrett 2000, Reid 2000, Bennett et al. 2006, James and Saunders 2001, Turner 2005 3. Reid 2000, Radford <i>et al.</i> 2005 4. Bennett & Ford 1997 5. Andr�en 1994 6. Gibbons <i>et al.</i> 2009
Connectivity	>50m distance between habitat (vertebrates)	<ol style="list-style-type: none"> 1. There is a positive relationship between size and distance between remnants and a. landscape function and b. species richness and diversity because the landscapes allow movement and ecosystem processes to occur. 2. The configuration of remnants affects species diversity, particularly in landscapes with low habitat abundance 3. The length of native vegetation along roadsides > 40m (and of the length of gaps) affects species dispersal opportunities and therefore landscape function. 4. Connected remnants are better than disconnected remnants. 	<ol style="list-style-type: none"> 1. a. Turner 2005 b. Turner 2005 2. Turner 2005 3. Bennett & van der Ree 2001 4. Leck 1979; Gilpin and Hanski 1991; Recher and Serventy 1991; Wilson and Lindenmayer 1995; Bennett 1999
Native vegetation/habitat quality			
Weediness	>25% cover of weeds in remnants		
Habitat diversity (including structure, species richness, logs, recruitment)	<60/100 Habitat Hectare score	A diversity of plant species and habitat elements generally increases the diversity and resilience of fauna species	Lindenmayer <i>et al.</i> 2006
Patch size	<3-40ha	<p>There is a positive association between remnant size and:</p> <ol style="list-style-type: none"> 1. species richness and diversity 2. vegetation quality 3. resilience of species and systems to adapt and survive shocks. <p>5 ha, 10 ha, 40 ha, 100 ha and 400 ha are thresholds where a change in species richness and diversity occurs.</p>	<ol style="list-style-type: none"> 1. Kitchner <i>et al.</i> 1982; Bennett 1987; Loyn 1987; Taws 2001; MacNally and Horrocks 2002

Table 5: Indicative priorities for critical biodiversity attributes to help inform SES local plans

SES	Vegetation extent	Habitat Quality	Threatened species*	Notes
Commuting Hills	M (Create major corridors)	VH (Existing remnants)	M Focal species** are used to engage community (e.g. Squirrel Glider, Tree Goanna)	<ul style="list-style-type: none"> Protect existing vegetation extent through planning overlays, including potential corridors. Weed control important. Maintain, link and buffer large remnants.
Upland Slopes	<p>VH (Create biolinks across Tablelands and Mansfield)</p> <p>M (Strathbogie forests and public land)</p>	<p>VH (Strathbogie Ranges forests and public land)</p> <p>VH (Tablelands and Mansfield)</p>	M Focal species to engage community (e.g. Brush-tailed Phascogale, Long-nosed Bandicoot)	<ul style="list-style-type: none"> Extent more important, for example, in eastern Strathbogie Ranges and Mansfield where native vegetation extent is less than 10%. Priority corridors/linkages should be identified and targeted to increase to 10-30+% in priority linkages. Identify and manage small public land reserves. Target bogs and rocky outcrops for habitat quality. Western Strathbogie Ranges is more important for managing public land for habitat quality.
Southern Forests	L (assumes no loss)	VH (Public land)	VH for specific species: e.g. Mountain Pygmy Possum, Leadbeater's Possum, owls, frogs, fish	<ul style="list-style-type: none"> Work with public land managers, particularly on burning regimes, weed control, and monitoring changes to quality. No loss of existing vegetation extent
Productive Plains	VH (establish corridors)	M (Enhance woodland remnants)	M Focal species to engage community. Woodland birds, including Grey-crowned Babbler and Bush-Stone Curlew)	<ul style="list-style-type: none"> Continue to work with farmers to increase extent. Identify public land reserves. Increase extent to 10 - 30% + in priority landscapes
Agricultural Floodplains	VH (Manage and establish links within priority landscapes)	M	M Focal species to engage community (e.g. Grey-crowned Babbler, Brolga, Superb Parrot)	<ul style="list-style-type: none"> Existing remnants health critical – particularly in wetlands and along waterways such as Barmah Forest and Goulburn River Increase extent 10 - 30% + in priority landscapes.
Urban Centres	L	M	M Focal species to engage community	<ul style="list-style-type: none"> Engage community in surrounding natural landscapes.
Catchment-wide	VH	VH	L	<ul style="list-style-type: none"> SES's to inform extent and quality. Use systems approach to managing threatened species, focusing on resilience.

* While not a critical attribute, this indicative information on threatened species should help early discussions during local planning.

** Focal and priority species determined through existing resources such as the BAP Conservation Plans (see GBCMA website and example of focal species information in Appendix 8) and in consultation with partners and community. Projects to protect these species would also benefit a range of other species and broader ecosystem function.

3.3 Long-term biodiversity targets

Target 1: Increase the extent of native vegetation in fragmented¹ landscapes by 70,000ha by 2030².

Target 2: Improve the quality of 90% of existing³ habitat⁴ by 10% by 2030.

Target 3: Increase the population viability⁵ of 20 threatened species by 2030.

Targets 1 and 2 are consistent with the goal of 'net gain' (listed in DSE 1997 and DELWP 2016a)

Long-term biodiversity targets are important in trying to understand progress towards achieving this Strategy's vision. Targets improve decision-making by:

- identifying and quantifying the current understanding of the type, amount and distribution of biodiversity assets that need to be conserved;
- communicating the scale of change required to reach a target (this information is easily accessible by individuals, community and agencies, including funding bodies); the magnitude of the change required is the important message, with the actual figures being less important;
- creating a reference point to aim towards, to provide a common sense of purpose and direction regardless of the scale of individual actions (from catchment to paddock);
- identifying assumptions behind the targets to develop and prioritise key research questions to improve understanding of outcomes; and
- satisfying the needs of important external stakeholders (including government investors).

The biodiversity targets (developed first in 2000 and reviewed in GBCMA 2003a, Keogh *et al.* 2009, GBCMA 2010a and Miles 2015) consider:

- latest scientific knowledge;
- feasibility of measurement within a scientific framework;
- feasibility of reversing the degree of landscape modification;
- ongoing threatening processes; and
- community expectations of public and private investment (noting that this can change over time).

While the targets are specific, measurable, achievable, relevant and time-related (SMART) we acknowledge the need for flexibility in dealing with dynamic complex ecological systems. Targets may be adjusted over time with increased understanding of system processes at various scales, or when considering policy changes, such as Victoria's Draft Biodiversity Plan (DELWP 2016a).

Further rationale for the targets is provided in Appendix 5, including an overview of measuring progress and links to targets in other program areas.

¹ Intact, Fragmented and Relict landscapes modelled by DSE (DSE 2009c), threatened EVCs and Landscape Context Tool provide a guide for identifying "fragmented landscapes".

² Relative to 2005 levels.

³ Targets are based on a subset of the latest available native vegetation data from DELWP based on mapping undertaken in 2005 (DSE 2007d). The subset does not include grassy vegetation extent. Further details are provided in Keogh *et al.* 2009, along with areas (ha) required to achieve targets per bioregion and EVC. Note – progress towards Target 2 is based on the area of native vegetation subject to change in quality by at least 10%, as an accurate benchmark of vegetation quality upon which to consistently measure catchment-scale change is not currently available.

⁴ Here habitat refers to native vegetation species diversity and structure, and other habitat elements such as logs and rocks.

⁵ Population viability will be measured as feasibly and appropriately as possible for each selected species such as an increase in range, numbers of individuals or genetic variability.

4. Spatial prioritisation

Natural and agri-environmental systems are complex, interconnected systems and it is important that scale is considered when making strategic planning decisions. Scales considered and managed for include: state, catchment, social-ecological system, zones, landscape, property and site. Processes occur at all of these scales and managing at just one scale ignores system complexity. However, Australian and Victorian Government investment priorities influence decision-making at the catchment-scale. Table 6 (below) provides examples of planning at several scales.

Further explanation and examples of how some of the tools mentioned in Table 6 are used in spatial prioritisation are provided in Appendix 6. As part of developing this Strategy, bio-geographic zone priorities (GBCMA 2010a) were reviewed by considering new information and mapping products (Figure 3). A comparison between the zones, NaturePrint, and the Climate Change Adaptation Priority Areas demonstrates a correlation between the three approaches (Figure 3). Spatial priorities remain the same, however there is now additional supporting data. Prioritisation at the landscape scale is now also underway (Appendix 6).

Table 6: Examples of tools used at each scale of conservation planning in the Goulburn Broken Catchment

Scale* ⁶	Key tools ⁷	Description	Purpose
National	Legislation, Major program priorities	For example, EPBC Listed species and vegetation communities.	Communicates national biodiversity priorities, determines funding priorities.
State	Species distribution models (e.g. NaturePrint)	NaturePrint: State-wide model of priorities to conserve the most species, determine statutory requirements	Spatially represents biodiversity values across the State. Determines priorities for vegetation permitted clearing regulations.
	Strategic Management Prospects	DELWP's Spatial tool (yet to be released) building on NaturePrint	Identifies biodiversity priorities (locations and actions) that provide the best return on investment
	Actions for Biodiversity Conservation (ABC)	ABC: threatened species priority actions and areas	ABC: determines funding priorities.
	Legislation, Flora Information System, Fauna Information System.	Listed species and locations.	Identify statutory obligations for protection of government-listed species and communities
Catchment/ region	RCS	Catchment-scale strategy that covers multiple themes and priorities	Identifies regional priorities across six social-ecological systems within a resilience framework.
	This Strategy	Biodiversity sub-strategy of the RCS	Biodiversity context, principles, vision, targets, thresholds, priority areas etc.
	Bio-geographic zones (see Figure 3)	Broad geographical units with similar ecological values that have been prioritised for biodiversity protection and restoration.	Broadly communicates where protection and restoration efforts will be focused. Informs catchment planning and investment, including local plans and landscape-scale projects.
Social-ecological systems (sub-catchment)	Local planning across SESs	Planning units that recognise complexity and variation across the Catchment. Plans identify locally relevant issues and actions based on social and ecological characteristics of the SES.	Identify priority landscapes and projects based on local circumstances.
Landscape	Priority landscapes within SESs (see Figure 12)	Landscapes prioritised on criteria to meet objectives of local plans (see case study below)	Targeted investment into focus areas
Property/ site/patch	Vegetation quality assessment, management plans.	Identifies site value attributes and needs, taking into account surrounding values and contribution towards broader objectives.	Targets specific ecological needs of sites to inform landscape-scale priorities, and targeted implementation by extension officers and community
	Biodiversity Action Planning. See GBCMA website for interactive mapping tool and BAP Conservation Plans. (and Appendix 8 for example of focal species information for one of the 18 BAP Conservation plans)	Spatial representation of priorities based on bioregional conservation status, threatened species, size, etc.	Assists with the setting of priorities areas and guides local implementation

⁶ These various scales influence each other from above and below

⁷ Relevant policies and legislation are summarised in Appendix 1.

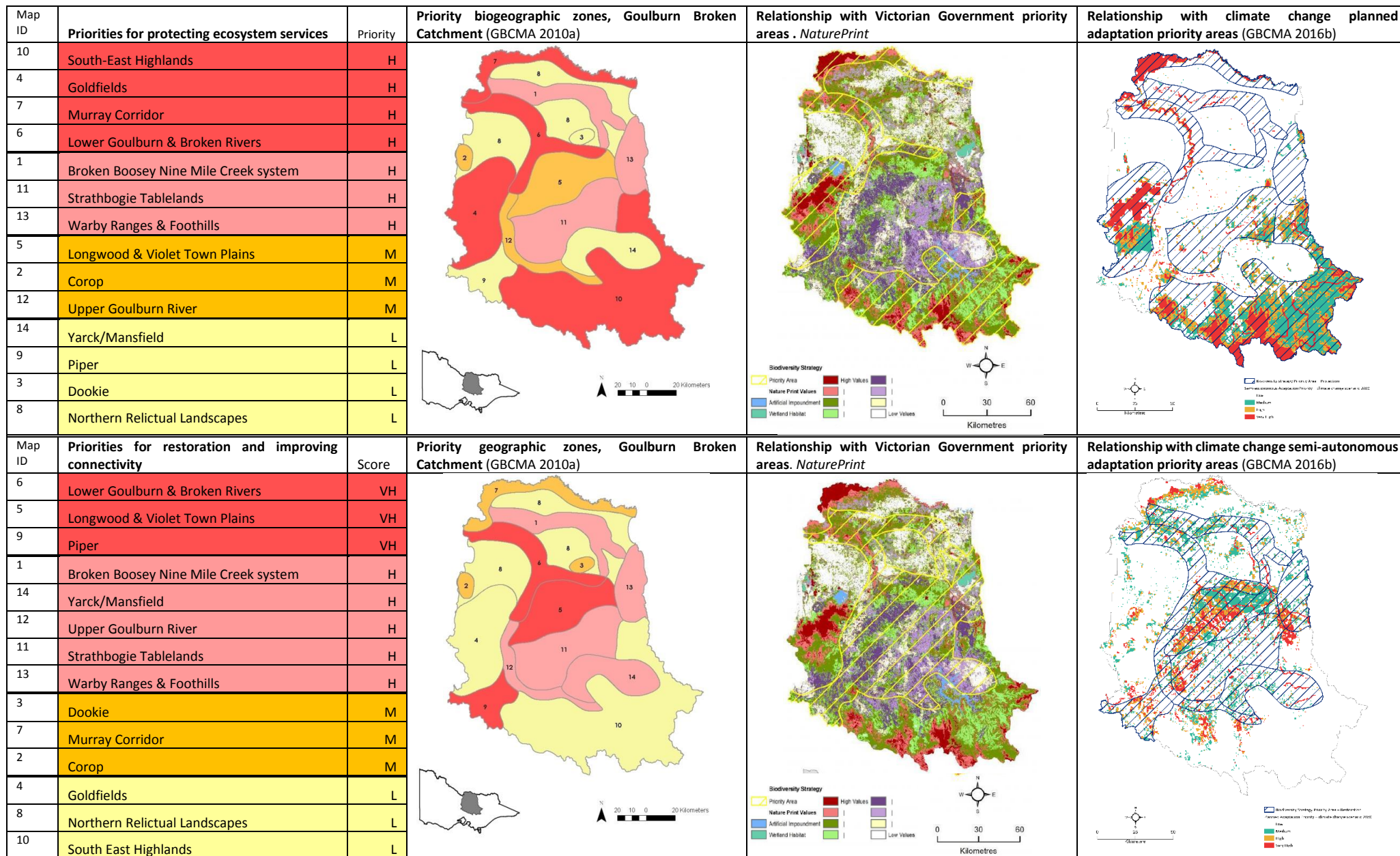


Figure 3: An example of three different methods of mapping spatial priorities. While there is no one answer, having a range of tools and mapping layers helps make informed decisions about where resources should be focussed.

PART C – HOW WILL WE GET THERE?

5. Strategic directions and initiatives

Strategic directions, initiatives and actions focus efforts towards achieving long-term targets listed in Part B of this Strategy. The Goulburn Broken CMA will work with partners to implement this Strategy, including annual planning and project development. Implementation planning will identify specific actions and tasks, including timelines, responsibilities and priorities. Appendix 7 provides a list of preliminary actions under each strategic initiative.

The following five **Strategic Directions** highlight the key focus areas for Part C of this Strategy.

- 1. Anticipate and adapt to change**
- 2. Strengthen partnerships**
- 3. Invest wisely**
- 4. Build on ecological infrastructure**
- 5. Legitimise biodiversity conservation**

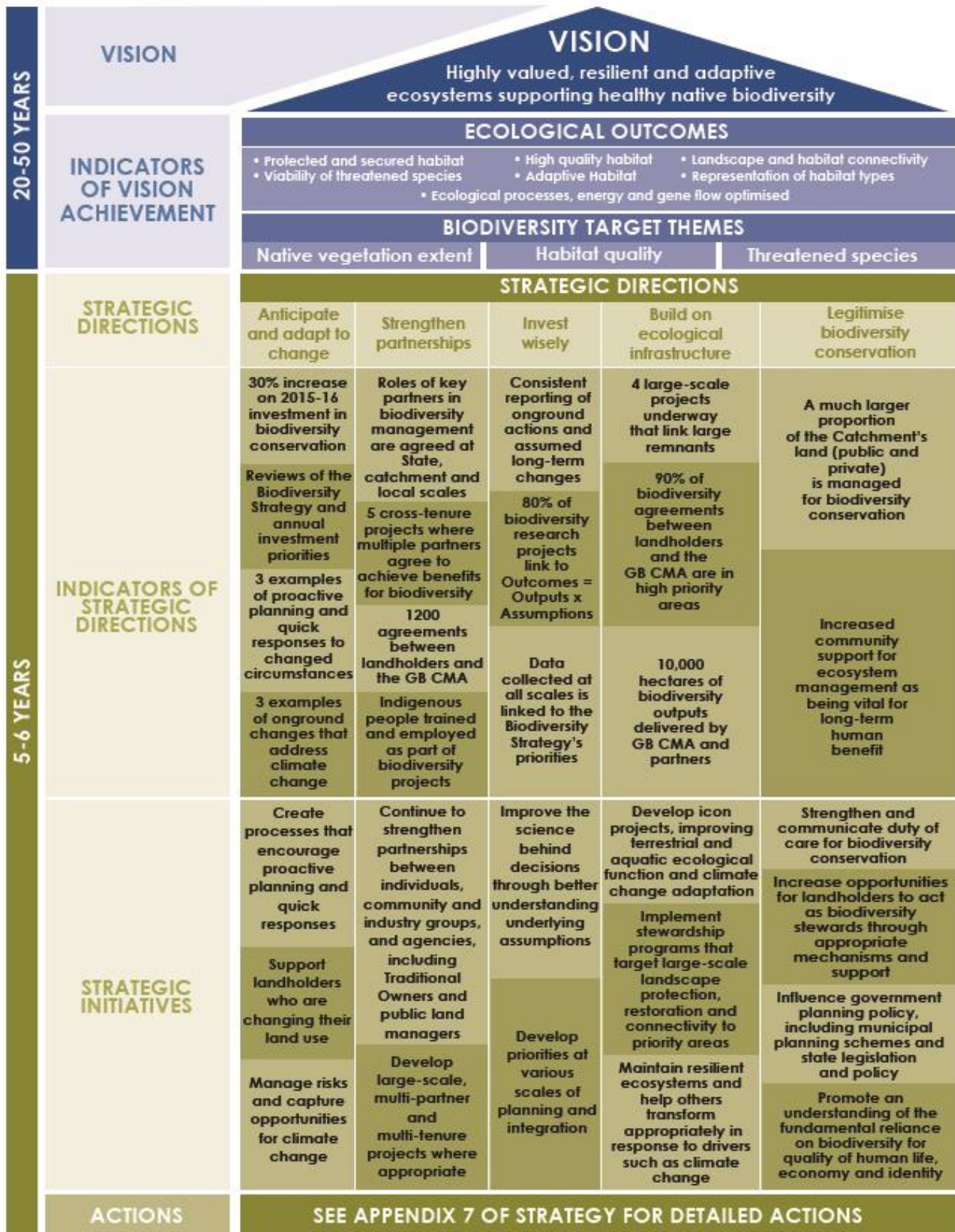


Figure 4: The strategy framework: logic between vision and actions

5.1 Anticipate and adapt to change

Strategic Initiatives

1. Create processes that encourage proactive planning and quick responses, including plans that factor in local differences and uncertain knowledge and futures, governance arrangements that are shared by partners, and processes that are regularly reviewed.
2. Support landholders who are changing their land use, such as peri-urban development, farming enterprise, and lifestyle property, by helping them factor biodiversity into their planning and implementation.
3. Manage risks and capture opportunities from climate change.

Key indicators of success for Strategic Direction 1 (Anticipate and adapt to change)

- 30% increase on 2015-16 investment in biodiversity conservation
- Reviews of this Strategy and annual investment priorities shared between partner agencies
- 3 examples each of proactive planning and responses to changed circumstances
- 3 examples of on-ground change that address climate change vulnerability in adaptation focus areas

The many factors affecting biodiversity conservation regularly change, especially the circumstances of private and public land managers. Management approaches must be proactive to adapt to both expected and unexpected changes, responding as necessary, according to the principles listed in section 3. This Strategy must therefore be reviewed regularly (according to the planning cycle requirements advanced in Table 8, section 6).

The Goulburn Broken CMA works with partners, especially landholders, to put in place processes that optimise responses for biodiversity conservation given current, known circumstances and future foreseen and unforeseen circumstances.

Rapid joint-stakeholder responses in the Goulburn Broken Catchment in recent years include the fruit industry employment and fire recovery programs (GBCMA 2015a). Both programs provided significant biodiversity benefits and were only possible because of efforts to nurture partnerships over many years so there was a good sense of shared priorities.

Opportunities for attracting contributors and investors from public, private and philanthropic sectors also need to be pursued to help address increasing threats to biodiversity.

This Strategy provides a regional perspective for delivering national and state policies, strategies and projects. The Victorian government has drafted Victoria's Biodiversity Plan 2036 (DELWP 2016a), reinforcing the Goulburn Broken CMA's priorities around the importance of engaging with the community in achieving conservation and biodiversity health.

Significant progress on regional NRM planning for climate change has been achieved recently due to investment from the Australian Government in 2013 resulting in new and emerging policies and management tools related to adaptation that present opportunities for addressing the vulnerability of social-ecological systems to climate change. The Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment (GBCMA 2016b) identifies focus areas for climate change adaptation, including management options and priority areas for carbon farming, factoring in consideration of the risks of such activities to the Catchment's natural resources. Focus areas for adaptation specific to biodiversity conservation are identified in section 4 and Appendix 4 of this Strategy.

CSIRO has developed national and Murray Basin-specific climate change adaptation planning information and tools such as AdaptNRM that includes 2 modules specific to biodiversity '*Implications of Climate Change for Biodiversity*' (Williams *et al.* 2014) and '*Helping Biodiversity Adapt*' (Prober *et al.* 2015). These modules introduce the concept of 'ecological similarity' for assessing the potential for broad shifts in biodiversity, as a whole, in response to climate and land use change and associated principles for biodiversity conservation. The Goulburn Broken CMA will look to work with its partners to integrate this new information and tools with local knowledge to guide biodiversity management planning.

The effect of climate change on individual species and required restoration is largely unknown. To this end, the Goulburn Broken CMA is working with CSIRO (Dr. Linda Broadhurst) to begin trials of planting the same species but different provenances in the Catchment. For example, sourcing seed from Banksias that also occur in NSW in drier areas and determining if they do better in the Catchment under a changing climate.

The Goulburn Broken CMA will continue to proactively seek opportunities through carbon markets to promote investment in positive outcomes for natural resources through bio-sequestration activities. It will be important to work collaboratively with partner organisations, researchers, carbon brokers and landholders to provide guidance on regional priorities to achieve good outcomes for natural resources.

Major socio-economic trends in the Catchment are presenting increased risks and opportunities for biodiversity at a large scale. While some land is being more intensively managed for irrigated and dryland agriculture, other areas are being less intensively managed. For example, in some areas that were previously intensively farmed, 'lifestylers' own and manage land with biodiversity conservation as a primary purpose, and programs are being adapted and targeted to provide lifestylers with incentives and knowledge to conserve biodiversity.

5.2 Strengthen partnerships

Strategic initiatives

1. Continue to strengthen partnerships between individuals, community and industry groups, and agencies, including Traditional Owners and public land managers.
2. Develop large-scale, multi-partner and multi-tenure projects when appropriate.

Key indicators of success for Strategic Direction 2 (Strengthen partnerships)

- Roles of key partners in biodiversity management are agreed at state, catchment and local scales
- 5 cross-tenure projects where multiple partners agree to achieve benefits for biodiversity
- 1,200 agreements between landholders and the Goulburn Broken CMA, which include biodiversity outcomes
- Indigenous people trained and employed as part of biodiversity projects delivered across the Catchment, exceeding state employment targets for Aboriginal people

Many different land managers affect biodiversity, so it is important that a range of partners are engaged to achieve objectives. The relevance of this Strategy to various stakeholders is listed in

Table 1.

Relationships with partners need to be regularly reviewed to ensure there is a clear and agreed understanding of stakeholder roles, responsibilities and capacity.

Partnerships with private landholders and local community groups, including Landcare, will remain paramount because many threatened species rely on habitat that is mainly on private land, especially properties that were cleared for agriculture.

Community networks influence land management across large areas of the Catchment. For example, Conservation Management Networks (CMN) develop partnerships across different land tenures and engage the community in biodiversity conservation. 'Friends' groups, such as those for the Superb Parrot and Regent Honeyeater, have revegetated parts of numerous farms to create highly connected landscapes.

The updated Shepparton Land and Water Management Plan elevates the priority for partnerships and works in 'focus landscapes', which are like 'integrated multi-property whole-farm plans' for local areas that have large blocks and corridors of habitat, especially streamsides (SIRPPIC 2016).

Private industry groups are increasing their involvement in biodiversity management as part of their environmental performance agenda. For example, Bega Cheese's "milk suppliers and production operations strive to maintain a balance with ecosystems and prevent harm" (Bega Cheese 2016).

The *Aboriginal Heritage Act 2006* has established Registered Aboriginal Parties within the Goulburn Broken Catchment (Taungurung Clans Aboriginal Corporation and Yorta Yorta Nation Aboriginal Corporation), which gives traditional owners a formal role in managing cultural heritage on country. One of the main objectives of this Act is to promote the management of Aboriginal Cultural Heritage as an integral part of natural resource management.

The Yorta Yorta Nation Aboriginal Corporation (YYNAC) released its 'Whole of Country Plan' in 2012 that provides specific advice and recommendations regarding Yorta Yorta's aspiration for genuine engagement and adequate resourcing as an active NRM partner and leader. The Goulburn Broken CMA supported YYNAC in developing the Plan and strives to be a leader in working with Traditional Owners in the catchment in the effective and culturally sensitive management of Country, Knowledge, and natural and cultural resources.

Stronger collaborations with public land managers and traditional owners will be pursued to increase the focus on large-scale, cross-tenure projects. Public land often has the largest areas of habitat in a landscape, and should be the focus for connecting other areas of habitat, especially via private land.

Parks Victoria is developing a management plan for many of Victoria's River Red Gum areas, and it is expected to be completed during 2017 (Parks Victoria 2015a). Long-term strategic directions for Barmah National Park will be determined through the Yorta Yorta Traditional Owner Land Management Board (Parks Victoria 2015b).

"Public land, which covers one-third of the Catchment, has retained most of its native vegetation because its soils or topography are not suitable for agriculture. Large blocks and long streamside corridors of public land therefore provide the foundation for building biodiversity and water quality resilience. Balanced decisions around planned burns, emergency response and recovery, land development, cultural heritage, and invasive plants and animals require effective relationships between public land managers and surrounding landholders."
(GBCMA 2013 p. 22)

The importance of partnerships is also elevated by the need to consider biodiversity as part of broad community 'wellbeing' projects. Although biodiversity is often in poor condition in and near regional centres, urban people are increasingly valuing remaining vegetation for aesthetic and recreation purposes (GBCMA 2013).

Cross-program partnerships within the Goulburn Broken CMA will continue to be reviewed and strengthened to streamline planning and implementation and ensure biodiversity is considered in all land and water planning.

Case Study: Sand Ridge Woodlands - Working across Borders

By Jim Begley, Goulburn Broken CMA



The Sand Ridge Woodland Project has worked hard at building relationships between multiple partners for over 5 years. The original project area submitted for funding to the Australian Government in 2012 was defined as the Yorta Yorta Nation traditional boundary, and as a joint partnership project between Yorta Yorta Nation Aboriginal Corporation, Goulburn Broken CMA, Murray Local Land Services (Murray LLS) in New South Wales, Parks Victoria and New South Wales National Parks Service.

In doing so, the Project crossed many boundaries, including state borders between Victoria and NSW, catchment boundaries, National Parks, State Parks, Council land, Travelling Stock Reserves and private landholdings. With all groups now working under the same Yorta Yorta banner, it gave a new focus for delivering on-ground outcomes and put Cultural Heritage as a priority for identification and protection at the forefront of the project. In addition to this, Yorta Yorta's Woka Walla works crew were central to the success of the project as the preferred contractor to deliver many of the components. This included revegetation works, seed collection, pest plant and animal control, fencing to protect native vegetation, bird surveying and a training component for the works crew. The Yorta Yorta Cultural Heritage Unit has also played an integral part in surveying for Aboriginal Cultural Heritage where much historic activity and occupation is evident by significant artefact findings in the sand hills. Four repatriation burials were also a significant finding through the project, partnering with private and public land managers to protect these sites.

With such large tracts of sand hills on public land in the NSW Parks area along the Murray corridor, the Project was able to achieve targets efficiently and on time, while Murray LLS and the Goulburn Broken CMA worked largely with private landholders to protect and revegetate on a smaller scale. The Project is now entering its last phase of this current round of funding and will be completed by July 2017.

Outputs achieved across the Project area (up to 2016) include:

- 1,534 hectares of revegetation
- 450 hectares of remnant vegetation protection.
- 1,395 hectares of pest plant control
- 1,226 hectares of pest animal control

The environmental outcomes from this project however, are yet to be fully realised, with many project sites being in their early establishment phase. The bird survey results are beginning to show some indication of potential significant change when comparing bird species diversity and numbers from mature quality sand ridge woodland sites to low quality sand ridge sites. This work is trending that woodland bird numbers and bird diversity is greater in highly diverse and quality sand hill vegetation, with the more common bird species and less diversity of bird species counted in the open cleared areas with low vegetation quality. With 4 bird surveys still remaining in 2016/17 a more complete story is yet to be told.

From a social perspective, relationship building between agencies, councils, landholders and Traditional Owners has been a progressive step in the cooperation between groups for a common cause. Aboriginal Cultural Heritage protection activities and appreciation of such sites has increased and employment opportunities for local Indigenous people have been provided over the period of the Sand Ridge Woodland Project.

A Sand Ridge Woodland Condition Report (in prep.) will help to gain a broader understanding of issues, threats, attitudes and learnings from the Sand Ridge Woodland Project. It will also identify the current condition of sand hills that has been worked on so far, and attempt to identify the extent of potential works.

5.3 Invest wisely

Strategic Initiatives

1. Improve the science behind decisions through better understanding underlying assumptions, and associated data quality and management.
2. Develop priorities at various spatial scales of planning and integration.

Key indicators of success for Strategic Direction 3 (Invest wisely)

- Consistent reporting of on-ground actions and assumed long-term changes as per Goulburn Broken CMA's annual report
- 80% of biodiversity research projects in the Catchment link to: Outcomes = Outputs x Assumptions (as listed in the Biodiversity Monitoring Action Plan [GBCMA 2016a])
- Data collected at all scales is linked to this Strategy's priorities.

Funds for biodiversity conservation are likely to remain limited. While increased investment in biodiversity conservation is a performance indicator of this Strategy (see strategy purpose and strategic direction 1), it is important to invest limited funds wisely. This includes investing in areas according to defined priorities ('spatial prioritisation') so that the greatest biodiversity benefits are generated from investment (see Section 4).

The Goulburn Broken CMA has adopted a 'resilience approach', which includes investment decisions guided by an understanding of what is driving change and the risks of breaching tipping points (thresholds) for each social-ecological systems (section 2.2.3).

Current understanding of tipping points and progress is limited, although evaluation of progress in managing biodiversity has improved significantly in the last decade via the Goulburn Broken CMA's annual report. The equation *Outcomes = Outputs x Assumptions* has been used to improve assumptions and therefore understanding of progress.

It is also critical to understand which mechanisms appeal to land managers. The landscape has been shaped by a few drivers of change historically, such as booming wool prices in the 1950s, (Race *et al.* 2009 and see Appendix 2), and project managers must remain alert to what is driving change so that responses can adapt stewardship mechanisms appropriately.

Greater clarity of the trade-offs and risks of investment decisions result in better outcomes. The Goulburn Broken CMA has recently (2013-16) undertaken more detailed work on regional NRM planning for climate change, supported by the Australian Government. As a result, NRM planners have access to a Climate Change Adaptation Plan that provides an initial prioritisation for climate change adaptation in the Catchment based on spatially-enabled criteria for climate change vulnerability and NRM values. The adaptation priorities and associated management options outlined in the Plan will be considered at various spatial scales (GBCMA 2016b). See section 4 and Appendix 4 for climate change adaptation priority areas for biodiversity.

Some biodiversity projects in the Goulburn Broken Catchment use 'focal' species such as the Superb Parrot or Carpet Python to achieve broader biodiversity benefits while others, addressing specific actions for threatened species, have a single species focus (e.g. *Barred galaxias*). Threatened species are often a good way to garner community support and involvement.

Investment in biodiversity (both native vegetation and threatened species) needs to be consistent with knowledge of the likely impacts of climate change. Steffen *et al.* (2009, p.13) stress that a vastly enhanced conservation effort should be undertaken: "*Management approaches that seek to maintain current spatial arrangements of species will be very difficult to implement under a changing climate – and could well be counterproductive. Management objectives will need to be reoriented from preserving all species in their current locations to maintaining the provision of ecosystem services through a diversity of well-functioning ecosystems.*" As well as such adaptation strategies, transformation strategies also need to be considered. Of particular interest is species selection for future climates, however there is little information available to help make informed decisions at this point in time (Broadhurst *et al.* 2016). Prober *et al.*

(2015) provide some guidance on implementation option such as when to use ‘local species’ in plantings, as opposed to non-local native species using the proximity principle. DELWP (2016a) suggest that encouraging gene mixing may be appropriate to increase the genetic “fitness” of populations to adapt to a changing environment. This could lead to reduced emphasis on the use of “local provenance” material in revegetation projects. Identifying knowledge gaps, research priorities and possible experiments with different genetics and species will be part of the Goulburn Broken CMA’s annual Biodiversity Monitoring Action Planning process (with reference to Prober *et al.* 2015).

It is also timely to review single species programs, particularly those with poor prognoses under climate change, by comparing benefits and costs of these programs with those that have a broader biodiversity focus.

Ensuring translation between policy and implementation is crucial, as are well-formed research priorities. Increasing the use of risk assessments at all scales (e.g. species, sites, ecosystems) will help to assess the vulnerability of biodiversity and help shape appropriate management options and investment choices. The public and private benefits of investment also need to be determined to ensure that the right policy instruments are being applied, for example, under what circumstances should financial incentives be provided compared with extension, regulation or technology innovation?

Current approaches to translate national, state and regional strategies into action include the development of Goulburn Broken CMA’s priorities document, which is continually updated and used to communicate to the community and facilitate collaboration between potential partners.

5.4 Build on ecological infrastructure

Strategic Initiatives

1. Develop icon projects, improving terrestrial and aquatic ecological function and climate change adaptation
2. Implement stewardship programs that target large-scale landscape protection, restoration and connectivity in priority areas, across terrestrial habitats, waterways and wetlands
3. Maintain resilient ecosystems and help others transform appropriately in response to drivers such as climate change

Key indicators of success for Strategic Direction 4 (Building on our ecological infrastructure)

- 4 large-scale projects that link large remnants are underway
- 90% of biodiversity agreements between landholders and the Goulburn Broken CMA are in high priority areas
- 10,000 ha of biodiversity outputs delivered by Goulburn Broken CMA and partners

Much of the Catchment is highly modified from its natural state and is rapidly changing. Some ecosystems will not be able to adapt quickly enough to the compounding threat of a rapidly changing climate.

“The protected area system on public land and waters... ..is the backbone of Victoria’s conservation management system.”
(DELWP 2016a)

Biodiversity will experience a high pressure to change under climate change, yet contemporary principles underpinning NRM planning typically focus on preventing change by managing threatening processes or restoring ecosystems to a pre-European land use state. Therefore, NRM practitioners are now facing the challenge of transitioning from managing what is known to managing what might be. To manage the increasing pressure of climate change on biodiversity over the coming decades, practitioners need to build on carefully chosen parts of natural infrastructure to provide species and ecosystems with what they need to adapt (Prober *et al.* 2015). Priority areas for adaptation actions are identified in section 4 and Appendix 4 of this Strategy. The natural infrastructure practitioners aim to establish needs to be resistant to future shocks or capable of changing into a different form that is still desirable. Building knowledge in this area will enable future directions to continually adapt (as ‘adaptive pathways’): current knowledge of system thresholds and how to integrate system thresholds into planning is limited.

It is no longer feasible to attempt to maintain all species in their present locations and all ecosystems in their present composition. Rather, NRM planners could use the principle of minimising species loss nationally, which is best achieved by managing a full range of ecosystems, including climate refugia, to accommodate the widest possible range of species. This requires a focus on areas with habitat types that are under-represented by the formal reserve system. To help nature take its course, a diversity of representative ecosystems is needed that provide a diversity of functions, for a wide range of species. (Prober *et al.* 2015)

Central to giving ecosystems the best possible chance to adapt and evolve is to enhance resilience by building connections across fragmented and intact ecosystems, enhancing the national reserve system, protecting key refuges, implementing more effective control of invasive species and developing appropriate fire management regimes, all of which can only happen if they are integrated with the needs of land managers, especially landholders. Effective large-scale, cross-tenure projects enable essential connections between ecosystems to happen at a large scale.

Adequate resourcing of the Catchment's seedbank will be crucial in order to strategically plan for and deliver appropriate revegetation species, genetics and quantities.

The wet areas of the Catchment (rivers, floodplains and wetlands) are a central starting point for building 'biolinks' across priority areas of the Catchment. The Murray-Darling Basin Plan has developed sustainable diversion limits and set water aside to restore and maintain the health of rivers, floodplains and wetlands. This may present an opportunity to protect aquatic-dependent environmental values through the delivery of improved environmental flow regimes to a number of important environmental assets in the Catchment, including Barmah-Millewa Forest, the Lower Goulburn River, the lower Broken Creek and the Broken River.

Improved security and management arrangements for River Red Gum areas in much of the Catchment (as a result of the creation of national and regional parks in 2010 and the return to wetlands of Lake Mokoan) present opportunities for building ecological infrastructure. There are also opportunities to improve management of riparian areas for environmental gains.

The Goulburn Broken CMA's Land and Biodiversity and River and Wetland Health Programs are actively involved in a number of state-wide initiatives to set standards for riparian management, develop programs for the enhancement of public land protection and prioritise waterways, recognising biodiversity assets in the terrestrial and aquatic environments. The outcomes of these initiatives will be integrated into local programs as appropriate. Increased investment has been achieved for the management of riparian areas, which is an important foundation of landscape approaches. Details of the Victorian Government's five-year Regional Riparian Action Plan (including the regional plan for the Goulburn Broken Catchment) can be found at DELWP (2016f).

Roadsides support areas of high biological significance such as native vegetation, species and habitats. The depletion of habitats in other land uses has accentuated the importance of roadsides for biodiversity conservation. Native vegetation and habitat on roadsides can include the few remaining remnants in highly developed landscapes, as well as some of the higher quality remnants in areas with less development. Roadsides often provide the only connectivity to other remnants and also the framework to support revegetation and restoration efforts on other land tenures. In the Catchment, there are flora species known only to remain on roadsides and fauna that would otherwise not exist in some areas without roadside habitats. Hence, biodiversity conservation on roadsides is a topic of high importance that the Goulburn Broken CMA has been working with the Goulburn Broken Local Government Biodiversity Reference Group on for a decade. Management of roadside biodiversity is also incorporated into restoration projects across the Catchment in partnership with community NRM groups and local government.

Greater levels of biodiversity stewardship by land managers are needed to achieve the vision of this Strategy, which means that government investment in biodiversity conservation on both private and public land will need to be increased and supplemented.

The Goulburn Broken CMA is one of six natural resource management bodies of the Tri-State Murray NRM Regional Alliance, which is developing and implementing ‘Securing the Environment’, a project aiming to involve the community, connect sites, and implement works on land complementary to existing or planned water projects. The Alliance covers areas along the Murray River in New South Wales, South Australia and Victoria, and the project presents an opportunity for improving biodiversity across large areas.

5.5 Legitimise biodiversity conservation

Strategic Initiatives

1. Strengthen and communicate duty of care for biodiversity conservation.
2. Increase opportunities for landholders to act as biodiversity stewards through appropriate mechanisms and support.
3. Influence government planning and policy, including municipal planning schemes and state legislation and policy.
4. Promote an understanding of the fundamental reliance on biodiversity for quality of human life, economy and identity

Key indicators of success for Strategic Direction 5 (Legitimising biodiversity conservation)

- A much larger area of the Catchment's land (private and public) is managed for biodiversity conservation
- Increased community support for ecosystem management as being vital for long-term human benefit

Biodiversity underpins the processes that make all life possible. The importance of biodiversity to human welfare needs to be better understood by the community to ensure appropriate (and increased) investment by government and the community.

Although the connection between land use and natural systems is not always directly apparent, all human land uses ultimately rely on natural systems and the biodiversity they support.

Agricultural systems can be obviously and immediately connected to biodiversity. For example, pollination of crops by insects or year-round ground cover and summer feed for stock provided by well-managed native pastures. There may be more remote connections as well, such as the provision of water via rainfall that falls hundreds of kilometres away and filters through landscapes.

Biodiversity conservation can sometimes be perceived as a threat to prosperity. Improved policy and planning mechanisms are needed to better protect biodiversity values and allow for long-term biodiversity planning. The free market often fails where the connection between agriculture and biodiversity is not immediate as the farmer has little incentive to conserve natural values. However, significant government/community investment is justified because of the large public benefits of biodiversity and the overall net economic benefit of its conservation (Lockwood *et al.* 1999).

Better defining land managers’ duty of care based on contemporary community expectations will be crucial in establishing obligations and incentives for supporting land managers to improve biodiversity management.

*“There is a need to explore options to develop clear standards of land stewardship.”
(DELWP 2016a).*

Biodiversity conservation is often thought to be at the opposite end of the spectrum to agriculture and this dichotomy is not useful. Farmers rely on natural systems and natural systems need active stewards. Management of native vegetation is not the only way of addressing this potential dichotomy. For private landholders, the soil and its biodiversity is where they can play a crucial role in supporting healthy and functioning ecosystems. Increasingly there are examples of research and land management approaches where both biodiversity and production benefits are being realised (e.g. Crosthwaite *et al.* 2009). The need to integrate biodiversity and production is becoming recognised by landholders who are adopting different practices as shown in the National Landcare Programme-funded project ‘Community Directed Action Learning to Enhance Soil Ecosystem Services’ and in previously run programs in the Goulburn Broken Catchment such as ‘Land Class Fencing Incentives’, and ‘Green Graze’. Landholder incentives will

continue to be designed for land that is being used for a range of purposes, including agriculture (most of Catchment). These programs would result in substantial environmental gains across large areas and at a low cost to the government and community. New types of farming systems that emerge e.g., from the carbon market, will present potential opportunities that may enhance biodiversity. However, the risks of new approaches also need to be considered to ensure that approaches adapt and attract investment into public benefit biodiversity outcomes.

Reactions to several large bushfires in the Goulburn Broken Catchment in recent years appear to have entrenched an “either/or” attitude to native vegetation and people, although this needs further testing. Extra efforts will be needed to ensure that planning and fire management integrates ecosystem needs with those of people appropriately.

Significant liaison with stakeholders is needed following devastating events such as bushfires to ensure that responses factor in biodiversity and are at the appropriate scale: reactions such as removal of large trees and grading firebreaks immediately after bushfires, and increased fuel reduction burning over many years place biodiversity at considerably increased risk.

The value and needs of biodiversity are often not adequately considered in the planning of new housing estates, resulting in problems such as over-clearing of native vegetation to reduce fuel loads.

Improved native vegetation clearing regulations, including effective offsets will be vital to achieve improved biodiversity outcomes in the Catchment.

“As with any capital assets, the condition of environmental assets is critical to their functioning. Natural capital can be eroded by external impacts such as pollution and climate change, which can degrade the condition of ecosystems and their ability to generate or support the provision of essential products and services. Unlike other capital assets, however, many of our environmental assets exist in complex ecosystems, and the services they provide are either very costly or impossible to recover if the assets are degraded or lost. Investment in the sustainable management of our natural capital therefore represents a least-cost way of ensuring that we can continue to enjoy its benefits into the future. Investment in the protection of Victoria’s natural capital will also be an important aspect of our response to climate change”.
(DELWP 2016a)

Case Study: Goulburn Broken Native Vegetation Management and Offset Scheme

Scoping and Feasibility Study

The Goulburn Broken CMA and stakeholders (e.g. Local Government) have been investigating innovative opportunities to protect local and regional native vegetation values in the Catchment.

This includes a scoping study (ES Links 2013) that was completed prior to the native vegetation reforms in December 2013 and provided a basis for developing an over the counter scheme with the intention to support better location and aggregation of regulatory offsets, in addition to shifting to more secure third party offset agreements.

A feasibility study commenced in December 2015 to determine the feasibility for a regional native vegetation offset scheme and a voluntary contributions scheme, in accordance with requirements and principles of the 2013 Regulations; and the outcomes of the Scoping Study (ES Links 2013). The feasibility study identified issues with pursuing an over the counter based scheme in the current regulatory climate. However, a facilitator model (operating within the regulatory market to provide extension to potential sellers) and a voluntary contributions scheme (e.g. where investors can invest for local/regional NRM gains) are continuing to be developed as part of the feasibility study. Both options provide opportunity for the Goulburn Broken CMA to protect priority biodiversity sites.



6. Evaluation and deciding how to adapt

Circumstances will continually change, requiring frequent evaluation of progress to decide on adjustments to the directions set in this Strategy.

This chapter identifies what is needed for the Goulburn Broken Catchment's people to continue to be proactive and responsive when foreseen and unforeseen changes happen.

It emphasises evaluation and adaptation processes that make this Strategy a live (continually updated and implemented) document. The chapter also helps to recognise when to act differently and how to make actions happen.

6.1 The decision-making context and its implications

Major challenges for evaluation, decision-making and adaptation come from:

- Complexity: the complex system of people and nature, including highly integrated, multi-organisational and changing decision-making processes and structures that impact on biodiversity
- Risks: uncertainties about the risks to the resilience of the social-ecological system (at the scale at which the decision is being made) including uncertainties in measuring system elements and progress in managing them
- Rapid changes: the increasing pace of socio-economic, climate, land and water management, and technology changes
- Planning to implementation: the inherent difficulty in going from 'action to traction': developing well thought-out actions is one task; making actions happen is another (GBCMA in prep.).

Given these challenges, the GBCMA formalised a 'resilience approach' in the Goulburn Broken RCS 2013-2019, increasing the emphasis on adaptive management that had been evolving since the late 1980s (GBCMA in prep.).

Adaptive management requires the right people to be focused on making decisions about the right problems at the right time (GBCMA in prep.). Timely decisions require partners to have shared agreement on appropriate responses, often in advance of a circumstance arising, which demands significant investment in nurturing relationships: timely changes are often as much about organisational and cross-organisational culture as the quality of any written plan.

6.2 Sorting information for decision-making

Decisions impacting on biodiversity are made by people with many different roles who operate at several geographic scales and management levels.

Readily available and sorted information supports evaluation and effective decision-making, leading to action. For example, there is a need for information to help experts (to provide rigorous data), connectors (to link many stakeholders in a complex system), and salespeople (to get the message out) (Gladwell 2016).

Decision-makers at all levels need to consider questions such as:

- Was the original strategy appropriate?
- Have circumstances (such as new knowledge or different weather patterns) changed sufficiently to warrant a revised approach?
- Does the investment mix need to be modified?

The resilience approach considers the geographic scale at which it is sensible to be making decisions about the mix of rules and incentives that will work because the complex system of people and nature is functioning in essentially the same way. The Goulburn Broken CMA is developing information and plans at the scale of six social-ecological systems (SEs) that cover the Goulburn Broken Catchment (see section 3) (GBCMA 2013). Plans and processes for these SEs are at different stages. Evaluation processes will migrate towards the SE-scale as opportunities arise.

The resilience approach also emphasises a system's biophysical and socio-economic thresholds or tipping points and associated risks and opportunities. The focus for shared decision-making is on the system's critical attributes that underpin the functioning of SEs, and which are at risk of breaching thresholds, and the strategic initiatives to manage these attributes. (See the preamble of section 3)

While maintaining a long-term (multi-decade) focus on the condition of the Catchment’s critical attributes, this Strategy aligns with the Goulburn Broken CMA’s five-yearly and annual planning cycles. Information is therefore needed at three levels of evaluation (Table 7): the CMA uses its annual report to consistently present information across 13 investment themes at these levels, including a brief narrative of progress, supported by evidence.

Table 7: Evidence for three levels of decision-making in Goulburn Broken CMA

Evaluation level	Evaluation terminology	Typical questions used to focus evaluation	Examples of evidence to inform evaluation
1	Annual performance	<ul style="list-style-type: none"> How did we go this year against what we said we would do? 	Outputs (on-ground works and capacity building actions or tasks) achieved and funds spent against targets set in the Corporate Plan
2	Long-term strategy-implementation progress	<ul style="list-style-type: none"> How have we gone against what we said we would do when we wrote the (various) strategies? How effective were the implemented measures? 	Outputs and assumptions of their impact listed in strategies
3	Catchment condition change	<ul style="list-style-type: none"> What ‘shape’ is the issue we are managing in now? Was the original strategy appropriate? Have circumstances (such as new knowledge or different weather patterns) changed sufficiently to warrant a revised strategy? Does the investment mix need to be modified? 	Resource condition; trends; tipping points; indicators of resilience, adaptation and transformation responses

Source: GBCMA (2015b)

The Goulburn Broken CMA’s generic ‘plan-do-review’ cycle (Figure 5) emphasises the recurrent need for evaluation and helps to identify the different evidence needed to inform decisions (answer questions) at each step of the cycle (Table 8).

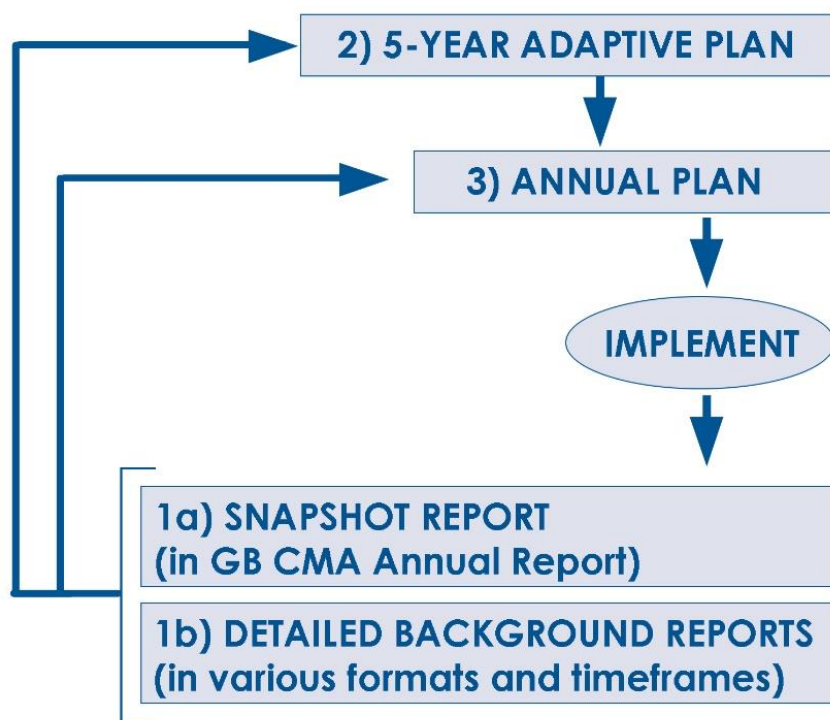


Figure 5: Goulburn Broken CMA planning cycles*

Source: Derived from a discussion paper by McLennan and McFarlane (2006).

* The annual plan considers annual determined priorities and available funding.

An example of a detailed background report is Green Graze Pilot Project Final Report (Moll *et al.* 2007).

The items of evidence in Table 8 can be quite detailed and vary in quality, being dependant on available resources. Detailed background reports (listed in Figure 5) include a broad range of information, which might be sourced within or outside the Goulburn Broken CMA, such as reports on threatened species, climate change, socio-economic circumstances, and progress towards targets.

Table 8: Strategy evaluation process checklist aligned with planning cycle steps

Planning cycle step	Evaluation action	Key evaluation questions to be considered annually*	Items of evidence in answering key evaluation questions
1a) Annual report 1b) Detailed background reports	1 Complete a snapshot report of <i>Biodiversity Strategy</i> implementation within the Goulburn Broken CMA's annual report. 2 Prepare detailed reports for various issues, according to a continually updated evaluation schedule.	What progress was made this year?	Achievements (outputs, including on-ground and non-works actions) completed against targets, given government funding received
		What progress has been made in implementing the <i>Biodiversity Strategy</i> to date?	Achievements (including on-ground and non-works actions) from all fund sources completed against strategic initiatives (listed in <i>Biodiversity Strategy</i>)
		What are the risks to biodiversity in the Catchment?	Drivers of change (including shifts in circumstances)
		What elements of the <i>Biodiversity Strategy</i> need to be updated?	Risks and opportunities ('catchment condition' related to critical attributes and their thresholds; future scenarios and preventable and unavoidable system transformations)
2) Adaptive plan (<i>Biodiversity Strategy</i>)	3 Update the 2016 <i>Biodiversity Strategy</i> in 2021.	Is the (2020) biodiversity vision for the Catchment or system right?	Community values Goulburn Broken RCS vision (alignment with <i>Biodiversity Strategy</i>)
		Is the purpose of the <i>Biodiversity Strategy</i> Working Group clear?	<i>Biodiversity Strategy</i> Working Group terms of reference
		Do the medium-term (5-year) strategic initiatives need to change?	Progress against <i>Biodiversity Strategy</i> 's long-term targets and 5-year directions and initiatives
			Assumptions that link outputs to outcomes (long-term goals)**
			Governance arrangements (including partnerships)
			Capacity to deliver (including social, organisational and individual)
			Trade-offs and synergies (including benefit/cost)
3) Annual plan	4 Prepare an annual plan based on received funds each year.	Do the listed investment priorities need to change this year?	Government priorities (resources available)
			Partnership agreements
Implement			

* Key evaluation questions are considered annually, but levels of detail and processes in answering them vary significantly, according to circumstances, including current risks and opportunities and availability (and costs) of evidence.

** The equation: Outcomes = Outputs x Assumptions is used as the basis for understanding progress and identifying knowledge gaps for research. Source: Derived from Shepparton Irrigation Region Land and Water Management Plan (SIRPPIC 2015)

6.3 Biodiversity evaluation and adaptation processes

6.3.1 Scheduling annual and 5-year reviews

An annual review of progress based on Table 8 should be prepared by the Goulburn Broken CMA's Land and Biodiversity Program staff, in collaboration with partners, which will especially inform:

- A report on annual performance, long-term strategy implementation progress and catchment condition in the Goulburn Broken CMA's Annual Report.
- Identification of 'hot issues' (by considering risks and opportunities)
- Priorities for the forthcoming year (based especially on annual evaluations of progress in implementing actions listed in the section 5 of this Strategy).

Consistent with Figure 5, a detailed review of this Strategy should be undertaken in approximately 2021.

6.3.2 Biodiversity Monitoring Action Plan

A detailed *Biodiversity Monitoring Action Plan* (BMAP first developed in 2005 and updated annually) describes the process for measuring biophysical change, especially progress towards long-term biodiversity targets (GBCMA 2016a). It identifies data and assumptions related to biodiversity gains and losses, and critical gaps in knowledge, many of which have become a focus of collaborative research projects.

Priorities for BMAP as at 2016 include:

- Investigate new technologies/emerging data (e.g. Indicators for Australia's Environment, ANU 2015) sources of native vegetation gains and losses to assess how much change is occurring through land use change.
- Improve data capture on native vegetation losses.
- Investigate research opportunities for measuring declines through dieback (especially paddock trees).
- Apply findings of direct seeding review and assess other revegetation sites determine success and therefore contribution towards extent target.
- Undertake and collate results from landholder photo comparisons, site assessments and remote analysis of tree cover change at Bush Returns sites to assess assumptions of how much natural regeneration is contributing to the extent target.
- Develop an on-ground monitoring strategy for the Catchment to identify elements of native vegetation that can be monitored (by the CMA) to detect changes in condition over time, and imbed processes to implement the strategy.
- Update Research Inventory to capture key research/monitoring projects and relationship with assumption testing (BMAP)
- Improve the communication of outcomes achieved through investment into biodiversity conservation.

Assumptions are due to be reviewed in 2016, and are likely to introduce additional priorities around native vegetation quality and threatened species (targets 2 and 3) including further investigations into public land management and its impact on targets.

The ability to measure and record gains and losses of native vegetation extent and quality remains extremely challenging in the Goulburn Broken Catchment, as it is across the state. It is a major impediment to tracking progress and implementing an effective permitted clearing process. The Goulburn Broken CMA is working closely with partners within and beyond the Catchment to rectify this situation.

6.3.3 Catchment and SES-scale planning, implementation and evaluation

Integrating biodiversity into complementary programs via SESs

Biodiversity conservation doesn't just happen through the Goulburn Broken CMA's Land and Biodiversity team projects. All programs within the CMA contribute to biodiversity conservation. Single actions can generate significant integrated benefits when partners have strong relationships.

For example, in the Agricultural Floodplains SES (Shepparton Irrigation Region), native vegetation benefits from actions implemented through eight separate "priorities" (equivalent to strategic initiatives) (

Table 9). Improving understanding of the assumption (quantitative relationship) between priorities and critical attributes is an ongoing challenge.

Table 9: Benefits of integrated intervention, planning, participation and evaluation in the Shepparton Irrigation Region Social-Ecological System (SIRPPIC 2015)

Priority	Critical attribute benefit levels from implementing priority				
	Water availability	Watertables	Water quality	Native vegetation extent	Farm and food-processor viability
1 Update irrigation infrastructure	Very high	High	High	Medium*	Very high
2 Build NRM into the farming system	Medium	Medium	Medium	Very high	High
3 Match drainage to meet changed needs	Low	Very high	Medium	Medium	High
4 Reconnect large areas of enhanced nature	Low	Low	High	Very high	Medium
5 Balance water availability for all uses	Very high	Low	Very high	High	Very high
6 Build stewardship, incorporating local action and ideas	Actions guided by these priorities emphasise the processes that enable overall resilience of the SIR to be factored into decisions about a specific critical attribute. Implementation of these actions creates a joint approach between community, business, and local, state and national government agency partners at different levels, which is essential in addressing problems and updating understanding.				
7 Maintain partnerships and good governance					
8 Adapt by understanding change and impact					

Catchment-scale targets are likely to remain important for several years in providing reference points for reporting progress and a sense of direction. Although they can guide SES planning, their application is limited. There are large inherent uncertainties in setting them and measuring progress. Priorities that are relevant to each SES need to be set, and these are likely to vary depending on the characteristics of the SES. For example, vegetation quality in the Southern Forests SES is likely to be important, while increasing vegetation extent is important in the Productive Plains SES.

Important tasks of implementing this Strategy will be to improve links between SES-scale and catchment-scale information and between the Goulburn Broken CMA, partner, and state and national evaluation processes.

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Appendices

Appendix 1 - Relationship of this Strategy with other key strategies

Australia's Biodiversity Conservation Strategy 2010 sets a national direction for biodiversity conservation over the next decade for all sectors – government, business and the community (Natural Resource Management Ministerial Council 2010). Its three priorities for action; 1. Engaging all Australians in biodiversity conservation, 2. Building ecosystem resilience in a changing climate and 3. Getting measurable results, are consistent with this Strategy's strategic directions of 'Legitimise biodiversity conservation', 'Build on ecological infrastructure' and 'Investing wisely', respectively.

Victorian Biodiversity Plan 'Protecting Victoria's Environment – Biodiversity 2036 (draft)

A draft Victorian Biodiversity Plan was released in 2016 with the aim of *"assisting Victorians to recognise the multiple values that biodiversity provides and to identify the tools, tasks and roles needed to ensure that Victoria's natural environment is healthy and positioned to cope with the effects of future population growth and climate change"* (DELWP 2016a). It is anticipated that the Plan will provide a state-wide view of priorities and highlight a collaborative and aligned approach to biodiversity conservation across the state, including the identification of specific tasks and partnerships.

Its focus on *"investing in resilient landscape scenarios"* with a *"management approach that can respond to change and account for a range of possible futures under climate change"* (DELWP 2016a) is consistent with the approach of the Goulburn Broken RCS and sub-strategies. Goal 1 of the draft Plan *"to encourage more Victorians to value nature"* is in line with this Strategy's strategic directions of 'Nurturing partnerships' and 'Legitimising biodiversity conservation' (see section 5). Goal 2 in the Draft Plan is around improving the extent and condition of native habitats, which mirrors this Strategy's long term approach (see section 3.2). However, the Goulburn Broken CMA has proposed some improvements in moving to a final State Biodiversity Plan, including adopting a systems-based approach, clarifying the role of regional NRM organisations and communities in implementing the Plan, recognising the complexity of engagement and delivery mechanisms in landholder engagement and explicitly outlining how a net gain in Victoria's native vegetation, will be measured and reported.

Updates to this Strategy will seek to align with State government priorities where possible and identify how such priorities can be incorporated in regional processes.

Goulburn Broken Regional Catchment Strategy 2013-2019

The Goulburn Broken CMA's *Regional Catchment Strategy (RCS)* *"provides the integrated planning framework or 'blueprint' for management of land, water and biodiversity resources in the Goulburn Broken Catchment. It is the overarching strategy for directing action, under which there are sub-strategies and action plans that implement priorities of the community and government"* (GBCMA 2013). This Biodiversity Strategy is one of the sub-strategies that helps to translate the RCS into on-ground action.

Goulburn Broken Waterway Strategy 2014–2022 (GBWS)

The Goulburn Broken Waterway Strategy, together with a range of related sub-strategies, underpins the Goulburn Broken RCS. It presents an integrated catchment planning framework for waterways in the Goulburn Broken region and is the primary guide for priority setting, maintenance and improvement of waterways in the Goulburn Broken Catchment. It has been developed by the Goulburn Broken CMA in partnership with regional agencies and the community. This reflects the regional planning process for waterway management set out in the *Victorian Waterway Management Strategy* where regional waterway strategies provide a single planning document for waterway management in each region of Victoria. The GBWS is the primary mechanism for implementing state-wide waterway policy. The overarching aim of the Strategy is to provide a single, regional planning document for whole-of-catchment management (i.e. rivers, estuaries and wetlands) and an action plan for achieving integrated waterway outcomes.

Aquatic and terrestrial biodiversity are dealt with separately through the Goulburn Broken CMA’s River and Wetland Health and Land and Biodiversity programs. Where appropriate, this Biodiversity Strategy aims to integrate and complement aquatic and terrestrial planning and implementation. Some institutional barriers such as State government funding processes make this process challenging in the short term.

Goulburn Broken CMA Land Health Statement 2014-18 (draft)

Historically the Statement (GBCMA 2014b) has been a Goulburn Broken CMA internal document developed to direct land health programs within the CMA. To meet the needs of the Goulburn Broken RCS, sub-strategies and local plans, the Statement is being updated with wider involvement of stakeholders and the community. Where appropriate, this Biodiversity Strategy aims to integrate and complement land health programs and vice versa and there will be ongoing efforts to integrate ecological and productivity benefits.

Local SES Plans

Sub-strategies to the Goulburn Broken RCS, such as this Biodiversity Strategy, are used in local planning to provide catchment-scale context, direction and technical information to support the community in local planning activities. As local plans mature and work on thresholds and critical attributes for each SES progresses, information in this Strategy along with other sub-strategies will be integrated. Local Plans provide an opportunity for this Strategy to be integrated across a number of themes at the local scale.

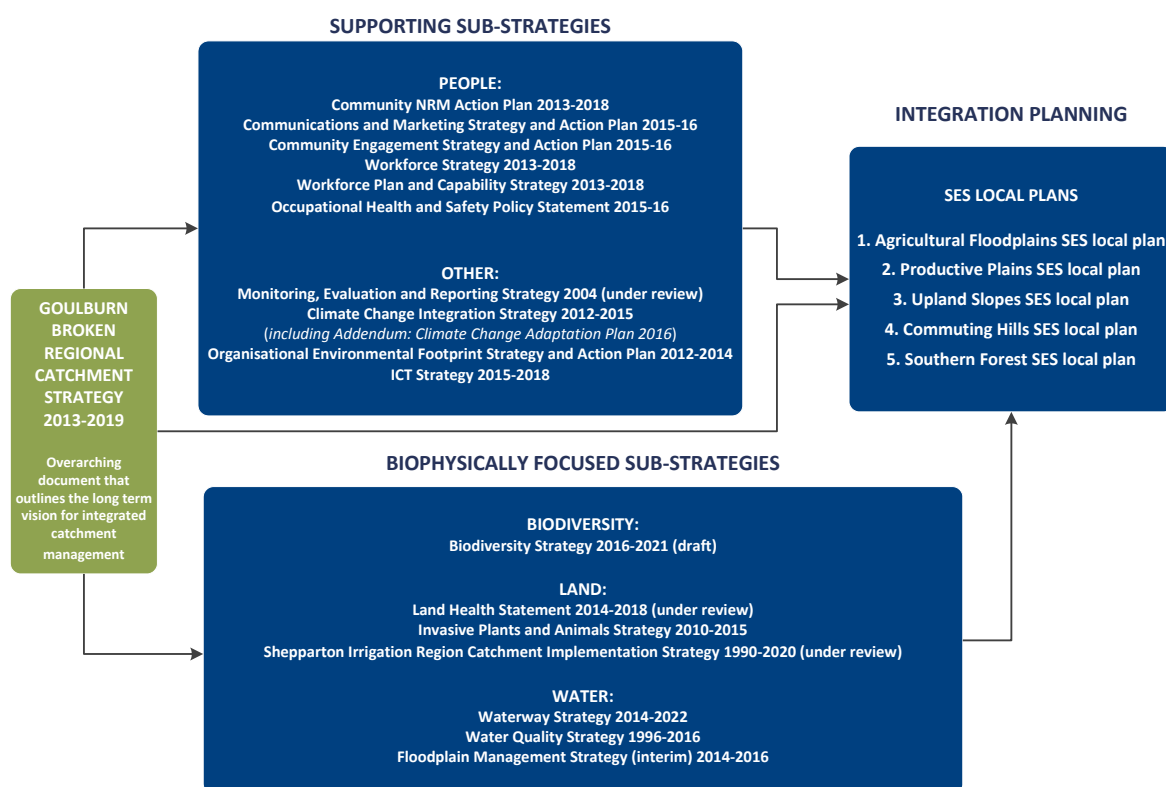


Figure 6: Goulburn Broken Regional Catchment Strategy and Sub-strategies structure

Yorta Yorta Nation Caring for Country and Culture, Whole of Country Plan 2012-2017

The Yorta Yorta Nation Aboriginal Corporation represents the descendants of the Original Ancestors of the lands of the Yorta Yorta Nation and is the State-recognised Registered Aboriginal Party on matters of cultural heritage. YYNAC’s Whole of Country Plan outlines platforms for action across Yorta Yorta country and a NRM action plan for on-ground research, works and projects. The Plan’s platforms focusing on inclusive policy development, strategic and operational engagement, opportunities for employment and management of species and habitats are reflected in this Strategy, particularly in initiatives identified for strategic directions of ‘Strengthen partnerships’ and ‘Build on ecological infrastructure’.

Indigenous Co-operative Management Agreements

In accordance with the *Yorta Yorta Co-operative Management Agreement*, the Goulburn Broken CMA is consulting with the Yorta Yorta Joint Body in developing this Strategy. The *Yorta Yorta Co-operative Management Agreement* was signed by the Victorian State Government and the Yorta Yorta Nation Aboriginal Corporation in June 2004. It formalises the right of the Yorta Yorta people to have a role in natural resource management decision-making in specific areas of Crown land within Yorta Yorta Country. The Yorta Yorta Joint Body acts as the vehicle for the facilitation of the co-operative management arrangement. A Co-operative Management Agreement is not yet in place for the **Taungurung Clans Aboriginal Corporation**, however a Memorandum of Understanding between the Corporation and the Goulburn Broken CMA is in development. Taungurung Clans Aboriginal Corporation are currently developing a **Draft Country Plan** (Taungurung Clans Aboriginal Corporation, in prep.)

Emerging policy directions that will influence biodiversity

The draft ***Our Catchment Our Communities Strategy*** (DELWP 2016d) outlines goals and actions to improve the Victorian integrated catchment management framework in response to the 2014 Victorian Auditor-General's Office performance audit of the effectiveness of CMAs in performing their legislative functions and how (the now) DELWP supports and monitors CMAs in fulfilling their roles and responsibilities. These actions will support the development of the next Victorian Catchment Condition and Management Report, the next Victorian State of the Environment Report, and the next iteration of Regional Catchment Strategies.

The Victorian Government is developing a new water plan to set the strategic direction for long-term water management. **The Water for Victoria discussion paper** focuses on nine key elements: climate change; waterway and catchment health; water for agriculture; recreational values; Aboriginal values; resilient cities and towns; planning and entitlement frameworks; the potential of water grids and markets; and jobs, economy and innovation (DELWP 2016e).

Parks Victoria is developing a **River Red Gum Parks Management Plan** that will guide the protection of many of Victoria's River Red Gum floodplain forests and wetlands, cultural sites and the management of tourism and recreation. The 220,000 hectare planning area includes national parks, state parks, conservation reserves, crown land reserves and other areas managed by Parks Victoria along the Murray River between Wodonga and the South Australian border (Parks Victoria 2015a).

Emerging markets for carbon present opportunities for retaining and sequestering carbon while supporting biodiversity conservation. However, potential opportunities and threats to biodiversity are yet to be fully understood. A strategic initiative of this Strategy is to manage risks and capture opportunities from climate change initiatives and the Goulburn Broken CMA will continue to work with carbon market policy developers, NRM organisations and project implementers to achieve good outcomes for NRM from carbon sequestration activities.

Summary of related policies and legislation

The legislative and policy context for this Strategy is summarised in Table 10.

Table 10: National and Victorian legislative and policy context

State of Victoria
<ul style="list-style-type: none">• Our Catchment, Our Communities, Integrated Catchment Management in Victoria 2016-19• Victoria's Biodiversity Plan "Protecting Victoria's Environment – Biodiversity 2036", draft 2016• Permitted clearing of native vegetation – biodiversity assessment guidelines (the Biodiversity Assessment Guidelines) 2013• Victoria's Water Plan (under development, discussion paper released 2016)• Victorian Floodplain Management Strategy 2016• Northern Region Sustainable Water Strategy 2009• Food and Fibre Sector Strategy 2016
National and international
<ul style="list-style-type: none">• Australia's Biodiversity Conservation Strategy• United Nations Convention on Biological Diversity• Convention on International Trade in Endangered Species (CITES)• Convention on Migratory Species (CMS or Bonn Convention)• Japan-Australia Migratory Birds & China-Australia Migratory Birds Agreement, Republic of Korea-Australia Migratory Birds Agreement• Ramsar Convention on Wetlands of International Importance• East Asian Australasian Flyway Site Network
Related legislation
<ul style="list-style-type: none">• <i>Environment Protection and Biodiversity Conservation Act 1999</i> (the EPBC Act) (Commonwealth)• <i>Flora and Fauna Guarantee Act 1998</i> (currently under review)• <i>Catchment and Land Protection Act 1994</i>• <i>Wildlife Act 1975</i>• <i>Coastal Act 1995</i>• <i>Environmental Protection Act 1970</i>• <i>National Parks Act 1975</i>• <i>Planning and Environment Act 1987</i> (and the Victorian Planning Provisions)• <i>Water Act 1989</i>• <i>Victorian Environment Assessment Council Act 2001</i>

Appendix 2 – Key drivers and results of change to Goulburn Broken Catchment’s biodiversity

Era	Drivers and results of change
1820s	Aboriginal land management replaced with European land use and management
1836	Major Mitchell survey starting a land rush. Squatters take over crown land and grow sheep and cattle
1850s	Gold mining leads to increased population, clearing and waterway degradation
1860s	Rabbits and environmental weeds moving throughout Victoria
1860	Squatters land opened up for purchase (Nicholson Land Act 1860)
1870s	High wool prices leads to increases in flock sizes and area of land exploited
1903	Licences granted to graze crown frontages on waterways
1907	Forests Department established resulting in more controlled timber harvesting, declaration of reserves and collection of royalties.
1929	Superphosphate introduced into the environment via government subsidies
1930s	Large scale clearing and ploughing leads to fragmented and relictual landscapes in high production areas
	Murray river regulation begins and irrigation changes landscapes
	Salinity becomes an issue and drainage projects evoked
1940s	Soldier settlement – more farms, and farms developed in marginal land
	Large scale clearing encouraged by government and enabled through oil-fuelled vehicles (bulldozers), chainsaws, pesticides and herbicides
1950	Myxomatosis introduced reducing impact of rabbits
1950s	Wool prices boom resulting in new land cleared and increased use of introduced pastures and fertilisers
1955	Lake Eildon completed to current size
1956	<i>National Parks Act</i> enacted to manage and protect Victoria’s national park.
1959	Game licences introduced resulting in protection of some wetlands
1960s	<i>Pinus radiata</i> forests planted
	Clearing continues but attitudes towards the Australian environment beginning to change
1970s	Land Conservation Council established to identify areas for nature reserves
	Lifestyle properties in the hills close to urban centres becomes popular
1980s	Revegetation on farms begins to reverse past trends of exploitation
1986	Landcare introduced in Victoria
1987	Clearing reduced through permit process (Planning and Environment Act 1987)
1990	Government commitment to integrated catchment management
1990s	Recognition that public land areas (including riparian frontages) offer significant potential for biodiversity gains.
1992	Water rights capped and rights to water become tradeable
1997	Catchment Management Authorities formed under the <i>Catchment and Land Protection Act</i> .
	First Goulburn Broken Regional Catchment Strategy developed
2000s	Longest dry period on record (10-year Millennium drought)
	Fires in 2006 and 2009 burn over one-third of the Catchment’s woody native vegetation
2000	Development of the Goulburn Broken Native Vegetation Management Strategy
2010	River Red Gum Forest Conservation Reserves increase from 5.7% to 14.2% of original extent.
	18% of State in conservation reserves (including terrestrial and marine reserves).
	Lake Mokoan decommissioned
2013	Changes to native vegetation permitted clearing regulations result in increased losses in native vegetation

Table compiled from sources such as Mansergh *et al.* (2006) and DSE (2004). A detailed timeline of changes in the Violet Town-Longwood region of the Catchment can also be found in Race *et al.* (2009).

Appendix 3 – Summary of flora and fauna status in the Goulburn Broken Catchment

Table 11: Number of taxa by class and Victorian Conservation Status Category of *flora* in the Goulburn Broken Catchment

Threat Category ¹	Monocotyledons	Dicotyledons	Conifers	Ferns and allies	Mosses and Liverworts	Total
Presumed Extinct	1	1	0	0	0	2
Endangered	16	35	0	0	0	51
Vulnerable	26	52	0	1	0	79
Rare	49	135	0	8	8	200
Poorly Known	20	27	0	3	3	53
Total Threatened	112	250	0	12	11	385
No. of native species in Catchment	878	1865	11	87	220	3,061
% native species threatened in Catchment	13	13	0	14	5	13
No. of introduced species in Catchment	243	535	6	0	0	784

Source: DELWP 2016b

Table 12: Number of taxa by class and Victorian Conservation Status Category of *fauna* in the Goulburn Broken Catchment

Threat Category ¹	Birds	Mammals	Reptiles	Amphibians	Fish	Total
Presumed Extinct	0	2	0	0	0	2
Regionally Extinct	0	2	0	0	1	2
Extinct in the Wild	0	0	0	0	0	0
Critically Endangered	6	1	0	3	3	13
Endangered	16	5	5	3	2	31
Vulnerable	35	3	5	1	6	15
Data Deficient	0	1	2	1	0	4
Near Threatened	27	4	1	0	1	33
Total Threatened	84	18	13	8	13	136
No. of native species in Catchment	345	56	62	31	52	546
% native species threatened in Catchment	24	32	21	26	25	25
No. of introduced species in Catchment	13	16	0	0	11	40

Source: DELWP 2016b

Explanation of flora and fauna listings

Species in Victoria can be 'listed' at two levels. The Advisory List of vertebrate taxa that are considered threatened, poorly known, near threatened or extinct in Victoria is maintained by the Victorian Government (Department of Environment, Land, Water and Planning at the time of writing). Together with the range of programs and other resources available, lists of this type serve to increase community awareness of threatened species and may encourage community members to become involved in activities to protect threatened species, thereby reducing the risk of their conservation status worsening (DSE 2013, DEPI 2014).

This advisory list is not the same as the statutory list of threatened taxa established under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). There are no legal requirements or consequences that flow from inclusion of a species in this advisory list. However, some of the species in this advisory list are also listed as threatened under the FFG Act. The FFG Act Threatened List only includes items that have been nominated, assessed by the Scientific Advisory Committee and approved for listing by the responsible Minister(s) (DSE 2013, DEPI 2014).

There are also species on this list that are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Within the Goulburn Broken Catchment, the EPBC-listed Ecological Communities include:

- Alpine *Sphagnum* Bogs and Associated Fens (endangered – listed January 2009)
- Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions (endangered - listed July 2000)
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and derived grasslands of south eastern Australia (endangered - listed April 2010).
- Natural Grasslands of the Murray Valley Plains (critically endangered – listed September 2012)
- Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (critically endangered – listed March 2012)
- White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grasslands or Box Gum Grassy Woodlands and Derived Grasslands [Short Name] (critically endangered – listed May 2006)

Summary of the Bioregional Status of Ecological Vegetation Classes (EVCs) in the Goulburn Broken Catchment.

Table 13: Legend for Bioregional Conservation Status of Ecological Vegetation Classes (EVC)

Status		Criteria
Presumed Extinct	X	Probably no longer present in the bioregion (the accuracy of this resumption is limited by the use of remotely - sensed 1:100 000 scale woody vegetation cover mapping to determine depletion - grassland, open woodland and wetland types are particularly affected).
Endangered (End)	E	Contracted to less than 10% of former range; OR Less than 10% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: <ul style="list-style-type: none"> – 10 to 30% pre-European extent remains and severely degraded over a majority of this area; or – naturally restricted EVC reduced to 30% or less of former range and moderately degraded over a majority of this area; or – are EVC cleared and/or moderately degraded over a majority of former area.
Vulnerable (Vul)	V	10 to 30% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: <ul style="list-style-type: none"> – greater than 30% and up to 50% pre-European extent remains and moderately degraded over a majority of this area; or – greater than 50% pre-European extent remains and severely degraded over a majority of this area; or – naturally restricted EVC where greater than 30% pre-European extent remains and moderately degraded over a majority of this area; or – rare EVC cleared and/or moderately degraded over a minority of former area.
Depleted (Depl)	D	Greater than 30% and up to 50% pre-European extent remains; OR Combination of depletion, degradation and current threats is comparable overall to the above and greater than 50% pre-European extent remains and moderately degraded over a majority of this area.
Rare	R	Rare EVC (as defined by geographic occurrence) but neither depleted, degraded nor currently threatened to an extent that would qualify as Endangered, Vulnerable or Depleted.
Least Concern (LC)	LC	Greater than 50% pre-European extent remains and subject to little to no degradation over a majority of this area.

Table 14: EVC coverage pre-European settlement and 2005 (Source: DSE 2007b; DSE 2007c).

Bioregion	Ecological Vegetation Classes		Pre-European		Existing (as at 2005)			
	Conservation Status	No of EVCs	Vegetation (ha)	Cover (ha)	Vegetation Cover (ha)	% of pre-European EVC cover remaining	% of remaining cover on Private land	% of remaining cover on Public land
Murray Fans	Endangered	31	169,904	43,620	26%	85	15	
	Vulnerable	31	59,602	33,361	56%	58	42	
	Depleted	46	32,922	31,767	96%	4	96	
	Least Concern	2	761	757	99%	0	100	
TOTAL		112	263,189	109,505	42%	53%	47%	
Victorian Riverina	Endangered	39	709,669	128,621	18%	88	12	
	Vulnerable	29	36,604	21,302	58%	48	52	
	Depleted	5	1,070	763	71%	26	74	
	Least Concern	1	212	75	35%	77	23	
TOTAL		76	747,555	150,761	22%	82%	18%	
Northern Inland Slopes	Endangered	21	58,397	9,338	16%	92	8	
	Vulnerable	5	24,996	8,651	35%	86	14	
	Depleted	1	342	280	82%	21	79	
	Least Concern	3	7,626	5,920	78%	36	64	
TOTAL		30	91,361	24,189	26%	75%	25%	
Goldfields	Endangered	24	19,256	9,885	51%	38	62	
	Vulnerable	8	39,609	17,302	44%	87	13	
	Depleted	9	99,507	83,290	84%	32	68	
	Least Concern	2	10,131	8,315	82%	36	64	
TOTAL		43	168,503	118,792	70%	41%	59%	
Central Victorian Uplands	Endangered	23	183,025	44,006	24%	86	14	
	Vulnerable	12	160,075	45,803	29%	91	9	
	Depleted	9	157,055	94,444	60%	66	34	
	Least Concern	4	20,145	12,492	62%	53	47	
	Rare	1	103	92	89%	99	1	
TOTAL		49	520,403	196,837	38%	75%	25%	
Highlands Northern Fall	Endangered	6	4,071	3,126	77%	13	87	
	Vulnerable	7	10,714	4,329	40%	66	34	
	Depleted	5	6,062	3,686	61%	54	46	
	Least Concern	15	491,967	405,073	82%	16	84	
	Rare	3	847	767	91%	10	90	
TOTAL		36	512,814	416,214	81%	17%	83%	
Highlands Southern Fall	Least Concern	9	719	707	98%	4	96	
TOTAL		9	719	707	98%	4%	96%	
Victorian Alps	Endangered	3	2,574	2,574	100%	0	100	
	Vulnerable	2	17	17	100%	0	100	
	Least Concern	13	85,660	85,638	100%	0	100	
	Rare	6	1,005	1,003	100%	0	100	
TOTAL		24	89,256	89,232	3%	0%	100%	
GRAND TOTAL		379	2,395,299	1,106,237	46%	42%	58%	

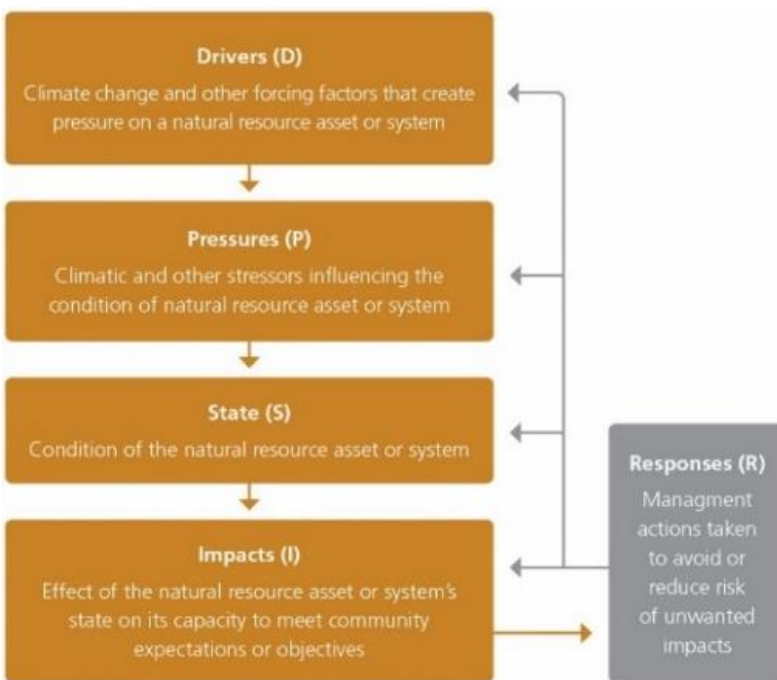
Note – data in the above table excludes areas mapped as water bodies (fresh and human-made) and sandy beaches. A list of individual EVCs for the Goulburn Broken Catchment can be found at www.gbcma.vic.gov.au.

A table of native vegetation statistics (e.g. ha/% remaining) across each SES will be developed for local planning.

Appendix 4 – Vulnerability of biodiversity to climate change and adaptation priorities

The Goulburn Broken CMA has led the development of a Climate Change Adaptation Plan with its partners to assist with integrating climate change planning into NRM activities across the Goulburn Broken Catchment (GBCMA 2016b). The Plan identifies priority landscapes for climate change adaptation and carbon sequestration in the context of improving the resilience of natural resources and identifies management options for all groups involved in NRM to consider. These have been incorporated into this Strategy where applicable.

The Plan has been developed primarily for natural resource management planners (but may inform the work of researchers and implementers) to provide an initial prioritisation for climate change adaptation and mitigation based on the vulnerability and values of natural resources – it is one important component of climate change adaptation decision-making but not the answer. Investigations to further understand the interactions between drivers of change in social-ecological systems and how key points of natural resource vulnerability may be overcome will continue.



An analysis of the influence of climate change on the condition of natural resources has been undertaken using the Driver-Pressure-State-Impact-Response (DPSIR) model (see

Figure 8). Table 15 summarises the drivers and pressures with a high influence on biodiversity condition that are expected to experience a change in influence under climate change. The level of influence of some pressures on condition is expected to be high only under climate change.

Figure 8: The DPSIR model (GBCMA 2016b)

Table 15: Drivers and pressures with a high influence on biodiversity condition that will experience a change in trend of influence under climate change

Strongest drivers of biodiversity condition	Trend in level of influence on condition under climate change	Assumptions
Climate variability and change	Increasing	Climate has a strong and pervasive influence on biodiversity condition via climate-dependent ecosystem processes. Direction of influence depends on climate phases, but overall is assumed to be neither detrimental nor beneficial. Climate change is likely to have an overall detrimental influence on biodiversity condition.
Water availability and policy reform	Increasing	Currently a positive influence on the condition of biodiversity as has recently provided improved balance of environmental and consumptive water uses. However, with reduced rainfall under climate change, competition between environmental and consumptive water uses is likely to increase and water availability for environmental flows likely to reduce, leading to a detrimental influence on biodiversity condition.

Strongest pressures on biodiversity condition	Trend in level of influence on condition under climate change	Assumptions
Change in fire regime and management	Increasing	Key pressure on terrestrial ecosystems in forest and alpine areas (trend for excessive frequency) and rural land (trend for insufficient fire). Severe fire weather to increase with climate change, placing (especially) biodiversity in fire-sensitive systems in public land areas at risk.
Change in rainfall regime	Influence high only under climate change	Ecosystem processes tightly linked to rainfall. Changes will be pervasive across the Catchment in all ecosystem types and generally detrimental because drier climate overall and increased drought incidence and intensity under climate change.
Extreme weather and climate events	Increasing	Extreme weather, especially fire and drought, adversely affects biodiversity in remnant native vegetation in rural areas and forests on public land. Flooding generally has a positive influence on condition of riparian, wetland and aquatic ecosystems. Climate change to increase adverse effects of fire and drought and may reduce flooding incidence.
Increase in temperature	Influence high only under climate change	Ecosystem processes are linked to temperature and fire (influenced by temperature). Changes will be pervasive across the Catchment for terrestrial and aquatic ecosystems and generally detrimental.
Invasive plants and animals	Increasing	Invasive species compete with, displace, damage or prey on native flora and fauna, reducing population and affecting recruitment. Climate change may enable the introduction of new invasive species.
Irrigation – regulation, drainage, diversion and storages	Increasing	Much of the influence on condition is a historical legacy of changes in flow and water regimes. While NRM programs are seeking to reduce negative influence, this pressure still contributes to a negative trend in biodiversity condition. Climate change will reduce water resource availability and likely increase detrimental impact on biodiversity condition.

Biodiversity has already faced change in the Catchment (see section 2.2. and Appendix 2) and climate change adds a new dimension to what is already happening by directly affecting native species and by changing the way other threats interact with them. Reduced water availability and increased temperatures will drive how biodiversity responds to climate change. Plants and animals that cannot adapt or migrate are at greatest risk of dying out. Species with restricted distributions, small populations, long reproductive cycles and are highly specialised will be the most vulnerable to climate change. Species with a poor ability to move or colonise new areas are also at risk of extinction. Some of the most vulnerable species for the Catchment are likely to occur in the alpine zone and freshwater systems. It can be hard to predict extinction as species often enter a slow decline and then die off quite suddenly. Many species already have some level of capacity to cope with change, however, it is unclear how many species will be able to cope with the predicted change. While species may be able to adapt their behaviour or biological processes to a point, some change may be so great that they have to move. Species movement is predicted to be complex. Some species will broaden their range while others will contract. Species with very specific living requirements may have to live in small pockets of refugia making them vulnerable to extinction from factors including fires and storms. Many alpine species are predicted to move to high altitudes where possible. Theoretically plants and animals are capable of moving to new places, but in reality it can be very difficult for them to move. For birds, animals and insects to successfully relocate they require a safe pathway and suitable new habitat. For some species these pathways do not currently exist and will

need to be provided through restoration. Migrations may also put additional pressure on species already living in these areas. Plants that rely on animals to move their seed may find it especially difficult to colonise new areas. (CSIRO 2015)

Adaptation options identified in GBCMA (2016b) and reflected in section 5 and Appendix 7 will go some way to addressing these impacts but the appropriateness of adaptation actions will need to be reviewed regularly to consider their effectiveness under changing circumstances.

A Spatial Assessment Tool was developed to assess the vulnerability of the Catchment’s natural resources to climate change and identify focus areas for adaptation. The Tool can assist NRM planners to develop scenarios of climate change impact based on spatial data with criteria able to be assigned different levels of importance. The Tool is not an end in itself, but instead a means to assist NRM planners and decision-makers to understand their complex planning and decision-making environment.

The assessment of adaptation priority reflects four main attributes; exposure, sensitivity, adaptive capacity and value (environmental, social and economic) (see Figure 9). A regional NRM planning framework review and the DPSIR analysis was used, in consultation with regional NRM planning stakeholders, to identify a set of criteria to assess adaptation priority which was adapted to focus specifically on biodiversity (see Table 16).

Priority areas for climate change adaptation have been identified in two types of landscapes; each are of high value but differ in vulnerability under the climate change scenario for 2030 (low change; warmer [0.5-1.5°C increase in annual average temperatures] with little change in annual average rainfall [-5 to +5% change]). Planned adaptation priority areas (see Figure 10) have higher sensitivity and lower adaptive capacity and are of high value. Such areas should be considered first for developing and implementing management programs to address vulnerability to climate change. Semi-autonomous adaptation priority areas (see Figure 11) have lower sensitivity and higher adaptive capacity under current tenure and management and are of high value. Specific adaptation interventions may not be required above current management and tenure arrangement, however, given the high values present, a “watching brief” should be maintained to detect any changes in biodiversity condition that suggests the need for adaptation.

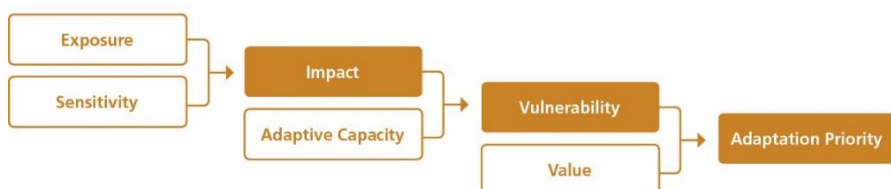


Figure 9: The climate change adaptation prioritisation framework (GBCMA 2016b)

Table 16: Criteria for assessing adaptation priority for biodiversity (GBCMA 2016b)

Exposure	Sensitivity	Adaptive capacity	Value
<ul style="list-style-type: none"> – Change in maximum annual average temperature – Change in average spring and autumn rainfall – Surface water yields - change in mean annual flow – Waterlogging and salinity – current shallow aquifer depth to water table – Area currently inundated in a 1 in 100 flood – Change in annual average minimum temperature 	<ul style="list-style-type: none"> – Native vegetation connectivity – Native vegetation condition – Index of stream condition – Native veg range under current conditions – Current land use – Land and soil health hazards – Proximity to wetlands 	<ul style="list-style-type: none"> – Tenure – Whole farm planning – Irrigation supply – NRM works 	<ul style="list-style-type: none"> – Biodiversity value – Stream reach and wetland value

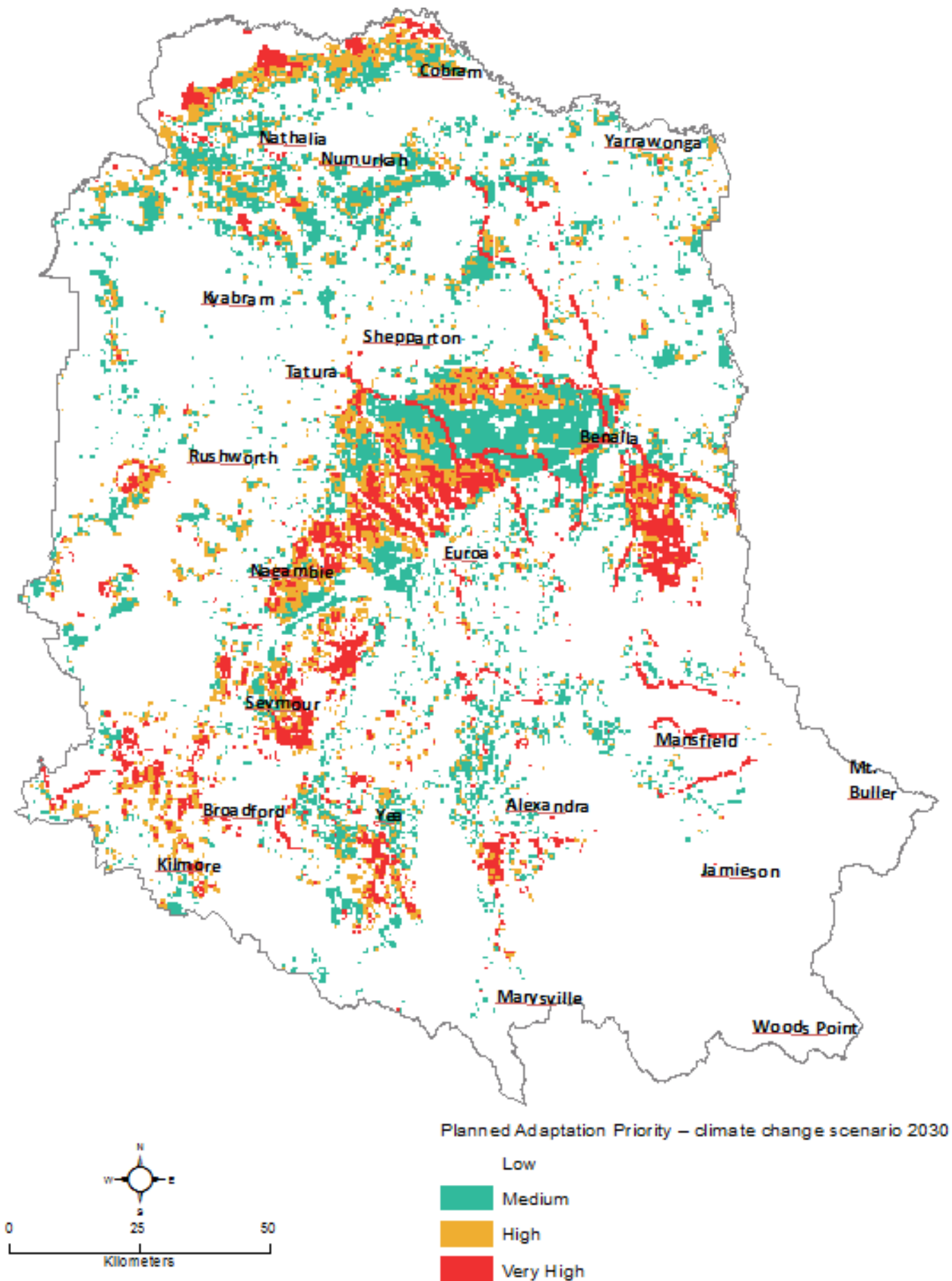


Figure 10: Planned climate change adaptation priority areas for biodiversity in the Goulburn Broken Catchment

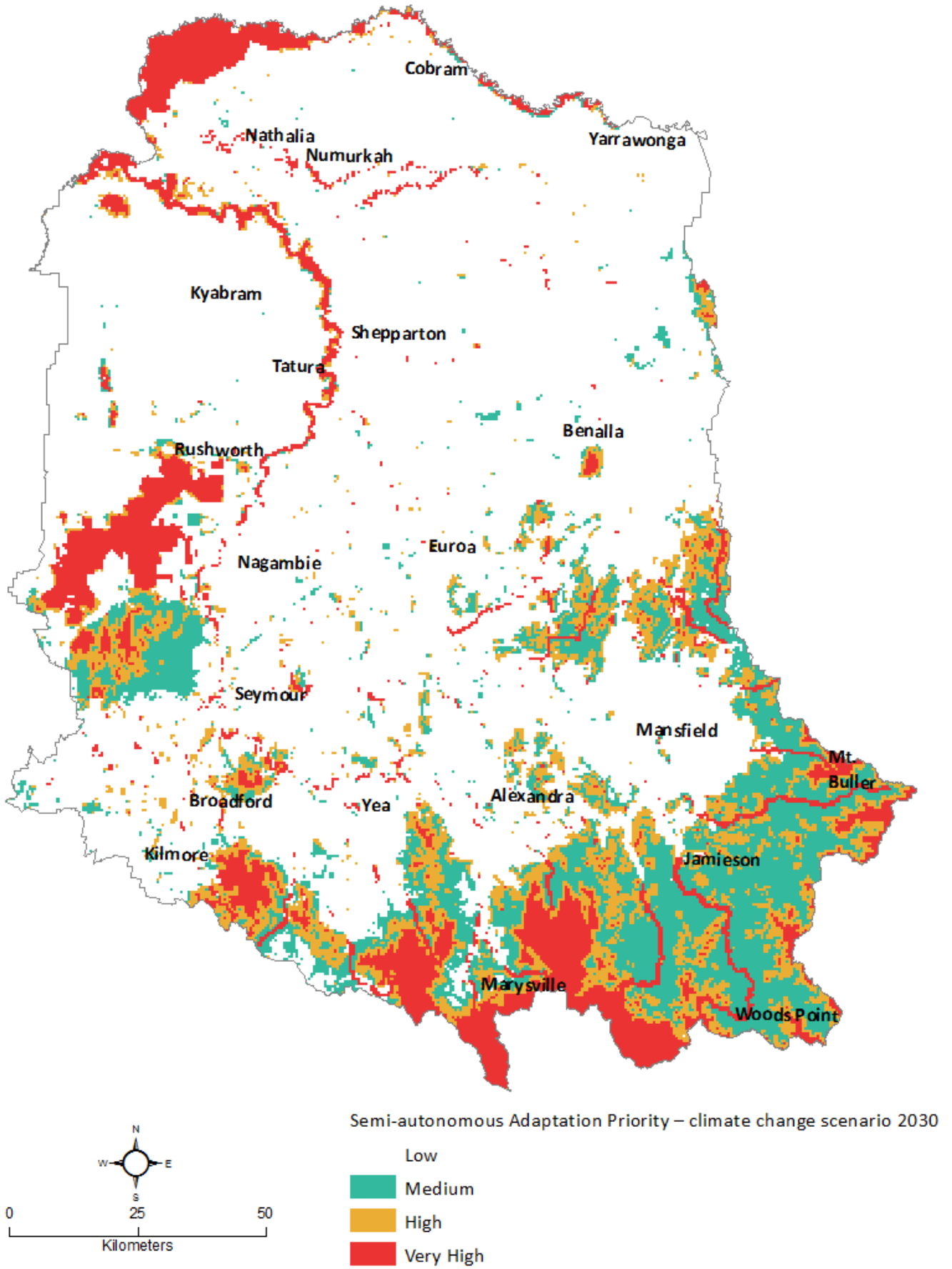


Figure 11: Semi-autonomous climate change adaptation priority areas for biodiversity in the Goulburn Broken Catchment

Appendix 5 – Targets rationale

Native vegetation targets

The native vegetation targets focus on the extent and quality of native vegetation and habitat elements. There is scientific evidence that extent and habitat quality influence system functioning. For example, extent of native vegetation is particularly important in determining the richness and distribution of birds (Bennett *et al.* 2006). A diversity of plant species and habitat elements generally increases the diversity and resilience of fauna species (Lindenmayer *et al.* 2006). However, it is recognised that system functioning is more complex than just these factors, and other aspects such as landscape context (where the vegetation is in the landscape: surrounding land use; size and shape of remnant; distance to large remnants, connectivity, distance to water sources) and threatening processes (pest plants and animals, climate change), effect the biodiversity value of a remnant, landscape and catchment. Where possible these factors have been considered in the targets, e.g. the area (ha) established for the native vegetation extent target incorporated a spatial assessment of configuration and connectivity (GBCMA 2010a). These more complex factors can be considered further at finer scales, for example when developing priority landscapes (see Appendix 6).

Access to suitable habitat is essential for the survival and successful reproduction of all species (Lindenmayer and Fischer 2006). Habitat quality can include components such as mature trees, understorey, logs, leaf litter, native species diversity, and weed cover. These components provide different habitat resources for different species. For example, logs and leaf litter on the ground are habitat for insects and microflora that in turn provide important food and nutrients for other native flora and fauna. Mature trees provide food and shelter for native fauna. Therefore, an increase in the quality and availability of these components is assumed to be of benefit to native flora and fauna.

Threatened species target

The threatened species target recognises that there is value in conserving as many species as possible in the Catchment because of their (often unknown) importance in maintaining ecosystem function, and their intrinsic, cultural and economic values. The value of conserving threatened species is reflected in relevant legislation including the *Flora and Fauna Guarantee Act 1998* and the *Environmental Protection and Biodiversity Conservation Act 1999*. However, threatened species survive within complex systems and the Goulburn Broken CMA recognises that threatened species cannot be managed in isolation, hence its approach to managing social-ecological systems. Projects that aim to manage threatened species will consider the broader context of the species' requirements within a system, with an aim of long-term population persistence *in-situ*.

The threatened species target:

- recognises that measurable aspects of a species likely change as population viability varies between species (e.g. range, genetic variability) (but it will just be an indicator for direction of change for most species). It is not possible to influence the conservation status of threatened species as most species also occur outside of the Catchment (this was the basis of a previous target, see McLennan *et al.* 2004);
- will require benchmarking and long-term sampling (Burgman and Lindenmayer 1998); and
- could be useful to determine shifts in distribution due to climate change. This is particularly important for those species with limited environmental tolerances.

The selection process for identification of the twenty species is provided in Appendix 9. The number of species chosen to measure, similarly to the native vegetation extent targets, is not as important as conveying the intent of the target, and the precise number may change over time, with input from State agency staff and other experts. Developing a consistent approach to threatened species reporting that can be used by a range of stakeholders, such as CMAs and Parks Victoria, would be of great benefit.

Monitoring progress towards targets

Progress towards targets is measured by the equation, 'Outcomes = Outputs x Assumptions'. Defining assumptions is critical in understanding progress towards outcomes. For example, the amount of native vegetation management activities such as revegetation occurring through Goulburn Broken CMA funded projects (outputs) is known, but assumptions are made about how much activity is occurring outside of this funding (such as privately funded activities) and its contribution towards the targets to provide a more accurate measure of change over time. Assumptions include estimations in gains and losses in extent through fuel reduction burning, permitted and illegal removal of native vegetation, and natural regeneration as a result of land use change. Documenting the importance and certainty of assumptions, results in identification of priorities for research. The Goulburn Broken CMA will continue to apply and refine this approach through the implementation of this Strategy and periodic reviews of outputs achieved and assumptions. Details of this approach, and updates are documented in the dynamic (annually updated) *Biodiversity Monitoring Action Plan* (GBCMA 2016a), which is available from the Goulburn Broken CMA upon request.

Links to targets of other programs

River and Wetland Health

Aquatic, riparian and wetland biodiversity are all important components of biodiversity. While being catered for to a certain degree in the Goulburn Broken CMA biodiversity targets, aquatic, riparian and wetland biodiversity are a strong focus of the *Goulburn Broken Waterway Strategy 2014-2022*. A key focus under this Strategy is to continue to strengthen the links between the 'Land and Biodiversity' and 'River and Wetland Health' programs of the Goulburn Broken CMA.

Riparian areas are critical in agricultural dominated areas where much tree cover has been lost, as it provides refuge for most species that are no longer or rarely found in the broader landscape (Bennett *et al.* 2014). Areas of permanent or occasional water are particularly important for climate change adaptation as they provide drought refugia. These features are considered when prioritising at the landscape scale (see section 4)

Pest Plants and Animals

The Goulburn Broken CMA and its partners recognise the importance of controlling pest plants and animals for biodiversity outcomes. While target 2 in this Strategy considers weeds as a component of vegetation quality, no specific biodiversity targets have been set for pest plants and animals.

Pest plants and animals pose threats within the complex systems being managed, and need to be considered at finer scales than catchment-scale as issues, species and level of threat will vary across the Catchment. For example, blackberries may be the priority weed in one area, but have little effect in another.

Community Capacity

Community involvement in planning and delivery of projects to achieve targets is recognised as the only way to achieve the vision. However, it is also recognised that it is difficult to measure how building the capacity of the community results in practice change for better environmental outcomes. Indicators for community involvement are outlined in Section 5.

Appendix 6 – Scales of spatial prioritisation: background

Catchment Scale: Climate change adaptation priority areas

Appendix 4 describes the regional NRM planning for climate change project, which developed a spatial assessment tool to assess the vulnerability of the Catchment's natural resources to climate change using spatially-enabled criteria (GBCMA 2016b). The tool identifies adaptation priority areas in two types of landscapes, each are of high value but differ in vulnerability under the 2030 climate change scenario (RCP 4.5, low change: warmer with little change in rainfall): Planned adaptation priority areas – higher sensitivity and lower adaptive capacity – and Semi-autonomous adaptation priority areas – lower sensitivity and higher adaptive capacity (under current tenure and management).. Figure 3 shows alignment between the climate change adaptation priority areas and the priority biogeographic zones.

Regional Scale: Priority biodiversity protection and restoration zones

To assess the relative contribution that different areas make towards reaching the vision, the Catchment was divided into 14 biogeographical zones, each with their own ecological attributes and functional characteristics (GBCMA 2010a). These zones, varied in biodiversity characteristics and potential to contribute to the vision. Key characteristics such as the proportion of native vegetation, ratio of public to private land, and assets, threats and opportunities were identified (Miles and Stothers 2009). A summary of the zone characteristics is provided in GBCMA (2010a).

The zones were assessed based on their existing biodiversity attributes and the potential to contribute to the ecological outcomes described in Section 3 to identify broad zones of focus for the life of the Strategy (GBCMA 2010a). The method used is summarised in GBCMA (2010a).

Two types of priorities for zones were identified: 1. those that require protection to enhance existing values (e.g. increase vegetation quality), and 2. those that require restoration through revegetation and enhancement to increase native vegetation extent. These two actions are reflected in the targets, and vision. The most intact zones such as the South-eastern Highlands, the Murray Corridor and the Goldfields had the highest scores for existing biodiversity values (native vegetation condition, soil health, species diversity etc.), and the priority is to maintain and improving biodiversity condition.

The highest priority zones for restoration including increasing native vegetation extent and quality were the Lower Goulburn and Broken Rivers, and the Longwood and Violet Town Plains.

Lower priority zones generally reflected highly modified landscapes. However, significant values, such as wetlands, large remnants, and threatened species exist within these zones, and therefore further prioritisation is required at the landscape scale to ensure that these values are managed. Biodiversity Action Planning is one tool to assist with SES, landscape and site-scale planning (see Appendix 8).

The zone assessment (GBCMA 2010a) provided an inclusive, objective approach to prioritisation at a sub-catchment level. The information and priorities for each zone is one tool to help inform priorities at the SES and landscape scale.

Landscape Scale: Focus Landscapes in the Agricultural Floodplains SES

The Agricultural Floodplains SES contains areas of high intensity farming as well as some areas that have significant biodiversity values, therefore it is important that there is strategic planning to identify and manage high value landscapes. Previously, sites of high value were identified (from Biodiversity Action Plans) but landscape scale priorities have only recently been identified, and the methods used are outlined below.

Priority landscapes were identified based on a range of criteria and in consultation with key stakeholders.

The criteria for identifying priority landscapes were:

- **Vegetation extent:** areas that had relatively high vegetation cover. It is easier to add value to landscapes that have existing native vegetation and core remnants which can act as sources of populations.
- **Connectivity:** The Landscape Context Tool showed that there are high priority areas for connectivity.
- **Vegetation Quality:** large remnants with quality habitat are important in providing a source of flora and fauna to repopulate the landscape. There is a high proportion of existing high quality sites (as identified in BAP)
- **Likely uptake by landholders:** The landscapes were categorised based on land use types to enable effective and targeted extension within each landscape
- **Existence of public land reserves:** this ensures that large remnants have security and provided a basis to achieve connectivity to adjoining private land.
- **Waterways and Wetlands:** Diversity and abundance of wetlands and waterways to provide drought refugia.
- **Existing community networks:** For example, the Goulburn Murray Landcare Network, Lower Goulburn Conservation Management Network and Broken Boosey CMN areas were included in priority areas.

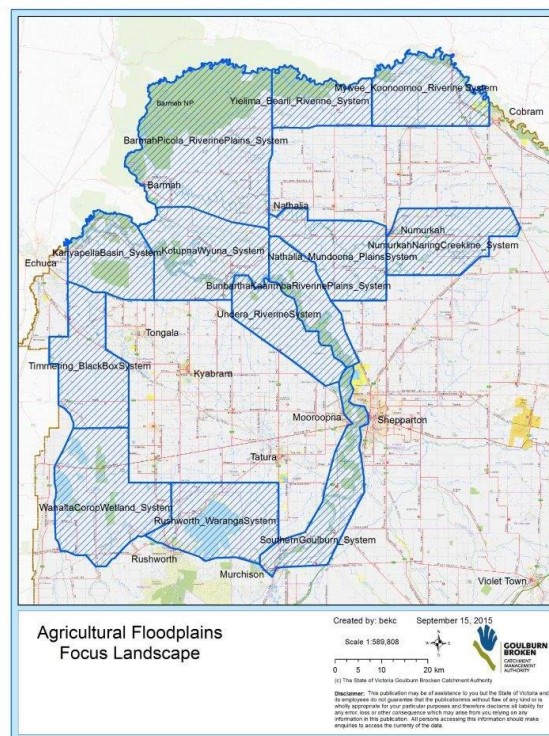


Figure 12: Focus landscapes in the Agricultural Floodplains

Landscape - Site scale: Biodiversity Action Planning

Biodiversity Action Planning (undertaken in the Catchment during 2003-2008) identified sites that were considered to be of high value through analysis of a range of criteria. Within each of the 20 BAP zones identified, scientific and local knowledge was used to map priority sites and develop a Conservation Plan. For some zones, high value sites were mapped through ground-truthing, while for others aerial photography was used. Values assessed included cover of native vegetation and threatened species records (see www.gbcma.vic.gov.au for details and maps). This spatial data can be used to identify and prioritise areas where there are clusters of priority sites, and used by extension officers and community groups to identify priorities (e.g. focal species) to engage the community.

Appendix 7 – Action plan linked to strategic directions and initiatives

1 Anticipate and adapt to change
1.1 Create processes that encourage proactive planning and quick responses , including plans that factor in local differences and uncertain knowledge and futures, governance arrangements that are shared by partners, and processes that are regularly reviewed.
1.1.1 Annually review socio-economic, ecological, climatic and political circumstances, and governance arrangements, Strategy progress, and align the Strategy with government investment priorities. This could consider the evidence for answering evaluation questions in Table 8 of section 6 and other planning tools such as the Adapt NRM framework (CSIRO 2015).
1.1.2 Factor whole-of-catchment biodiversity priorities into SES-scale plans, and identify key attributes, thresholds, goals, and implementation priorities at the SES scale, considering multiple futures (climate change and other drivers).
1.2 Support landholders who are changing their land use , such as peri-urban development, farming enterprise and lifestyle property by helping them factor biodiversity into their planning and implementation.
1.2.1 Support private landholders through incentives and other mechanisms, such as providing labour for high priority sites (as per various disaster employment crew examples). Factoring in agency-support costs to allow post-project support is also needed.
1.2.2 Explore the potential for native vegetation restoration through management of constraints along the Goulburn River.
1.3 Manage risks and capture opportunities from climate change
1.3.1 Assess the feasibility for carbon sequestration that encourages biodiversity outcomes in line with the <i>Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment 2016</i> and through partnerships with DELWP, carbon project developers and the Carbon Market Institute.
1.3.2 Review and update protection and restoration priorities and approaches (including revegetation species selection) under projected climate change (e.g. using the <i>Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment 2016</i> and associated spatial assessment tool, AdaptNRM biodiversity modules and the Murray Basin Cluster Climate-ready Restoration project [Broadhurst <i>et al.</i> 2016]).
2 Strengthen partnerships
2.1 Continue to strengthen partnerships between individuals, community and industry groups, and agencies , including Traditional Owners and public land managers.
2.1.1 Review how partners participate in biodiversity management, including this Strategy's implementation, local government-led processes, and strategy and investment evaluation processes. Consider efficiency and effectiveness and whole-of-catchment and SES-scales.
2.1.2 Factor biodiversity assets into authorities' disaster planning and activities, including prior to, during and following wildfires, floods and drought.
2.1.3 Work with Traditional Owners to include traditional ecological knowledge into natural resource management plans on Country, including training for practitioners. Identify an agreed process for consulting with indigenous groups, from applying for funding to implementation.
2.1.4 Work with Parks Victoria to add sites to the reserve system where they have high cultural and natural values, including support for Traditional Owners in their pursuit of Indigenous Lands Trust funding for land applications.
2.1.5 Support Traditional Owner groups to place Cultural Heritage Agreements over sites where appropriate and promote these agreements for helping to manage cultural heritage sites on private property.
2.1.6 Partner and employ indigenous groups in: trialling and practicing cultural burning practices, water conservation, climate change strategies and actions, revegetation planning and landholder negotiation.
2.2 Develop large-scale, multi-partner and multi-tenure projects when appropriate
2.2.1 Support community-agency network models, supported by a local co-ordinator, that address the public: private land interface, e.g. Conservation Management Networks. (See Context Pty Ltd 2008 and Castles 2009).
2.2.2 Support private land managers who manage large areas of habitat, moving away from servicing small sites.
2.2.3 Ensure integrated planning and implementation for terrestrial and aquatic biodiversity (cross program collaboration) to encourage a reduced silo effect from national and state governments.

3 Invest wisely
3.1 Improve the science behind decisions through better understanding underlying assumptions , and associated data quality and management.
3.1.1 Continue to annually update the Goulburn Broken CMA's Biodiversity Monitoring Action Plan (the method for documenting and improving the certainty of assumptions around progress towards biodiversity targets [through appropriate research]).
3.1.2 Continue to work with universities, other agencies and local communities to understand ecological processes and develop indicators for measuring change over time (to be incorporated into a monitoring framework).
3.1.3 Work with scientists in the Catchment to increase understanding of soil biodiversity and appropriate management for resilient SESs.
3.1.4 Define and agree on roles for reporting biodiversity outcomes at national, state, catchment and local levels.
3.1.5 Increase the use of approaches that aim to measure or predict biodiversity outcomes for guiding investment choices, and develop standard metrics where possible.
3.1.6 Review incentive and grant programs, including whole farm planning processes, to ensure biodiversity is adequately integrated. Assess against risk areas and recommendations in Vegetation Incentives Analysis 2007-08 (Stothers <i>et al.</i> 2008) and consideration of the public and private benefits.
3.1.7 Research climate change implications for biodiversity, such as fire sensitivity for restricted range environments and species and triggers for changing management.
3.1.8 Improve knowledge about landholders as change agents (apply and build on practice change research).
3.2 Develop priorities at various scales of planning and integration
3.2.1 Develop landscape-scale priorities and implementation plans within SESs, using this Strategy, the Goulburn Broken RCS, Biodiversity Action Planning Reinvigorate the use of Biodiversity Action Planning, including the BAP Implementation Planning model initiated in 2008 and the BAP review (Wilson 2011), and incorporate into local planning and implementation.)
3.2.2 Where appropriate, undertake risk assessments for specific biodiversity assets to determine priorities for investing or removing investment, including at the SES scale.
3.2.3 Integrate environmental watering with biodiversity landscape planning (3.2.1).
4 Build on ecological infrastructure
4.1 Develop icon projects, improving terrestrial and aquatic ecological function and climate change adaptation
4.1.1 Spatially identify priorities for building catchment-scale biodiversity 'resilience', especially in response to climate change, factoring in indicators such as regeneration potential/success, and update maps accordingly. (Links with action 1.3.2.)
4.1.2 Identify and manage key areas likely to provide refuge in the face of climate change, including environmental watering of wetlands.
4.2 Implement stewardship programs that target large-scale landscape protection, restoration and connectivity in priority areas , across terrestrial habitats, waterways and wetlands
4.2.1 Implement long-term, stewardship-focused incentives where appropriate
4.2.2 Improve targeting of private land incentives for biodiversity conservation by designing project focus areas (eligibility) and metrics (preferences) to align with priority areas identified in this Strategy and where identified, priority landscapes determined by agreed criteria.
4.3 Maintain resilient ecosystems and help others transform appropriately in response to drivers such as climate change
4.3.1 Develop ways to communicate ecosystem resilience and transformation for consideration in annual investment priorities. This might also lead to improved research into ecosystem changes.
4.3.2 Factor biodiversity thresholds into planning at SES-scale, based on possible and likely future conditions. This follows the 'adaptation pathways' approach.
4.3.3 Continue to integrate biodiversity at all geographic scales (catchment, SES, landscape, farm etc) and management scales (CMA, municipality, program, project, etc.).
4.3.4 Identify and manage risks to biodiversity. (Update broader risk assessment [Appendix 5 of the Biodiversity Strategy for the Goulburn Broken Catchment, Victoria 2010-2015] to identify current severity of threats to biodiversity, including pest plants and animals, fuel reduction burning and timber harvesting practices.

5 Legitimise biodiversity conservation
5.1 Strengthen and communicate duty of care for biodiversity conservation.
5.1.1 Include biodiversity values in priorities for riparian zone and river frontage management.
5.1.2 Ensure incentive payments are contributing towards management that is considered above a landholder's duty of care.
5.1.3 Provide practical guidance to land managers on how to meet statutory obligations and explore options for encouraging and recognising voluntary management.
5.2 Increase opportunities for landholders to act as biodiversity stewards through appropriate mechanisms and support.
5.2.1 Promote and showcase land management methods and philosophies that demonstrate a whole-of-farm approach, where both biodiversity and production benefits can be realised.
5.2.2 Provide and communicate a range of mechanisms and tools to achieve biodiversity outcomes, considering the varied demographic, knowledge and expectations of landholders and the emerging soil and carbon management approaches that complement biodiversity outcomes. The SES-approach to planning should help promote this approach.
5.2.3 Apply learnings from the Goulburn Broken CMA's Green Graze Pilot Project (whole-of-farm grazing management tender program).
5.3 Influence government planning and policy, including municipal planning schemes and state legislation and policy.
5.3.1 Assist local government to develop and apply planning tools to match land-use intensity with land characteristics for the benefit of biodiversity. Tools include the Municipal Strategic Statement review, policies, and overlays.
5.3.2 Trial a regional offsets scheme for clearing of native vegetation, especially for new urban and agricultural developments.
5.3.3 Influence forest management including timber harvesting and burning practices to achieve improved biodiversity and catchment health outcomes.
5.3.4 Identify opportunities for communicating the contributions of community activities such as Conservation Management Networks to broader ecological objectives.
5.3.5 Encourage risk management processes for addressing impacts to biodiversity, building on lessons from the Goulburn Broken Roadside Biodiversity Risk Management Protocols project implemented by the Goulburn Broken CMA and local government.
5.4 Promote an understanding of the fundamental reliance on biodiversity for quality of human life, economy and identity
5.4.1 Facilitate broader community awareness and acceptance of practices to protect and improve the condition of natural assets, including biodiversity, via schools, CMNs and other community groups.
5.4.2 Develop a communication plan linked to this Strategy, including an action around marketing the GBCMA's proactive approach to biodiversity planning and implementation.

Appendix 8 –Biodiversity Action Planning - an example of focal species selected for one of the BAP zones.

Biodiversity Action Planning was developed for the Catchment between 2003-2008 to identify and map biodiversity assets in the Catchment. Conservation Plans were prepared for 18 zones across the Catchment. The plans contain detailed information on biodiversity assets and priorities, including focal species and their habitat requirements (Table 17) (http://www.gbcma.vic.gov.au/land_and_biodiversity/resources_publications/bap)

Table 17: Focal species and their habitat requirements – Barmah Landscape Zone

Table 2: Focal Species and their Habitat Requirements – Barmah Landscape Zone	
	<p>Grey-crowned Babbler (<i>Pomatostomus temporalis</i>) (e)</p> <p>Minimum patch size (threshold) >2ha, >1km continuous roadside Critical distance between patches <500m from known site Dispersal threshold <2km, very few records >10km Ecological Vegetation Class Woodlands Some other requirements (general) Mature trees, shrubs (>6m), linkages</p>
	<p>Bush Stone-curlew (<i>Burhinus grallarius</i>) (e)</p> <p>Minimum patch size (threshold) >1ha, >40m wide Critical distance between patches <1km Dispersal threshold <2km from known site Ecological Vegetation Class Creeklines, Woodlands Some other requirements (general) Ground timber, fox control</p>
	<p>Superb Parrot (<i>Polytelis swainsonii</i>) (e)</p> <p>Minimum patch size (threshold) Larger the better Critical distance between patches Varies for breeding/non breeding Dispersal threshold Varies for breeding/non breeding Ecological Vegetation Class Woodlands, Forests (River Red Gum) Some other requirements (general) Hollows, shrubs, corridors, dead trees</p>
	<p>Brown Treecreeper (<i>Climacteris picumnus</i>) (k)</p> <p>Minimum patch size >30ha Critical distance between patches <500m from known site Dispersal threshold <1km EVC utilised Woodlands, edges, forest clearings Some other requirements (general) Mature trees, fallen timber*, linkages</p>
	<p>Tree Goanna (<i>Varanus varius</i>) (v)</p> <p>Minimum patch size (threshold) >2km roadside/streamside patches Critical distance between patches <2km Dispersal threshold <2km Ecological Vegetation Class Most except wetlands Some other requirements (general) Mature trees, fox control, logs</p>
	<p>Brolga (<i>Grus rubicunda</i>) (v)</p> <p>Minimum patch size (threshold) >50ha or clusters of wetlands Critical distance between patches Varies Dispersal threshold Varies Ecological Vegetation Class Wetland (ephemeral, 20-30cm depth) Some other requirements (general) Fox control, Canegrass, <i>Eleocharis spp</i></p>
	<p>Squirrel Glider (<i>Petaurus norfolcensis</i>) (e)</p> <p>Minimum patch size (threshold) >0.5ha, >1km length Critical distance between patches <50 metres Dispersal threshold <1km Ecological Vegetation Class Woodlands, Forests Some other requirements (general) Mature trees, Hollow-dependant#</p>

* Habitat requirements include fallen timber at >40 tonne/hectare (MacNally 2006).

Tree-hollows (with tight-fitting entrance hole) are essential to Squirrel Gliders for breeding and den sites.

Victorian threatened status definitions: (e) = endangered, (v) = vulnerable, (k) = poorly known.

Habitat Requirement Source: Variety of Sources (GBCMA in prep.) and DSE 2005a.

Photo Credits: Grey crowned Babbler (Graeme Chapman), Bush Stone-curlew (Ian McCann), Tree Goanna (Peter Robertson) and Squirrel Glider (John Seebeck) (NRE 2002f); Superb Parrot and Brown Treecreeper (Dr. Neville. R. Bartlett 2006); and Brolga (Paul O'Connor 1992).

Appendix 9 - Threatened species management within a resilience planning framework

Funding for conservation will always be inadequate given the size of the problem. Therefore, decisions need to be made about where and how to spend scarce resources. The first major decision is should scarce funds be spent on individual threatened species or should a systems-based approach be adopted? If single species are to receive funding, then strategic planning is required to determine which species should be funded, how much should be spent, and the likelihood of outcomes, to optimise desired objectives, maximise return on investment and reduce loss of individuals and species. These questions become even more complex with the effects of climate change, as it is unlikely that all species will survive that extinction threat.

The Victorian Government implements the *Flora and Fauna Guarantee Act 1988* (FFG Act), which is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. Part of this role is to develop Action Plans for threatened species through information stored in the internet-based information system about Threatened species: the 'Actions for Biodiversity Conservation (ABC)'. While the ABC prioritises areas and actions for particular (not all) threatened species, there is currently no process to prioritise which threatened species should be targeted for funding. Prioritisation is difficult given varying degrees of knowledge of species, their distribution, habitat requirements, interactions with other species, as well as fundamental questions about how to reverse the extinction process. To add to the complexity there are also social considerations, such as which species people 'want' to save, which may be different species to those that are the most ecologically beneficial species to invest in, or those most likely to survive in the long term or a range of other criteria that could be used to determine priorities. Currently, some species receive a higher proportion of funding because they are State emblems (Leadbeater's Possum and Helmeted Honeyeater), or are iconic (e.g. Mountain Pygmy Possum) and therefore have high levels of social support.

Extinction processes are not well understood, but are most often related to habitat loss and invasive species that interact in complex ways. Managing for particular threatened species can result in improving ecosystem function, and managing ecosystems can result in improving the viability of threatened species. Therefore, it is important that both species' requirements and ecosystem function are considered when the objective is to increase species viability in the long term. A good example of a species-specific combined with an ecosystem approach to management is the Turquoise Parrot Project in the Goulburn Broken Catchment. Species-specific nest boxes were constructed and erected for the parrots, and revegetation to create corridors for movement will improve ecosystem function for a range of many species, including other threatened species.

A potential method for identifying threatened species priorities and targets in the Goulburn Broken Catchment

The Goulburn Broken Catchment Management Authority uses a resilience (systems) based approach in biodiversity conservation, and this can extend to threatened species investment and management. A systems based approach recognises that threatened species are part of large ecological systems and that they interact with other species and functions. It also recognises, in part, that if habitats are protected and enhanced then potentially threatened species long term survival can be enhanced because the systems within which they survive are resilient, and that all management should be within an integrated and adaptive framework that considers community expectations.

A systems-based prioritisation method is being developed (2016) that will be transparent, and inclusive in the decision-making process.

It is transparent because it documents the decisions and assumptions behind the decisions.

It is inclusive: a range of agency staff, researchers and community representatives can be involved in the decision-making process.

It can transform the long, (sometimes overwhelming) list of individual species and communities into clear, discrete groupings to allow for synergistic actions where appropriate.

Initially, all threatened species were put into a spreadsheet with general criteria as a first cut to reduce the number of threatened species to those which we have information. It is not possible to manage a species if we do not know its basic ecology and biology, however, that produces a list of species for which we do not have any information and that information is valuable. Then, with the reduced list, we can identify which species we want to further scrutinise, based on a range of criteria, such as its endemism in the Catchment, its social appeal, and the ecosystem with which it is associated. The objective is to prioritise species that occur in each of six major ecosystem types in the Catchment: Alpine, Woodlands, Wetlands, Waterways/riparian and Forests. We can then work with the community to develop threatened species projects that both enhance individual species survival as well as the ecosystems in which they inhabit. Working with the community will ensure informed decisions are made about management, and enhance long-term ownership of projects by the community with their chosen focal species.

This prioritisation project will be finalised after the completion of this Strategy.

STRATEGY ENDS