Goulburn Broken Catchment
Biodiversity Strategy

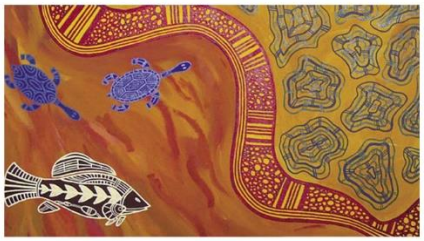
GOULBURN BROKEN
CATCHMENT MANAGEMENT AUTHORITY

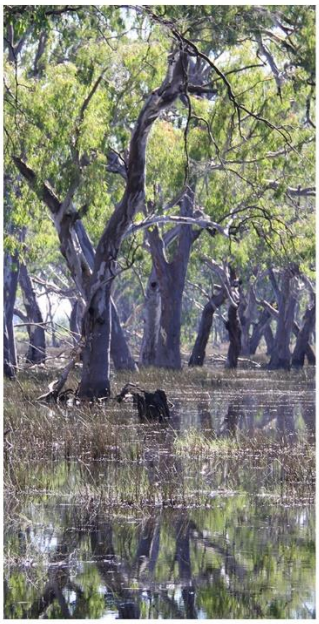














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Acknowledgement of Traditional Owners
The Goulburn Broken Catchment Management Authority and its partners acknowledge the Traditional Owners of land, the Yorta Yorta Nations, Taungurung Clans and other custodians, in the Goulburn Broken Catchment and 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 (SESs).

All our environment and people benefit from increased opportunities for our Traditional Owners, who have a rich culture that is intrinsically connected to natural systems.

The strategy provides a regional perspective for implementing a 20-year plan, *Protecting Victoria's Environment – Biodiversity 2036*, being developed by the Department of Land, Water and Planning (DELWP). 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 SESs, and will inform the renewal of the Regional Catchment Strategy (RCS) 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 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 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 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 government's $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 (MDBA) has set sustainable diversion limits to protect river systems, including the Barmah-Millewa Forest and the Lower Goulburn Floodplain as two of 18 key environmental icon sites.

This update of the Biodiversity Strategy for the Goulburn Broken Catchment 2010-2015 is the next step in understanding the impact of these changes in our journey towards improving the resilience of the SESs 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 Catchment Management Authority (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 CMA

Chris Norman
CEO
Goulburn Broken CMA

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Executive summary

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

The strategy identifies initiatives under five-year strategic directions for achieving a 15-year vision. The strategy informs the Goulburn Broken CMA's 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. It also provides flexibility for stakeholders to interpret, implement and review strategic initiatives, recognising that a variety of actions can contribute.

As with other Goulburn Broken CMA RCS sub-strategies, this Biodiversity Strategy was prepared with partners and the community.

Where are we at?

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

Since the early 1990s, the uptake of environmental works has increased significantly, including the integration of biodiversity into farming-systems and waterway management. There has been an increase in community action following a corresponding acceptance of the challenge to improve the condition of biodiversity. There has also been strong progress in implementing the Biodiversity Strategy (Miles 2015). However, many species are threatened with extinction, largely as a result of a loss of habitat and ongoing threats, such as pest plants and animals, clearing and degradation of native vegetation, and the increasing trend of treating water as a commodity.

The recent trend in native vegetation extent, a critical attribute of biodiversity, is below what is needed to achieve the long-term target of an increase by 70,000 hectares by 2030. 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 in achieving gains in extent. Monitoring changes in native vegetation extent and condition requires a state-level coordinated approach. In addition, while community and individual landholders are willing to increase native vegetation extent and quality by revegetating and other measures, achievements are limited because of restricted levels of funding.

The link between biodiversity and sustainable agriculture is clear. Biodiversity programs aimed at supporting private landholders in the catchment must be integrated within a farming system if they are to be successful, so that nature's ecosystem services benefit agricultural production, and land management practices are sympathetic to nature. Biodiversity is no longer considered in isolation when management decisions are made. Consistent with the Goulburn Broken Catchment RCS, biodiversity is an important part of complex systems of people and nature, with an aim of resilient SESs being a major factor in how programs are devised and delivered.

The RCS identifies six different SESs within the Goulburn Broken Catchment. This Biodiversity Strategy guides the identification of planning needs, on-ground actions and specific thresholds for critical attributes that affect biodiversity conservation in each SES. Biodiversity conservation within SESs is affected 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 burns.

- 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, both risks and opportunities are presented for biodiversity conservation.
- Changing structure and function of government agencies, particularly related to declining resources for managing biodiversity associated with public land. In addition, ongoing changes to native vegetation management regulations make it difficult to assess how these regulations are affecting vegetation extent and quality.

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 flagship species by 2030.

These targets provide a platform to monitor progress, evaluate programs and identify knowledge gaps. Progress reports use scientific data and assumptions, which are continually refined with the 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 Biodiversity Strategy is to continue to strengthen the links between the Goulburn Broken CMA's Land and Biodiversity and River and Wetland Health programs.

This strategy recognises the importance of presenting information according to the scale of decision-making. While the Australian and Victorian governments' 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.

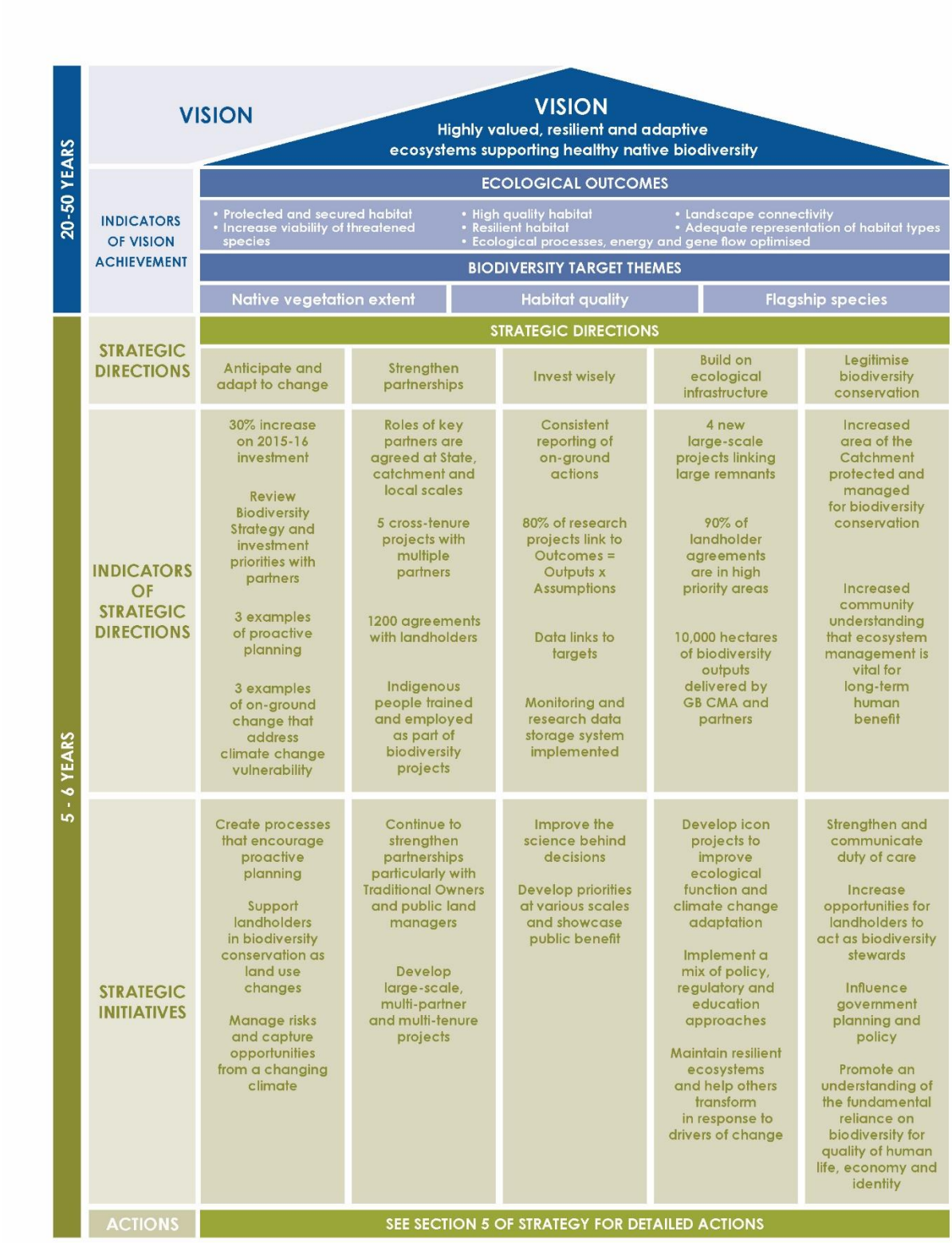
Spatial priorities of three separate approaches that apply at the catchment scale strongly correlate: DELWP's NaturePrint, a state-wide model of priorities (DELWP 2016a), Goulburn Broken CMA's biogeographic zones (GBCMA 2010), which have been reviewed, and Goulburn Broken CMA's priority areas for climate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

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

How will we get there?

The strategic framework (see figure on following page) 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 in Section 5, 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 Biodiversity Strategy and now include a strong emphasis on the resilience approach and the associated adaptive management so that there is close alignment with the RCS 2013-2019.



Evaluation and adaptation

As the drivers of biodiversity change shift and the information-base for decision-making 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 the impact of actions on biodiversity condition change.

1 Introduction

The 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 RCS in partnership with the community, all tiers of government and research and funding organisations.

This is the fourth major version of the RCS's biodiversity sub-strategy (previous strategies: GBCMA 2003, McLennan *et al.* 2004 and GBCMA 2010).

Sub-strategies have been critical in Goulburn Broken CMA's 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. Goulburn Broken CMA values demonstrating 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 (see inside front cover).

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 in this strategy is to build on the resilience approach, as outlined in the Goulburn Broken RCS 2013-2019, including how biodiversity thresholds need to be considered when developing local plans for the catchment's SESs. The strategy also considers new information and tools, particularly for climate change, and responds to changing drivers such as new and updated policy and legislation.

This strategy allows for flexibility for all stakeholders to interpret, implement and review strategic initiatives as various actions are implemented. Detailed actions are included in Section 5, 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. has a vision for biodiversity in the Goulburn Broken Catchment that is 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 for 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: a community summary will be developed and local plans for each SES identified in the Goulburn Broken RCS will incorporate and 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 details).

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 acknowledges issues and identifies how best the Goulburn Broken CMA and partners can influence improved policy outcomes.

During implementation of this strategy, specific actions will be identified for the range of land managers, both private and public, reflecting the strategy's 'tenure-blind' vision for biodiversity. Approximately one-third of the remnant habitat in the catchment is on public land, but most threatened species and ecological communities depend on private land entirely or at least in part for their habitat needs. The Goulburn Broken CMA plays a crucial co-ordinating and influencing role in the management of land for biodiversity outcomes, through partnerships with private and public land managers.

While this strategy has a strong focus on terrestrial biodiversity, it acknowledges aquatic and soil biodiversity values and promotes a systems-based approach to management.

Soil biodiversity is important in supporting healthy systems. There are strong 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 (Binning *et al.* 2001). Unfortunately knowledge in this area remains relatively low (GBCMA 2016b). 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.

A consultation draft of this strategy was released for stakeholder comment in July 2016. Submissions and comments received from various individuals and organisations were considered in finalising the strategy (Appendix 7).

The relevance of this strategy to stakeholders is outlined in Table 1 below.

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.
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 and agricultural industries	Provides guiding principles for biodiversity conservation and regional priorities to which landholders and industry can contribute.
Public land managers e.g. Parks Victoria, 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 water bodies (Goulburn-Murray Water and Goulburn Valley Water)/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.
Victorian Government (includes DELWP – regional and policy groups)	Provides a catchment framework for implementing state-wide policies, strategic objectives and investment frameworks, including translation of state priorities to the catchment level and describes regional process issues required, such as engagement.
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 implementer's 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 existing foundations of 'ecological infrastructure' (rivers, wetlands, creek systems, and healthy ecosystems) will be the basis for protection and restoration priorities. Connectivity between and within these systems 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 so that relevant parameters are monitored and timely actions are taken when trends are of concern.
- 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 whilst adapting to predicted 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 community values when decisions are made: recognition of the importance of the community in achieving biodiversity outcomes is crucial and support must be provided to land managers as active environmental stewards.
- The achievement of biodiversity outcomes relies on strong partnerships between Goulburn Broken CMA programs, government agencies, Traditional Owner groups, community NRM groups, research institutions and private and public land managers.
- Effective decisions in 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 policies and programs need to keep up;
  - planning should identify key attributes, feedbacks, and thresholds to improve intervention strategies; and
  - large uncertainties are an inherent and accepted part of planning, which need to be matched with a highly adaptive and flexible approach, including working with a range of partners and land managers to find solutions.

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. These are set amongst irrigated pastures and orchards, grazing and cropping systems and many other land uses. Average annual rainfall varies substantially, from historic figures of 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.

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, YYNAC, 2012)

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% 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 2016b).

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).

Populations of threatened species continue to decline and risks of extinction increase as: the 'extinction debt' from past clearing is realised; habitat loss continues through permitted and illegal clearing of native vegetation; weed invasion; high water tables; logs being used for firewood and as other habitat is 'cleaned up' by landholders; river flows are regulated (reducing natural flooding); deer populations explode on large parcels of public land; the flora and fauna is unable to move through fragmented landscapes; and inbreeding is elevated, leading to a subsequent loss of sub-populations.

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 2015 (GBCMA 2016b). At a finer scale, some aspects of biodiversity are improving and others declining (see GBCMA 2010 and GBCMA 2007).

Targets for management and long-term condition of biodiversity are based on the benchmark of current condition and an understanding of what is driving change to biodiversity. However, the drivers are complex and interactive.

Table 2: Summary of biodiversity statistics, Goulburn Broken Catchment

Biodiversity asset	Status
Native vegetation	• More than 60% 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	• 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	• 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	• 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	• 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 biodiversity condition 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 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), salinity, and the decade-long drought of the early 2000s.

The Goulburn Broken CMA's resilience approach acknowledges the complex interactions between biodiversity, people and drivers of change, and therefore emphasises management of SESs. Local SES plans being developed to align with the Goulburn Broken RCS. SES plans are adaptive: they will be regularly updated to reflect drivers and priorities and respond to RCS sub-strategies (such as this Biodiversity Strategy). An SES plan tailors actions according to demographics, knowledge, and community expectations and recognises the need to both manage risks and capture opportunities. The major drivers currently affecting biodiversity are climate change, land use change, and policy reform and change, and these are described below.

2.2.1 Climate change

Existing impacts on biodiversity condition in the Goulburn Broken Catchment will be exacerbated by climate change. Changes in rainfall regime and increased temperatures are expected to become major pressures (GBCMA 2016a). Significant climate events are already impacting biodiversity condition, including:

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).

- 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 on 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, particularly on people; and
- 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 14,000 hectares near Stewarton, Boweya and Creighton's Creek in mid-December 2014.

Climate change in the Goulburn Broken Catchment will continue to result in several changes that affect biodiversity in a variety of complex and interconnected ways:

1. Warmer average temperatures 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); and an increase in the frequency of extreme heat and drought and a subsequent increase in the incidence of large bushfires. Responses might be frequent planned, large-scale fuel reduction burns around communities, which can negatively affect biodiversity (Holland 2015). The cumulative impacts related to frequency of planned burning are also driving changes in biodiversity.
2. Reduced water flows in waterways, resulting in increased salinity or black water and low oxygen events can rapidly change native fish diversity and survival, especially those that have specific temperature requirements, live in specialised habitats, eat invertebrates, are small and do not produce many young (CSIRO 2015), while a few species, such as the Australian Smelt, are predicted to increase in range (Bond *et al.* 2010).
3. Temporal changes in climatic cues may affect species behaviour. For example, the timing of flowering may no longer coincide with pollinator abundance. Some species are already changing behaviours: migratory birds are becoming year-round residents, increasing the competition for food and other resources with resident species (CSIRO 2015). (See Appendix 4 for more details.)

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 2016a). Continuing to carry out actions that currently improve biodiversity conservation and resilience in the catchment, including reconnecting landscapes and pest plant control, will continue to be important in the short term to mitigate current threats to biodiversity, such as changes in land use to more intensive farming systems.

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 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)

Climate change projections suggest little change in annual or seasonal rainfall or increases in temperature (~1^{o}C) in the short to medium term (five to 20 years), so current actions are relevant, although there may be negative responses to these changes for some natural systems (GBCMA 2016a). In the shorter term, there is a need to increase the adaptive capacity of ecosystems to adapt in the longer term, and to monitor, plan and be prepared for the future when climate change will likely be the dominant influence on biodiversity conservation.

Long-term planning needs to respond in an adaptive way to the range of natural responses to change, and it is likely that at least some of the impacts of climate change will not be able to be mitigated through incremental modifications and conventional responses. For example, changes in frequency of fire could alter the species mix in some forests to more fire tolerant species (GBCMA 2016a, Prober *et al.* 2015) and a response may be to protect some areas from fire, or plant non-fire tolerant species elsewhere. Similarly, a drying climate may require a response of increasing genetic diversity of seed for revegetation from a drier range, maintaining the same species in ecosystems but changing the genetic structure. It may be more appropriate to monitor nature's response to climate change and manage for adaptation rather than second guessing what may or may not happen in the longer term.

The Goulburn Broken CMA (GBCMA 2016a) 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 '*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. (See Sections 4 and 5 and Appendix 4 for more details.)

2.2.2 Land use change

Collectively, rural landholders are custodians of much of the catchment's biodiversity, with their management of land and water being a significant determinant of biodiversity condition. Activities on public land, such as timber harvesting, planned burning, recreation, and management of water storage catchments, can also affect biodiversity.

> *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)

Private land-use changes include low-intensity to high-intensity production (and vice versa), 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 in the security of global financial markets. Longer-term pressures include ageing farmers, and increasing competition for land and other resources (GBCMA 2013). While the Goulburn Broken CMA cannot directly influence these drivers, it can proactively respond to them through various mechanisms. Monitoring and understanding trends in land use change in each SES leads to tailored responses that can result in positive outcomes for biodiversity. Section 5 includes generic broad-scale planning for, and responses to, change. Specific SES characteristics and possible responses are described below:

Productive Plains SES. Farmers are ageing, farms are being sold to increase existing farm sizes, and farmers are cropping more areas under drier conditions. Responses could include providing incentives to farmers to manage some of their farms for biodiversity conservation, and discussing succession planning.

Commuting Hills SES. Increasingly dominated by lifestylers, who have plans for their land other than traditional farming, and their capacity to manage it is variable (Barr 2003). Responses include providing resources to help this community manage the land sustainably and working with local government planners in identifying and protecting current high-value biodiversity assets, and potential ecological linkages that minimise future impacts of increased urbanisation.

Agricultural Floodplains SES. Changing water availability and security is dramatically affecting land use and the structure of rural communities and industries. 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 (SIR) is creating a new set of risks and opportunities for natural resources, including biodiversity (SIRPPIC 2015). A response may be to work with landowners in priority landscapes to identify the key actions that can be taken, such as linkages and buffering existing remnants that preserve biodiversity.

Upland Slopes SES. Changing socially, from farming dominated to a mix of farming and lifestylers, and tourism is becoming important. A potential approach to conserve biodiversity is to educate new landholders about understanding and better managing threats, coupled with incentives for on-ground works.

Southern Forests SES. Growing community concern about public land management, particularly sustainable forestry, fuel-reduction burning practices and pest animals, such as deer. Community action groups, such as Rubicon Forest Protection Group and the Strathbogie Sustainable Forestry Group, have been established. The effects of fuel reduction burning in these landscapes requires further scientific understanding. Responses include working with public land managers to enhance the quality of existing native vegetation.

2.2.3 Policy reform and change

The Goulburn Broken RCS 2013-2019 builds on almost 30 years of lessons and achievements in integrated catchment management: the Goulburn Broken Catchment's communities have significant experience and understanding of management approaches that will make a difference to the health of the catchment (GBCMA 2013). Many other policies and strategies developed and implemented by a range of agencies affect biodiversity conservation, potentially negatively and positively, including municipal planning controls, regional forest agreements, and changes in fuel-reduction burning targets and risk mitigation activities.

> *Victoria in Future 2015 projections indicate that Victoria will grow by 1.9 million people between 2014 and 2031 (at a rate of 1.6% a year) and is expected to increase by another 2.3 million people by 2051 (at a rate of 1.3 % a year). 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.*
> (DELWP 2015)

Changes to the Victorian Government's native vegetation permitted clearing regulations impact on the relevant agencies capacity to avoid, minimise and offset any loss. Changed regulations can make it difficult to understand the effect of regulations on biodiversity and can lead to confusion. A better understanding of gains and losses to inform regulation is needed.

The Goulburn Broken CMA and its stakeholders have identified and communicated to DELWP significant concerns with vegetation clearing regulations in general, 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.

Since 2010, there has been significant change in the agencies and groups that the Goulburn Broken CMA partners with to coordinate and deliver biodiversity programs, particularly because of various government department restructures. 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.

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

- A draft 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 (in preparation; Parks Victoria 2015a)
- Strategic Bushfire Management Plan, Alpine and North East and Safer Together: A new approach to reducing the risk of bushfire in Victoria (DELWP 2016g and 2016c).

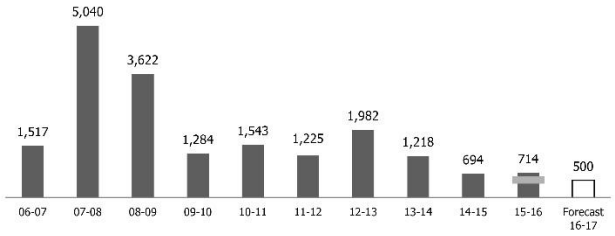
2.3 Progress in biodiversity conservation

Long-term strategies for biodiversity conservation have been implemented in the Goulburn Broken Catchment for more than two decades.

Since the early 1990s, the uptake of environmental works has increased significantly, including the integration of biodiversity conservation into farming systems and the management of waterways. 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.

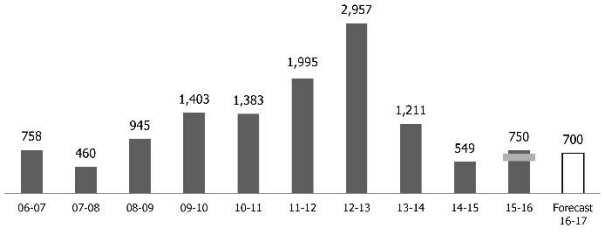
The Goulburn Broken CMA reports annually on activities carried out in the catchment, and the (on-ground) outputs generated by these activities (e.g. see Figure 1).

Remnant vegetation fenced, ha



Increased achievements in 2007-08 and 2008-09 were largely due to Drought Employment Program funding.

Indigenous revegetation (planted), ha



There is still significant community interest in revegetation. Direct seeding is currently the dominant method of revegetating, influenced by seasonal conditions.

Figure 1: On-ground works achieved from complementary programs 2005-06 to 2015-16
Source: GBCMA 2016b

Output reporting is linked to progress towards long-term resource condition targets (see targets listed in Section 3.3) using assumptions about how much each output contributes to the resource condition outcome, using the equation:

Outputs x Assumptions = Outcomes.

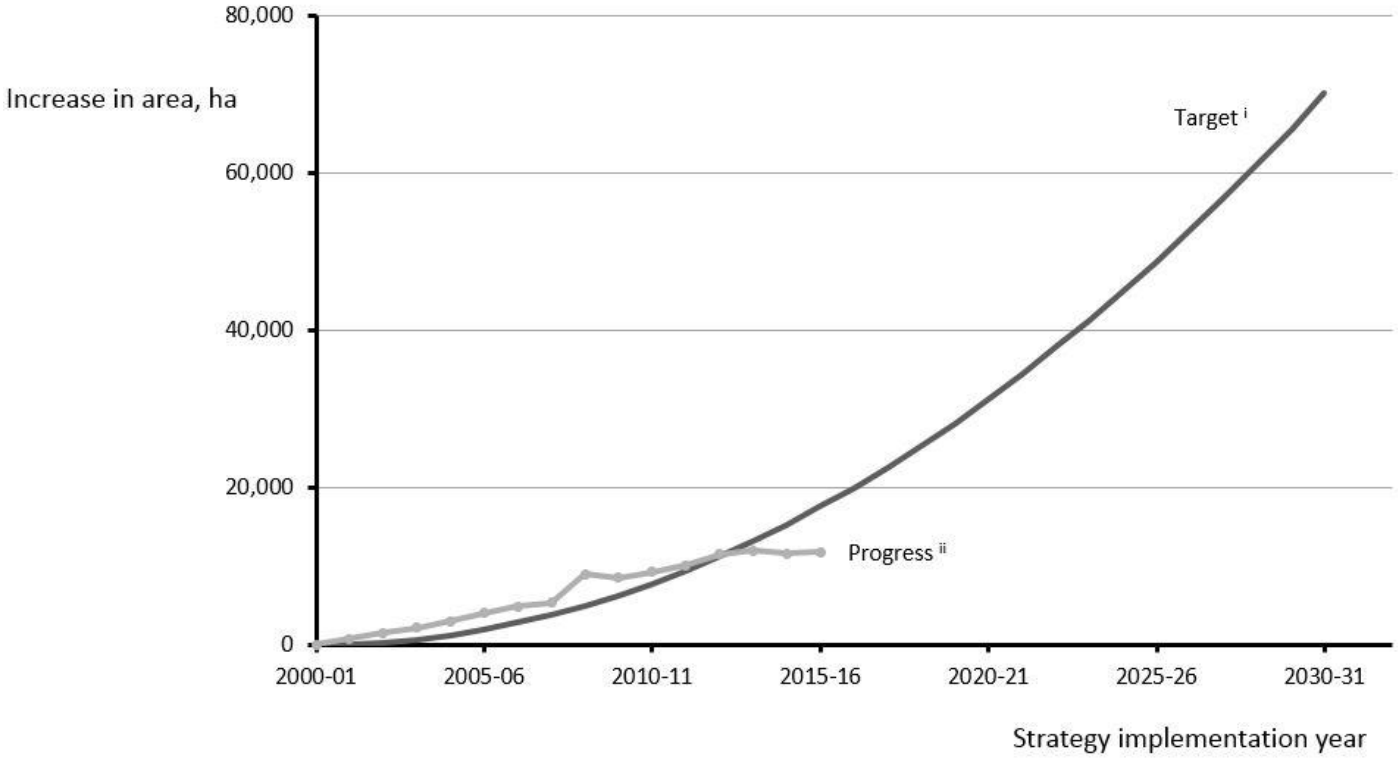
Outcome progress, an important measure of success, is also reported in Goulburn Broken CMA's annual reports.

While acknowledging uncertainty in the assumptions, Figure 2 shows that progress is trending away from the 2030 native vegetation extent target: there is a need for increasing investment in native vegetation management, particularly revegetation and improved policy to reduce clearing rates. The amount of revegetation possible is currently restricted by funding and not by community or landholder desire to revegetate (GBCMA 2016b).

The higher gain in 2008 also 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.

It should be noted that this update of the Biodiversity Strategy reflects revised assumptions of progress in native vegetation extent, which has resulted in less gains being achieved than reported in previous years, although gaps in data availability continue to create assumption uncertainty. Most changes to assumptions 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 identified in various strategies since 1990 that remain incomplete.



i. Resource condition target (revised 2009): Increase the extent of native vegetation in fragmented landscapes by 70,000 hectares by 2030 to restore threatened EVCs 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. The graph provides a general depiction of progress given best available knowledge. 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 Strathbogie 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

Source: GBCMA 2016b

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 species 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 may reflect that there is a 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 Nestlé, 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 work of the CMN.

Part B – WHAT ARE WE AIMING FOR?

3 Biodiversity outcomes

This section presents a framework for the biodiversity outcomes aspired to throughout this strategy. Section 5 and Figure 4 expand this framework, showing how longer-term aspirations will be progressed in a five-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	*Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity.*
Ecological outcomes	Assist in development and articulation of the vision. Based on expert and local knowledge, national and state biodiversity priorities (Barlow *et al.* 2007, Miles 2009, GBCMA 2010) and literature on ecological processes and biodiversity planning (e.g. Lindenmayer and Fischer (2006); McGregor *et al.* 2008; Bennett *et al.* 2009; Prober *et al.* 2015).	• *Protected and secured habitat* • *Landscape and habitat connectivity* • *Ecological processes, energy and gene flow optimised* • *High quality habitat* • *Viability of threatened species increased* • *Adequate representation of habitats* • *Habitat adapts according to regularly considered values and capacity to influence change*
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.	Key target themes which are quantifiable surrogates for ecological outcomes (e.g. ecosystem function and conservation of soil biota) and for reporting progress: • *Native vegetation extent* • *Habitat quality* • *Flagship species.*

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

The Goulburn Broken CMA's resilience approach includes the need to identify critical attributes that affect biodiversity conservation, and for those attributes, identify thresholds where the system is likely to tip into a different state (desired or undesired; preventable or inevitable) so that we can plan for that change. When we have identified thresholds, this can inform targets that are required to keep systems in a desired state. For example, water tables less than two metres will result in the system being tipped into high salinity soils (in some areas, if there is no intervention) and therefore it seems reasonable to have a target for watertables to be kept at greater than two metres below the surface.

However, the critical attributes will vary between SESs. For example, salinity is not a critical issue in the Upland Slopes SES and therefore depth to watertable is unlikely to be a critical attribute, but water quality may be identified, among others.

Focusing on the five or so critical attributes for each SES, determined by science and an informed community, fosters a shared understanding of trade-offs and multiple benefits of interventions within a highly connected system (see the example in Section 6.3.3).

Long-term targets can then reflect thresholds within each critical attribute. For example, vegetation extent is a critical attribute recognised in the Agricultural Floodplains SES, and thresholds are 10%-30%, so targets should reflect

maintaining extent to a minimum of 10%. Understanding how each SES is trending for each critical attribute guides actions and provides reference points for reviewing progress (see Sections 2.3 and 3.3).

Although biophysical targets in this strategy factor in the broader context of social and economic considerations at the whole-of-catchment scale, finer scale direction will be achieved when critical attributes are considered in detail in each SES local plan.

For each SES local plan, the extent and quality of native vegetation could be considered as important indicators of progress in managing terrestrial biodiversity because native vegetation:

- is a critical part of habitat (related to the ecological outcomes to be achieved in Table 3 above);
- is widely accepted as a surrogate for biodiversity in biodiversity planning;
- influences soil health (and vice versa);
- is measurable in a reasonable timeframe and there is science available to extrapolate how fauna are likely to respond to changes;
- is familiar to land managers, who are largely responsible for it; and
- is 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 for flora and fauna 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 thresholds that may be important to monitor and/or of community concern. This will result in differences between each SES in identified critical attributes, thresholds and intervention priorities. Table 5 provides examples of indicative priorities for potential critical biodiversity attributes that can help to inform SES local plans. However, local plans' critical attributes and therefore thresholds of concern will be developed with the community and therefore may differ to those suggested in Table 5.

In Table 4, thresholds provided are a minimum, and do not suggest that clearing of native vegetation can occur to go down to a threshold. For example, the Southern Forests SES would experience significant and undesirable transformation if native vegetation extent reduced to 30%, and would not be consistent with this strategy's principle of net gain. Thresholds at the SES-scale may therefore focus on different key social and ecological attributes according to the vision and identified drivers of change for each SES (see Table 5).

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 two per cent 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 important to the Goulburn Broken Catchment (and associated thresholds)

Critical attribute	Threshold	Assumptions(evidence – see associated reference number*)
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)	There is a positive association between native vegetation extent and: • landscape function [4, 8, 11] • biodiversity conservation [1, 2, 5, 8] • climate change resilience [9] • species richness [1, 2, 4, 11] Aiming for 10%-30% native vegetation cover in landscapes: • prevents species decline and loss [1, 4,5,11] • reduces the effects of fragmentation [2] • will continue to be meaningful under climate change [3, but see 6, 7] Note: Native vegetation extent in any landscape should include recognition that a range of habitat features are required to conserve the majority of species (e.g. particularly riparian, drainage lines and wetlands; scattered paddock trees; inclusion of a range of environmental gradients; consideration of specific species requirements; quality of habitat; threats ([1,3,4, 10]); and surrounding matrix (e.g. large patches, quality, connectivity ([1, 10])). The complexity of a range of interacting factors should be considered and thresholds used to provide some guidance to strategic planning.
Connectivity	< 50m distance between habitat (vertebrates)	Connectivity is important for • landscape function [1, 3] • species richness and diversity [1,2,3] • benefits all native species [see 8] • mitigating climate change. [6, 7] Note: Connectivity threshold is based on fauna. Connectivity will vary between species and for most species there are no measurements. Connectivity includes corridors, stepping stones and other linkages. Connectivity for flora can be important to maintain genetic integrity, as pollinators move between patches, and plants can move to respond to changing climatic conditions.
Native vegetation/habitat quality		
Weediness	> 25% cover of weeds in remnants	More than 25% weed cover reduces the resilience of remnants to naturally regenerate (based on Habitat Hectares' 'lack of weeds' score) but see 12. Note that thresholds should consider the threat of the weed – some species will have a higher cover but not threaten biodiversity, while others with less cover will have a great impact. Therefore, this thresholds requires review.
Habitat diversity (including structure, species richness, logs, recruitment)	< 60/100 Habitat Hectares score	Large old trees, logs, lack of weeds, understorey ground cover, age structure within remnant native vegetation are important habitat elements (i.e. those recorded in habitat hectares) [1, 2, 3, 4, 10 but see 13]. Habitat diversity occurs by having a range of age structures in remnant vegetation, and therefore management is often required to achieve this (e.g. mosaic burning).
Patch size	< 2-40 ha	There is a positive association between remnant size and: • species richness and diversity [4, 5, 13] • vegetation quality [4,5,] • resilience of species and systems to adapt and survive shocks [3,6,7] The thresholds of 5 ha, 10 ha, 40 ha, 100 ha and 400 ha are where a change in species richness and diversity occurs [1, 14]. All vegetation types and faunal communities respond to patch size. Note: This threshold is based on fauna. Generally 2 ha is used as a minimum size metric for incentive delivery, and considers social and ecological outcomes. Patch size for plants will be important for some species to ensure genetic diversity is maintained.

* Reference (see separate section for complete reference details):

1. Radford and Bennett (2007)
2. Fahrig (2003)
3. Doerr *et al*. (2011)
4. Fischer *et al*. (2007)
5. Andrén (1994)
6. Hodgson *et al*. (2009)
7. Bennett *et al*. (2015)
8. Lindenmayer *et al* (2005)
9. Nimmo *et al* (2015)
10. Radford *et al* (n.d.)
11. Radford *et al*. (2004)
12. Panetta and James (1999)
13. Holland and Bennett (2014)
14. Bennett and Ford (1997)

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

SES	Critical attribute		Flagship species*	Potential actions
	Vegetation extent	Habitat quality		
Commuting Hills	M (Create major corridors***)	**VH** (Existing remnants)	**M** Flagship species** are used to engage community (e.g. squirrel glider, tree goanna)	• Protect existing vegetation extent through planning overlays, including potential corridors. • Weed control important. • Maintain, link and buffer large remnants.
Upland Slopes	**VH** (Create biolinks*** across tablelands and Mansfield) **M** (Strathbogie forests and public land) Note: Extent more important, for example, in eastern Strathbogie Ranges and Mansfield where native vegetation extent is less than 10%. than in western Strathbogie Ranges where it is more important to manage public land for habitat quality	**VH** (Strathbogie Ranges forests and public land) **VH** (Tablelands and Mansfield)	**M** Flagship species to engage community (e.g. brush-tailed phascogale, long-nosed bandicoot)	• 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.
Southern Forests	**L** (Assumes no loss)	**VH** (Public land)	**VH** for specific species: e.g. mountain pygmy possum, Leadbeater's possum, owls, frogs, fish	• Work with public land managers, particularly on burning regimes, weed control, and monitoring changes to quality.
Productive Plains	**VH** (Establish corridors***)	**M** (Enhance woodland remnants)	**M** Flagship species to engage community (e.g. woodland birds; including grey-crowned babbler, bush-stone curlew)	• Continue to work with farmers to increase extent. • Identify and manage public land reserves. • Increase extent to 10-30%+ in priority landscapes
Agricultural Floodplains	**VH** (Manage and establish links*** within priority landscapes)	**M** (Enhance woodland and wetland remnants)	**M** Flagship species to engage community (e.g. grey-crowned babbler, brolga, superb parrot)	• Ensure enhancement of existing remnants– 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** Flagship species to engage community	• Engage community in surrounding natural landscapes.
Catchment-wide	**VH**	**VH**	**L**	• SESs 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 www.gbcma.vic.gov.au 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.

*** Establishing links and corridors should be considered in the context of increasing overall extent of habitat in priority landscapes, based on consideration of biodiversity thresholds.

3.3 Long-term biodiversity targets

Target 1: Increase the extent of native vegetation in fragmented[1] landscapes by 70,000ha by 2030[2].

Target 2: Improve the quality of 90% of existing[3] habitat[4] by 10% by 2030.

Target 3: Increase the population viability[5] of 20 flagship 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);
- recognising 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 2010 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) the Goulburn Broken CMA acknowledges 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 2009b), 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 flagship 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, SES, zones, landscape, property and site. Processes occur at all of these scales and managing at just one scale ignores system complexity. Table 6 (below) provides examples of planning at several scales.

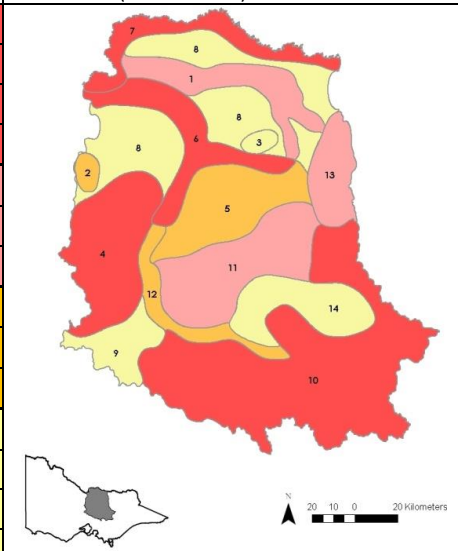
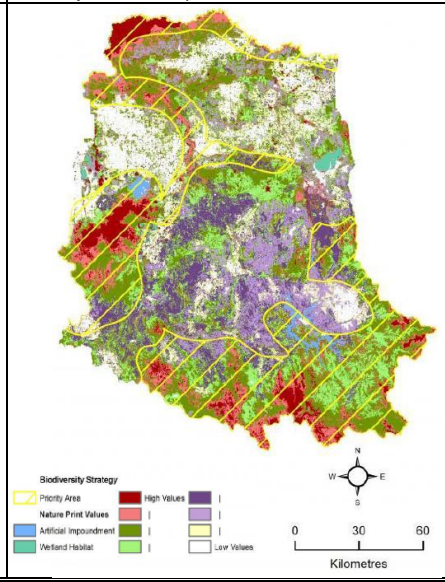
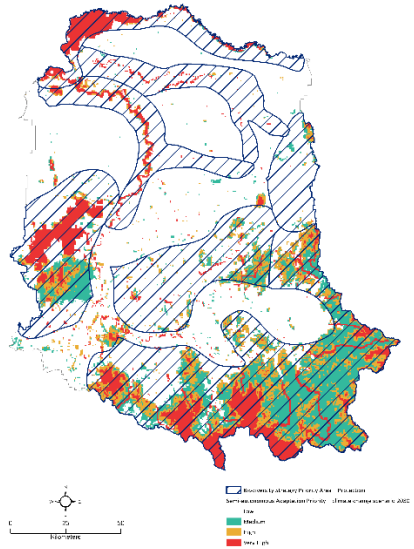
Further explanation and examples of how some of the tools mentioned in Table 6 are used in spatial prioritisation are provided in Appendix 6. As part of developing this strategy, bio-geographic zone priorities (GBCMA 2010) were reviewed by considering new information and mapping products (Figure 3). 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 species.	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 SESs 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
SESs (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 11)	Landscapes prioritised on criteria to meet objectives of local plans (see case study below)	Targeted investment into focus areas
		The Statewide Conservation Plan for Private Land in Victoria (Trust for Nature 2013) assesses terrestrial ecosystems, aquatic ecosystems and threatened plants and wildlife on private land	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
	BAP. 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.

Map ID	**Priorities for protecting ecosystem services**	Priority	**Priority biogeographic zones, Goulburn Broken Catchment** (GBCMA 2010)	**Relationship with Victorian Government priority areas (** *NaturePrint)*	**Relationship with climate change planned adaptation priority areas** (GBCMA 2016a)
10	South-East Highlands	H			
4	Goldfields	H			
7	Murray Corridor	H			
6	Lower Goulburn & Broken Rivers	H			
1	Broken Boosey Nine Mile Creek system	H			
11	Strathbogie Tablelands	H			
13	Warby Ranges & Foothills	H			
5	Longwood & Violet Town Plains	M			
2	Corop	M			
12	Upper Goulburn River	M			
14	Yarck/Mansfield	L			
9	Piper	L			
3	Dookie	L			
8	Northern Relictual Landscapes	L			

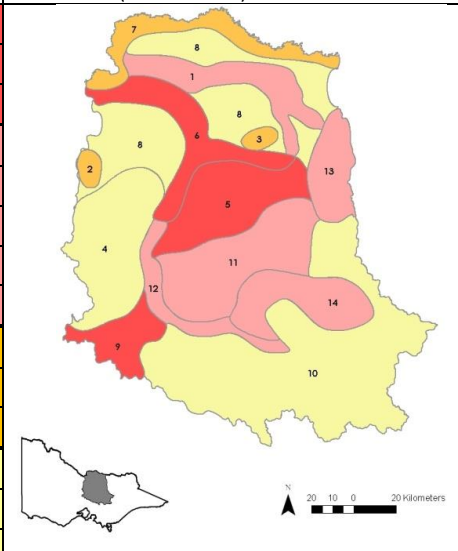
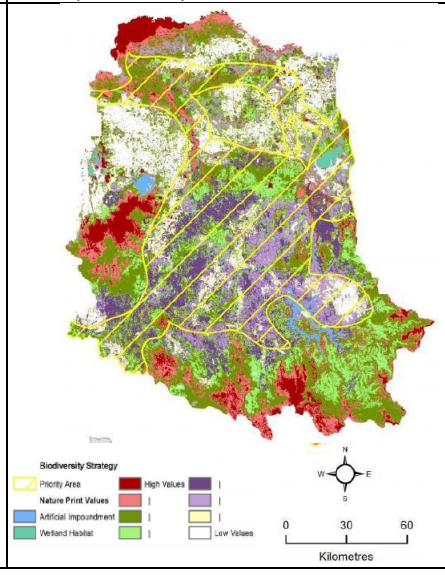
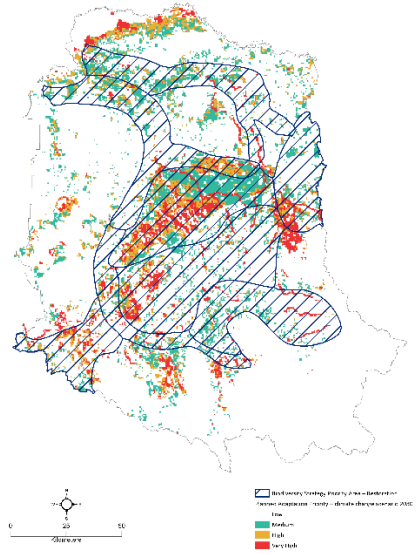
Map ID	**Priorities for restoration and improving connectivity**	Score	**Priority geographic zones, Goulburn Broken Catchment** (GBCMA 2010)	**Relationship with Victorian Government priority areas** (*NaturePrint)*	**Relationship with climate change semi-autonomous adaptation priority areas** (GBCMA 2016a)
6	Lower Goulburn & Broken Rivers	VH			
5	Longwood & Violet Town Plains	VH			
9	Piper	VH			
1	Broken Boosey Nine Mile Creek system	H			
14	Yarck/Mansfield	H			
12	Upper Goulburn River	H			
11	Strathbogie Tablelands	H			
13	Warby Ranges & Foothills	H			
3	Dookie	M			
7	Murray Corridor	M			
2	Corop	M			
4	Goldfields	L			
8	Northern Relictual Landscapes	L			
10	South East Highlands	L			

Figure 3*: An example of three different methods of mapping spatial priorities. This shows that 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 (2016–2021)

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. This section also 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**

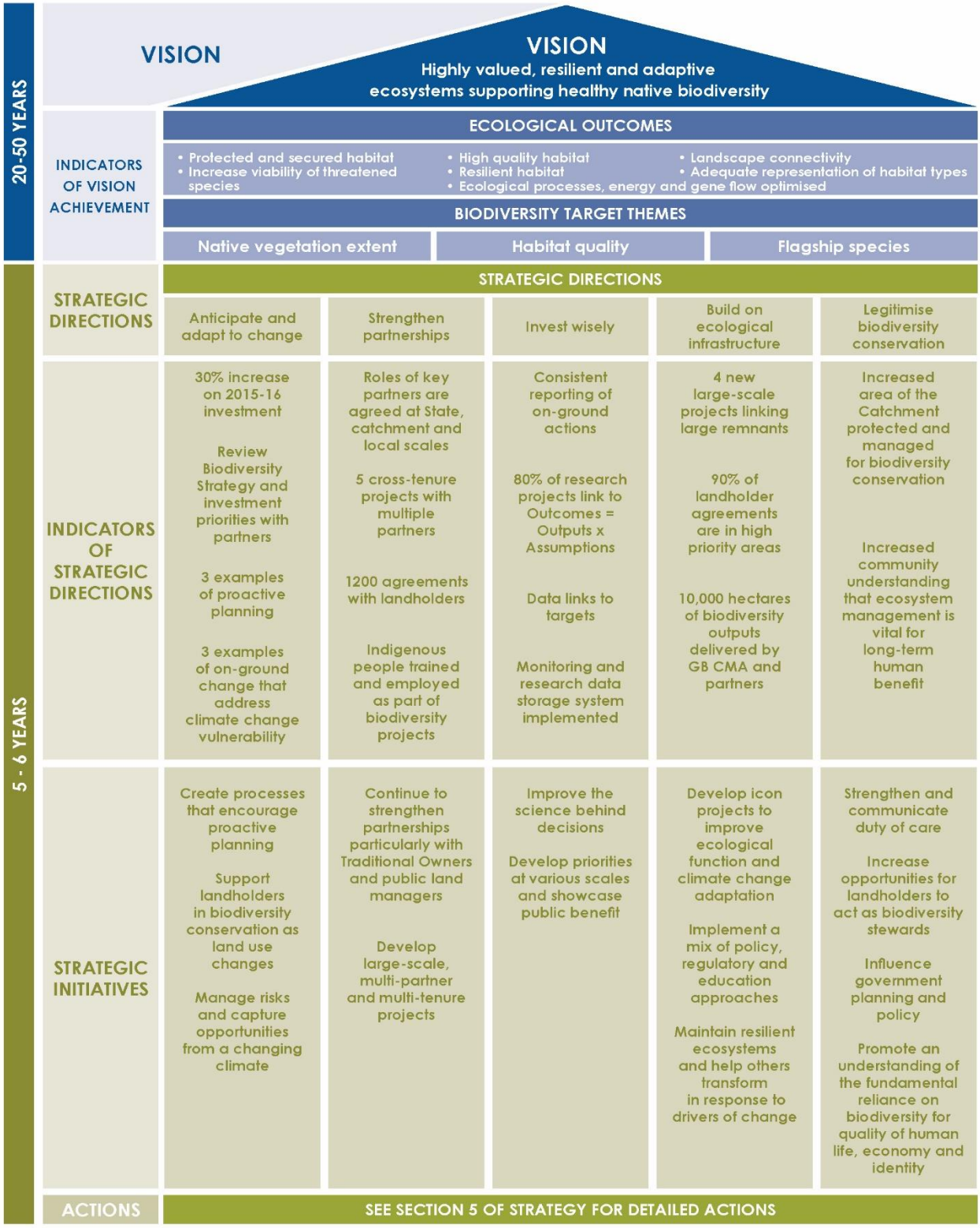


Figure 4: The Strategy Framework: logic between vision and actions. Note that indicators and initiatives have been abbreviated, and details can be found in Section 5.1 to 5.5.

5.1Anticipate and adapt to change

Key indicators of success for strategic direction one

- Thirty per cent increase on 2015-16 investment in biodiversity conservation.
- Reviews of this strategy and annual investment priorities shared between partner agencies.
- Three examples each of proactive planning and responses to changed circumstances.
- Three examples of on-ground change that address climate change vulnerability in adaptation focus areas.

Strategic initiatives and actions

1.1 Create a 'resilience approach' through processes that encourage proactive planning and quick responses at all scales, including plans that factor in local social-ecological differences and future scenarios, 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 AdaptNRM 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 Develop broad-scale planning and implementation processes that support landholders to include biodiversity conservation as land use changes, such as peri-urban development, farm-enterprise change, and lifestyle-property creation.

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). Agency-support costs to allow post-project support also needs to be factored in.

1.2.2 Explore the potential for establishing and improving native vegetation as constraints to flooding along the Goulburn River and its tributaries are managed.

1.3 Manage risks and capture opportunities from a changing climate

1.3.1 Assess the feasibility for carbon sequestration that encourages biodiversity outcomes in line with the Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment 2016, 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 as a way of transitioning to climate-ready biodiversity conservation (e.g. using the Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment 2016 and associated spatial assessment tool, AdaptNRM biodiversity modules [Williams *et al*. 2014, Prober *et al*. 2015] and the Murray Basin Cluster Climate-ready Restoration project [Broadhurst *et al*. 2016]).

1.3.3 Develop a pilot project that uses a 'specialist' team to help drive innovative implementation approaches, incorporating science-based planning (e.g. species selection), engagement (e.g. working more with industry), on-ground technical expertise, and learning.

1.3.4 Help biodiversity adapt to climate change so that ecological processes are optimised, and the evolutionary character of regional species are maintained.

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 1. 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: 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, presenting opportunities for addressing the vulnerability of SESs to climate change. The Climate Change Adaptation Plan for NRM in the Goulburn Broken Catchment (GBCMA 2016a) 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 two 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 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 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

Key indicators of success for strategic direction two

- Roles of key partners in biodiversity management are agreed at state, catchment and local scales.
- Five cross-tenure projects where multiple partners agree to achieve benefits for biodiversity.
- At least 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,

Strategic initiatives and actions

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 ensure traditional knowledge of ecology, medicine and culture is reflected in 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 partners, especially 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 practising cultural burning practices, water conservation, climate change strategies and actions, revegetation planning and landholder negotiation.

2.1.7 Partner public land managers and research institutions to develop a long-term monitoring plan of native vegetation on public land and implement appropriate responses.

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.

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, CMNs 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 2015).

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 (TCAC and YYNAC), 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 NRM.

The 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.

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)

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).

Development of a strategic and systematic approach to monitoring changes in vegetation quality due to logging and planned burns on public land would be of great benefit.

Opportunities need to be considered for adding to the National Reserve System, Australia's network of protected areas that conserve examples of natural landscapes and native plants and animals.

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 to build relationships between multiple partners for over five years. The original project area submitted for funding to the Australian Government in 2012 was defined as aligning with the Yorta Yorta Nation traditional boundary (either side of the Murray River) and as a joint project between YYNAC, Goulburn Broken CMA, Parks Victoria, Murray Local Land Services (Murray LLS) in New South Wales, and New South Wales National Parks Service.

In doing so, the project crossed many boundaries, including state borders, catchments, national and state parks, local government areas, travelling stock reserves and private landholdings. With all groups working under the Yorta Yorta banner, there was a new focus for delivering on-ground outcomes: cultural heritage was at the forefront in identifying priorities. As the preferred contractor, Yorta Yorta's Woka Walla works crew were central to the success of the project, delivering many of the activities. 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 also played an integral part in surveying the sand hills for Aboriginal cultural heritage, finding significant artefacts that provided evidence of much historic activity and occupation. Four repatriation burials were also a significant finding and protecting these sites involved partnering with private and public land managers.

The project team worked with public land managers New South Wales National Parks Service, who manage large tracts of sand hills, while Murray LLS and Goulburn Broken CMA staff worked largely with private landholders to protect and revegetate sites on a smaller scale.

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 still in the early establishment phase. The trend emerging from bird surveys is that woodland bird numbers and bird diversity is greater in highly diverse and quality sand hill vegetation sites, with more common bird species and less bird species diversity in the open cleared areas with low vegetation quality. With four bird surveys still remaining in 2016-17 a more complete story is yet to be told.

Aboriginal cultural heritage protection activities have increased, providing meaningful employment opportunities for local Indigenous people. Learning about and appreciating this knowledge of country has helped build relationships and cooperation between agencies, councils, landholders and Traditional Owners who are all working for a common cause.

The project is now entering the last phase of this current round of funding and will be completed by July 2017.

A Sand Ridge Woodland Condition Report is being prepared and will help provide a broader understanding of issues, threats, attitudes and learnings from the Sand Ridge Woodland Project. It will also identify the condition of sand hills sites that have been worked on so far, and attempt to identify the extent of potential works.

5.3 Invest wisely

Key indicators of success for strategic direction three

- Consistent reporting of on-ground actions and assumed long-term changes as per Goulburn Broken CMA's annual report.
- Eighty per cent of biodiversity research projects in the catchment link to: Outputs x Assumptions = Outcomes as listed in the Biodiversity Monitoring Action Plan (BMAP) (GBCMA 2016c).
- Data collected and links to targets.
- Monitoring and research data storage system implemented.

Strategic initiatives and actions

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 *et al*. 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 and showcase public benefits from investment.

3.2.1 Develop landscape-scale priorities and implementation plans within SESs, using this Strategy, the Goulburn Broken RCS, and Biodiversity Action Planning (BAP). Reinvigorate the use of BAP, 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).

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 one, it is important to invest limited funds wisely. This includes investing in areas according to defined priorities (e.g. spatial prioritisation) so that the greatest biodiversity benefits are generated from investment (see Section 4).

The Goulburn Broken CMA's resilience approach means investment decisions are guided by an understanding of what is driving change and the risks of breaching tipping points (thresholds) for each SES (Section 3.2).

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 *Outputs x Assumptions* = *Outcomes* 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. As a result of the Goulburn Broken CMA's recent regional NRM planning for climate change work, the catchment's NRM planners have access to a Climate Change Adaptation Plan. This plan provides an initial prioritisation for climate change adaptation 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 2016a). See Section 4 and Appendix 4 for climate change adaptation priority areas for biodiversity.

Some biodiversity projects in the Goulburn Broken Catchment use species such as the superb parrot or carpet python to garner community support and involvement in achieving broader biodiversity benefits.

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 options 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 Plan 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-informed 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 enables community and CMA-driven projects to be prioritised and collaboration opportunities to be identified. Goulburn Broken CMA also aims to influence other agencies' strategies through submissions and involvement in reference groups.

5.4 Build on ecological infrastructure

Key indicators of success for strategic direction four

- Four new large-scale projects linking large remnants are underway.
- Ninety per cent of biodiversity agreements between landholders and the Goulburn Broken CMA are in high priority areas.
- At least 10,000 ha of biodiversity outputs* delivered by Goulburn Broken CMA and partners

* Includes terrestrial, stream and wetland remnant fencing, covenants, revegetation, areas managed for natural regeneration/grazing regime change. Does not include weed control on public land, large zones of pest, plant and animal control on private land or environmental watering.

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

Strategic initiatives and actions

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 a mix of policy, regulatory and education approaches, in particular 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.

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 multitude of genes, species and ecosystems have a varied response to a changing climate. Relatively recent principles underpinning NRM planning typically focused on preventing change, by managing threatening processes, or restoring ecosystems to a pre-European land use state. However, NRM practitioners now face the challenge of transitioning from managing what was known to continually adapting as better knowledge becomes available, through strategic monitoring over the next several decades.

To manage the increasing pressure of climate change on biodiversity over the coming decades, practitioners need 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.

In an uncertain future, 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. 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, improving the national reserve system, protecting key refuges, implementing more effective control of invasive species and developing appropriate fire management regimes. These 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 (Broadhurst *et al.* 2016).

The wet areas of the catchment (rivers, floodplains and wetlands) are a central starting point for building biolinks across priority areas. The Murray-Darling Basin Plan (MDBP) 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) have been important actions in enhancing biodiversity values and 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 private and public land will need to be increased and supplemented.

The Goulburn Broken CMA is one of six NRM 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

Key indicators of success for strategic direction five

- A much larger area of the catchment's land (private and public) is protected and managed for biodiversity conservation as part of a multiple land-use and values approach.
- Increased community understanding that ecosystem management is vital for long-term human benefit.

Strategic initiatives and actions

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, by being involved in such processes as reference groups.

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.

Biodiversity underpins the processes that make all life possible (Diaz *et al.* 2006). The connection between biodiversity and 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 land uses ultimately rely on natural systems and the biodiversity they support.

Agricultural systems are usually obviously and immediately connected to biodiversity. Examples include pollination of crops by insects, year-round ground cover and summer feed for stock provided by well-managed native pastures, and biological control of pests by natural enemies. 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.

Farmers rely on natural systems and natural systems need active stewards, and there are many examples of land management approaches where biodiversity and production benefits are being realised (e.g. Crosthwaite *et al.* 2009). Farmers can play a crucial role in managing native vegetation and the soil and its biodiversity, for example, to support healthy and functioning ecosystems.

However, biodiversity conservation can sometimes be perceived as a threat to prosperity and improved policy and planning mechanisms are needed to better acknowledge that long-term biodiversity planning and land management prosperity are inextricably linked. 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 and 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)

The need to integrate biodiversity and production is recognised by landholders participating in the National Landcare Programme-funded project Community Directed Action Learning to Enhance Soil Ecosystem Services and in previous 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 the catchment). These programs 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 from the carbon market, for example, will present potential opportunities for enhancing 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.

Significant liaison between stakeholders following devastating events such as bushfires in recent years is increasingly resulting in more holistic risk management. For example, planning of on-ground works such as firebreaks along roadsides is simultaneously factoring in risks to infrastructure and biodiversity.

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: Business plan development – Voluntary investment scheme for biodiversity conservation actions in the Goulburn Broken Catchment

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, including establishing a voluntary investment scheme.

There are a number of state, national and international voluntary biodiversity programs operating with good effect. These schemes rely on contributions and partnerships: a regional scheme will similarly provide an avenue for business, industry, government and individuals (supporters) to contribute to biodiversity conservation in the Goulburn Broken Catchment.

The scheme will provide opportunity for innovation and long-term commitment to dedicated biodiversity conservation programs. It will direct effort and resources to priority areas, ensuring biodiversity investment is made in a strategic and efficient manner while acknowledging supporters. These projects will be complementary but separate to business as usual projects traditionally supported by the Victorian or Australian governments.

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 section 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 section 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 SES (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 Goulburn Broken CMA's resilience approach increases 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 SESs that cover the Goulburn Broken Catchment (see Section 3) (GBCMA 2013). Plans and processes for these SESs are at different stages. Evaluation processes will migrate towards the SES-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 SESs, 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 Goulburn Broken CMA uses its annual report to consistently present information across 13 investment themes at these levels, including a brief narrative of progress that is supported by evidence.

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

Evaluation level	Evaluation terminology	Typical questions used to focus evaluation	Examples of evidence to inform evaluation
1	Annual performance	• 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
2	Long-term strategy-implementation progress	• 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	• 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 2016b

The Goulburn Broken CMA's generic plan-do-review cycle (Figure 4) emphasises the recurrent need for evaluation to identify the evidence needed to inform decisions (answer questions) at each step of the cycle (Table 8). The annual plan (in Figure 5) considers annually determined priorities and available funding.

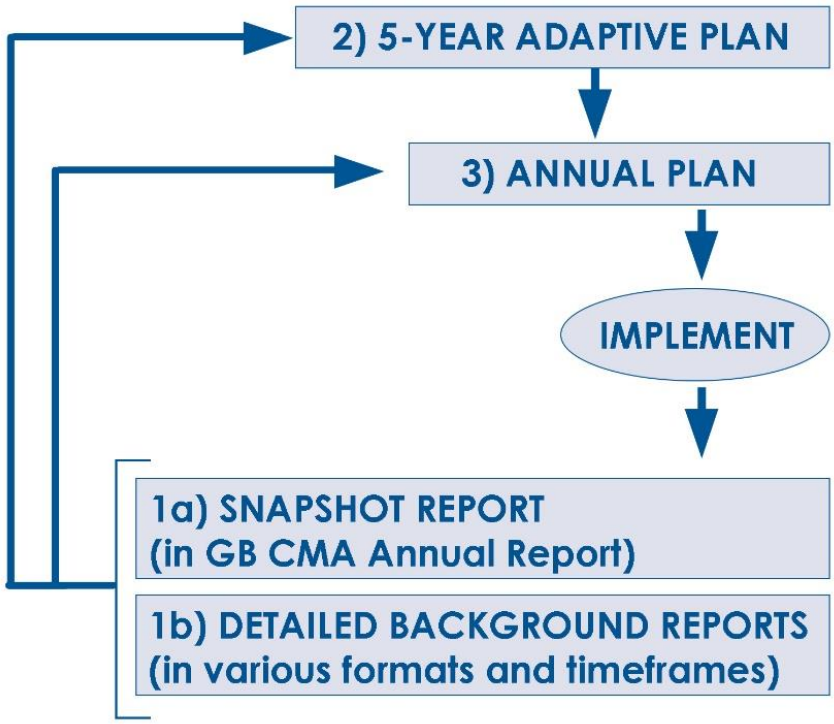


Figure 4: Goulburn Broken CMA planning cycles

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

Table 8 shows the items of evidence, which can be quite detailed and vary in quality, depending on available resources. Detailed background reports (listed in Figure 4) 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. An example of a detailed background report is Green Graze Pilot Project Final Report (Moll *et al.* 2007).

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 Biodiversity Strategy 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 *Biodiversity Strategy* to date?	Achievements (including on-ground and non-works actions) from all fund sources completed against strategic initiatives (listed in Biodiversity Strategy)
		What are the risks to biodiversity in the Catchment?	Drivers of change (including shifts in circumstances)
		What elements of the *Biodiversity Strategy* 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 (*Biodiversity Strategy*)	3 Update the 2016 Biodiversity Strategy in 2021.	Is the (2020) biodiversity vision for the Catchment or system right? Is the purpose of the Biodiversity Strategy Working Group clear? Do the medium-term (5-year) strategic initiatives need to change?	Community values
			Goulburn Broken RCS vision (alignment with Biodiversity Strategy)
			Biodiversity Strategy Working Group terms of reference
			Progress against Biodiversity Strategy'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			

Source: Derived from Shepparton Irrigation Region Land and Water Management Plan (SIRPPIC 2015)

* Key evaluation questions are considered at least 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. Exceptional circumstances, such as severe weather conditions or a dramatic change in institutional funding or arrangements, might cause the planning cycle to be brought forward, with the key evaluation questions considered sooner than originally expected.

** The equation: Outcomes = Outputs x Assumptions is used as the basis for understanding progress and identifying knowledge gaps for research.

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); and
- 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 4, a detailed review of this Strategy should be undertaken in 2021.

6.3.2 Biodiversity Monitoring Action Plan

A detailed BMAP (first developed in 2005 and updated annually) describes the process for measuring biophysical change, especially progress towards long-term biodiversity targets (GBCMA 2016c). 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 Goulburn Broken CMA) to detect changes in condition over time, and embed processes to implement the strategy.
- Update the research inventory to capture key research and monitoring projects, highlighted the relationship with assumption testing.
- 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 focus 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 Program's team projects. All programs within the Goulburn Broken CMA contribute to biodiversity conservation. Single actions can generate significant integrated benefits when partners have strong relationships.

For example, in the Agricultural Floodplains SES (SIR), native vegetation benefits from actions implemented through eight separate 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 Agricultural Floodplains (SIR) SES

Priority	Benefit to critical attribute 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					

Source: SIRPPIC 2015

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 (NRM Ministerial Council 2010). Its three priorities for action: engaging all Australians in biodiversity conservation; building ecosystem resilience in a changing climate; and getting measurable results, are consistent with this strategy's strategic directions of 'Legitimise biodiversity conservation', 'Build on ecological infrastructure' and 'Investing wisely'.

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 Victorian 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 *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 GBWS, 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 Victorian 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 its land health programs. 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.

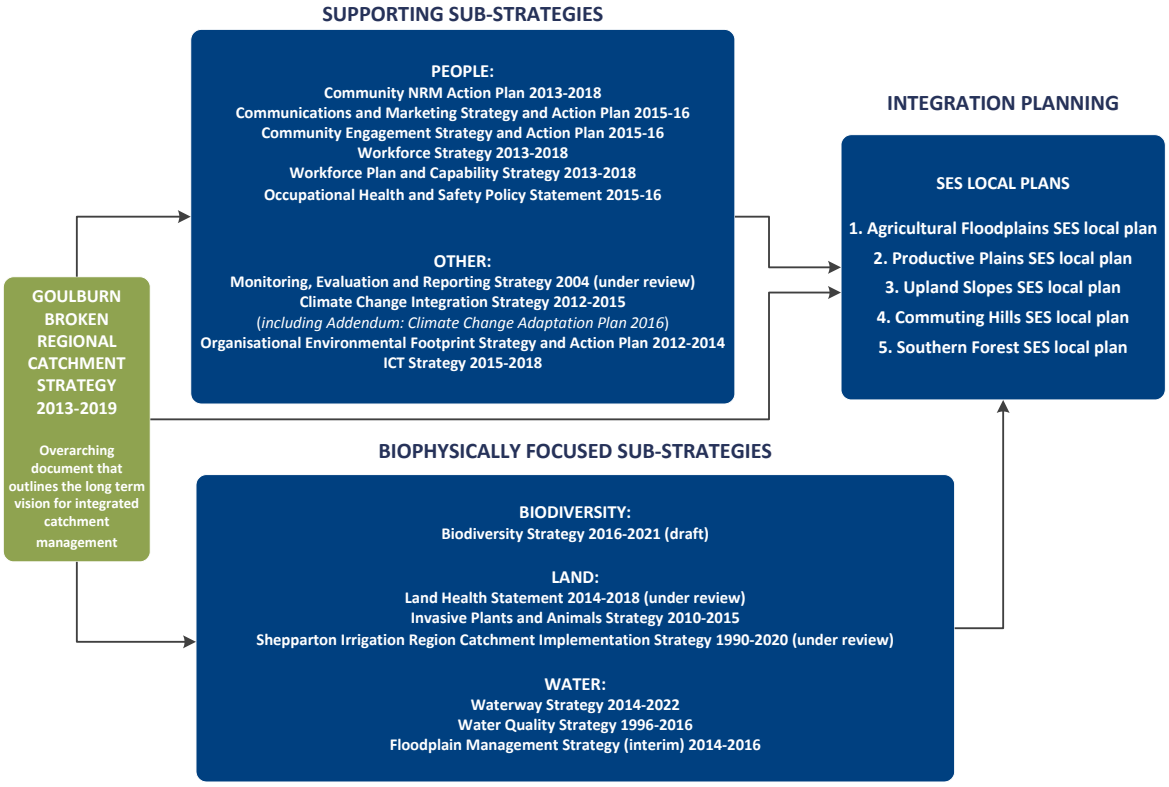

Figure 5: Goulburn Broken Regional Catchment Strategy and sub-strategies structure

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

The Yorta Yorta Nation Aboriginal Corporation (YYNAC) 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 Government and the YYNAC in June 2004. It formalises the right of the Yorta Yorta people to have a role in NRM 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 (TCAC), however a Memorandum of Understanding between the corporation and the Goulburn Broken CMA is in development. TCAC is currently developing a Draft Country Plan (TCAC, in prep.).

Emerging policy directions that will influence biodiversity

The 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 RCSs.

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 focused 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).

The Strategic Bushfire Management Plan for Alpine and North East and the Safer Together statewide approach to fuel reduction are policies that provide opportunities to consider risk and environmental impacts. Better consideration of biodiversity impacts and burning's cumulative impacts on refugia particularly in the forested upper catchment and the flow-on effects to private land in these areas will be of benefit. However, much more rigorous monitoring of the effects of planned burns on biodiversity in a range of ecosystems is required (see DEWLP 2016g and 2016c).

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
• 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
• 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
• *Environment Protection and Biodiversity Conservation Act* 1999 (the EPBC Act) (Commonwealth) • *Flora and Fauna Guarantee Act* 1998 (currently under review) • *Catchment and Land Protection Act* 1994 • *Wildlife Act* 1975 • *Coastal Act* 1995 • *Environment Protection Act* 1970 • *National Parks Act* 1975 • *Planning and Environment Act* 1987 (and the Victorian Planning Provisions) • *Water Act* 1989 • *Victorian Environment Assessment Council Act* 2001

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	*National Parks Act* enacted to manage and protect Victoria's national park.
1959	Game licences introduced resulting in protection of some wetlands
1960s	*Pinus radiata* 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 *Catchment and Land Protection Act*.
	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 (FFG Act 1988) of flora in the Goulburn Broken Catchment

Threat category	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

Sources: 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	4*	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

Sources: DELWP 2016b

*Australian Bustard, Plains-wanderer, Glossy Black-cockatoo and White-winged Fairy-wren.

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 (DELWP 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: – 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: – 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.

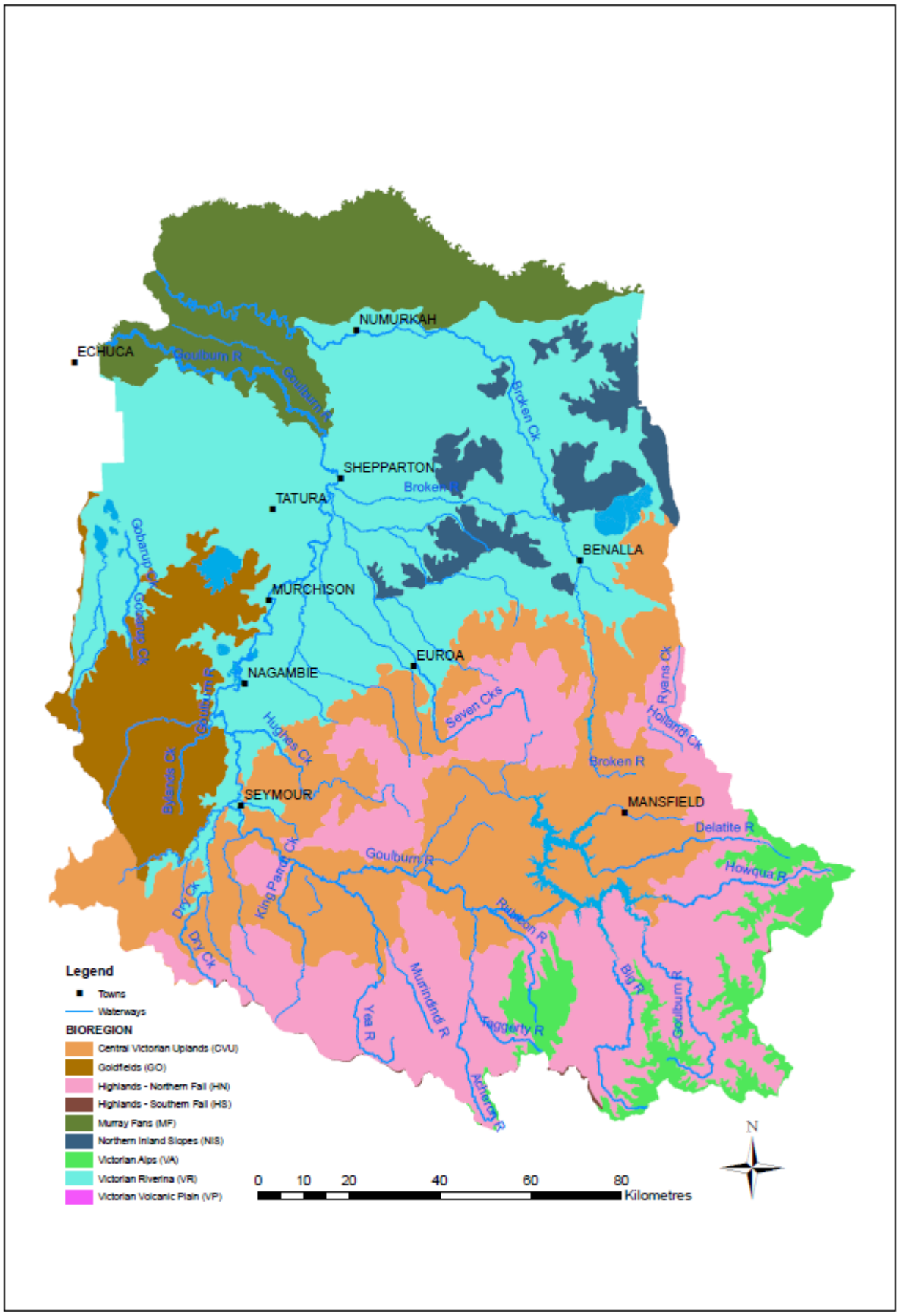

Figure 6: Bioregions within the Goulburn Broken Catchment

Table 14: Ecological Vegetation Class (EVC) coverage pre-European settlement and 2005

Bioregion	Ecological Vegetation Classes		Pre-European	Existing (as at 2005)			
	Conservation Status	No of EVCs	Vegetation 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**

Source: DSE 2007b; DSE 2007c

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 2016a). 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.

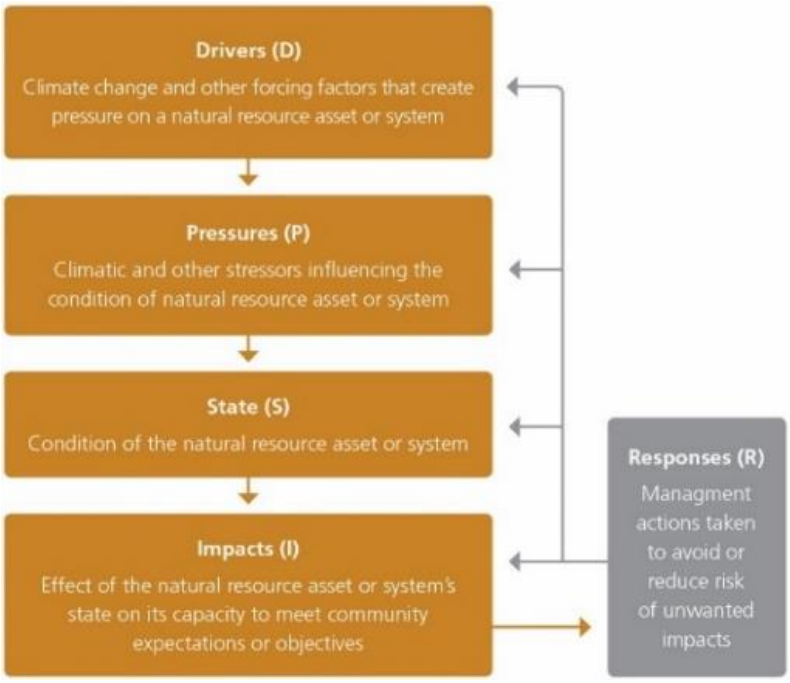

Figure 7: The DPSIR model
Source: GBCMA 2016a

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.

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.

The catchment's biodiversity has already faced change (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 2016a and reflected in Section 5 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 8). 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 **Error! Reference source not found.**) 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 **Error! Reference source not found.**) 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.

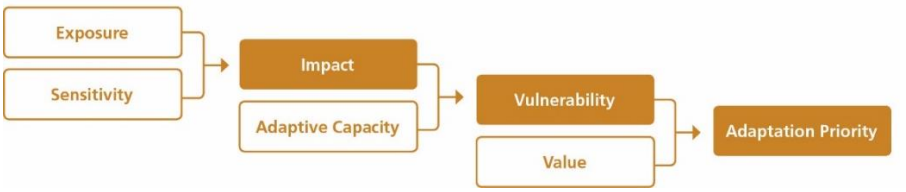

Figure 8: The climate change adaptation prioritisation framework
Source: GBCMAa

Table 16: Criteria for assessing adaptation priority for biodiversity

Exposure	Sensitivity	Adaptive capacity	Value
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	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	Tenure Whole farm planning Irrigation supply NRM works	Biodiversity value Stream reach and wetland value

Source: GBCMA 2016a

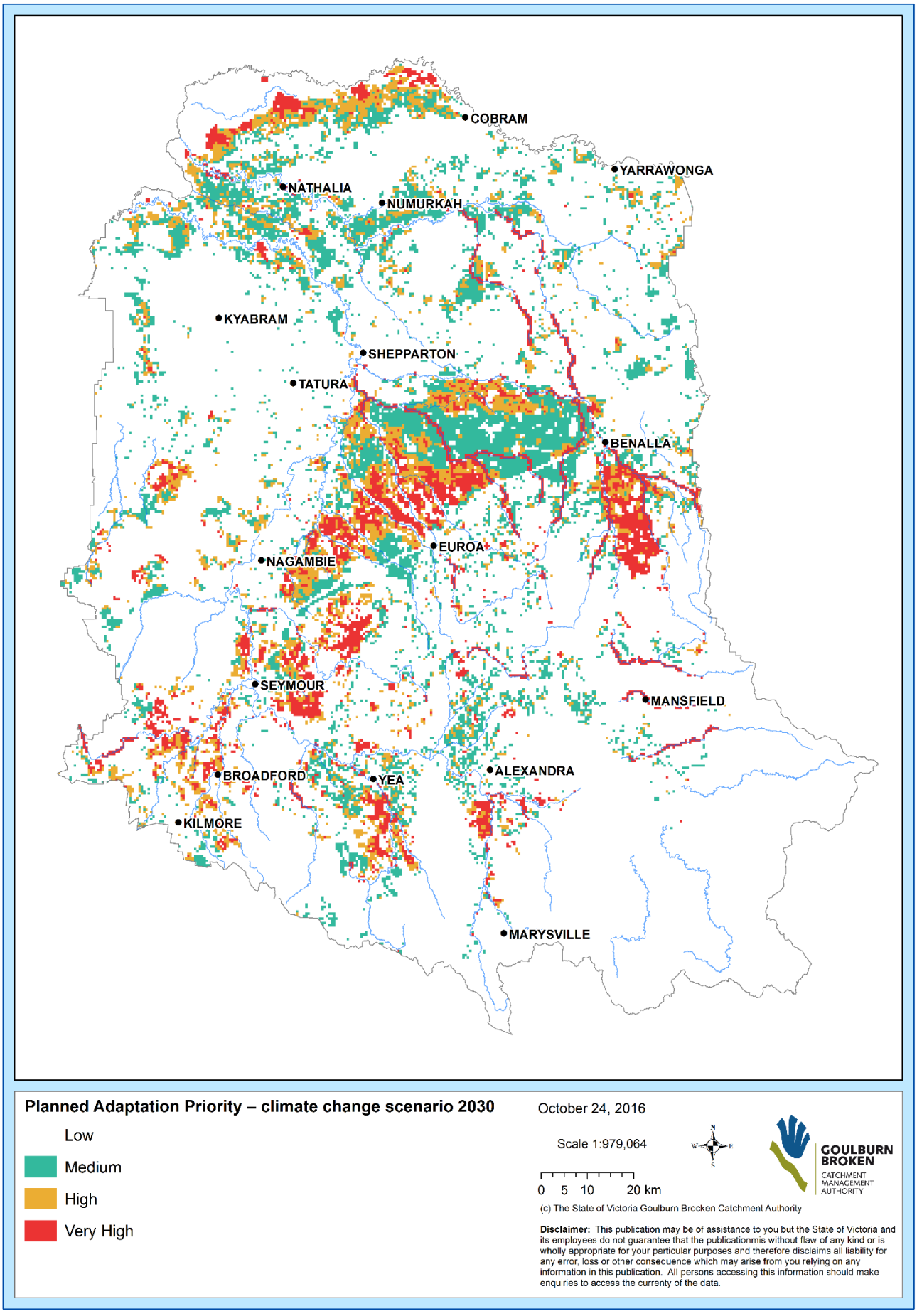

Figure 9: Planned climate change adaptation priority areas for biodiversity in the Goulburn Broken Catchment:

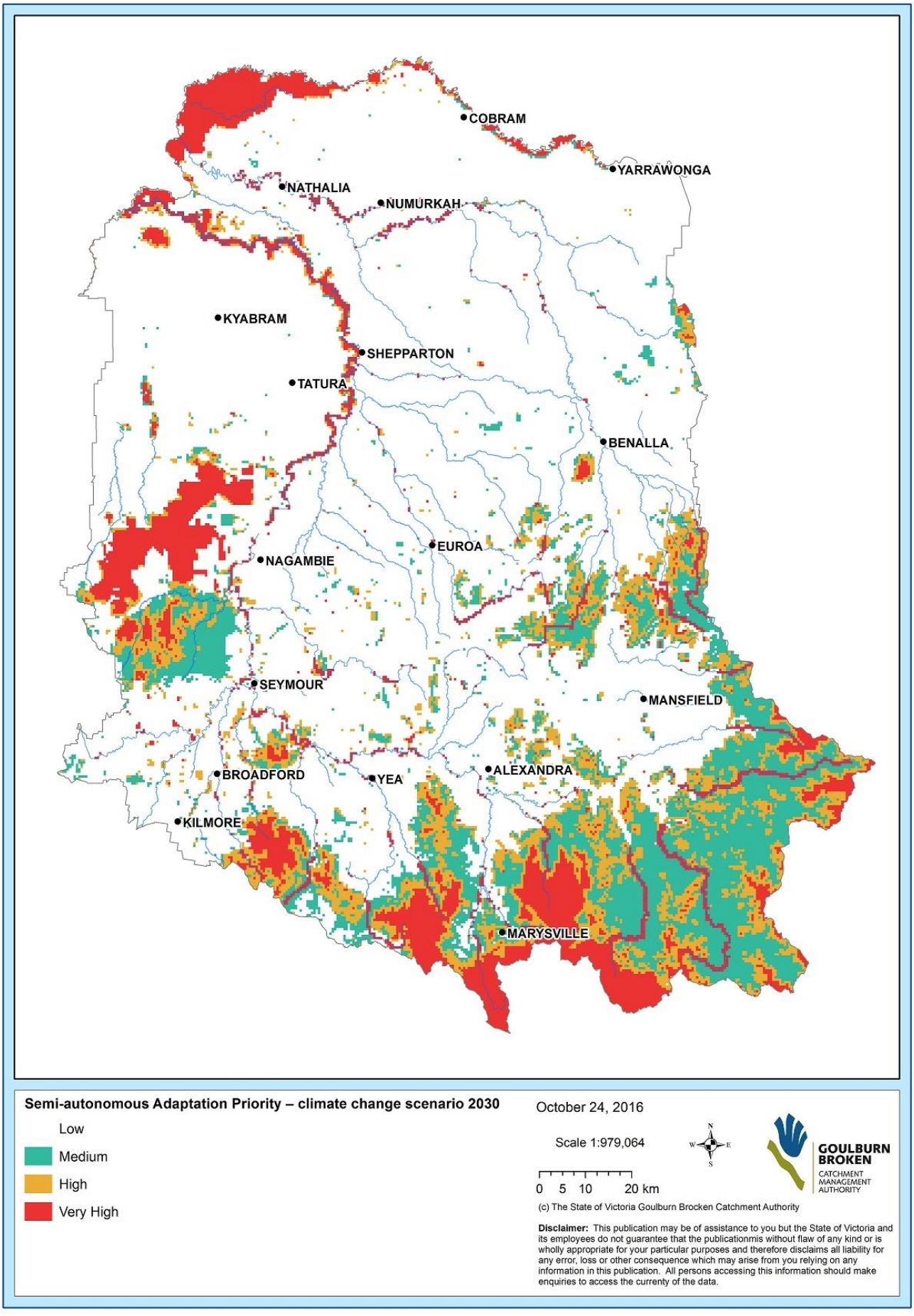

Figure 10: Semi-autonomous climate change adaptation priority areas for biodiversity in the Goulburn Broken Catchment

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 2010). 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 includes 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.

Flagship species target

The flagship 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. Many of the flagship species are threatened, and 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 at broader scales of landscapes (e.g. creating corridors) and SESs. 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 viability *in-situ*.

Considerations of the flagship species target include:

- The measurement and meaning of population viability is based on trends of populations defined variously depending on what is feasible to monitor, and relevant to each species, rather than actual data on 'viability' (i.e. viability here is not in the true scientific meaning of the word but one that encapsulates the direction in which we wish to progress and there are many assumptions (documented in BMAP)).
- 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).
- Viability measurements will vary between species (e.g. for one species the measure may be a change in population size and/or range, while another a change in genetic variability). Measurements will generally just indicate a likely direction of change for most species.
- May require initial benchmark data for some species and long-term sampling (Burgman and Lindenmayer 1998) but this may not be possible.
- It may 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 20 flagship 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 flagship species reporting that can be used by a range of stakeholders, such as

CMAs and Parks Victoria, would be of great benefit, and may help to show how works are affecting the viability of at least some species.

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) BMAP (GBCMA 2016c), 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 Goulburn Broken CMA's Land and Biodiversity and River and Wetland Health programs.

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 two 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 (GBCMA 2016a). The spatial tool identifies adaptation priority areas under climate change scenarios. 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 2010). 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 (GBCMA 2010).\

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 2010). The method used is summarised (GBCMA 2010).

Two types of priorities for zones were identified: those that require protection to enhance existing values (e.g. increase vegetation quality); and 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 improve 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. BAP is one tool to assist with SES, landscape and site-scale planning (see Appendix 8).

The zone assessment (GBCMA 2010) 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 BAP) 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.

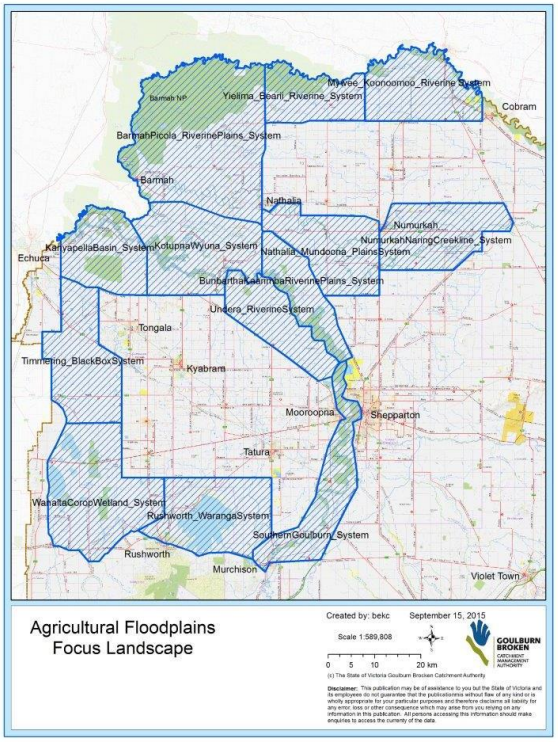

Figure 11: Focus landscapes in the Agricultural Floodplains

Landscape – site scale: BAP

BAP (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 – Submissions and comments on the draft Strategy

The Goulburn Broken Biodiversity Strategy 2016-2021 DRAFT was released for stakeholder comment between11th July and 5th August 2016. Submissions were received from:

- Shepparton Irrigation Region People and Planning Integration Committee
- Alfred Heuperman
- Parks Victoria
- Mitchell Shire Council
- Linda Broadhurst (CSIRO)
- Rebecca Caldwell
- Goulburn-Murray Water
- Ann Jelinek (Nature Focus)
- Gary Deayton (Moira Shire)
- Kate Stothers (GB CMA Board)
- Goulburn Valley Water
- Trust for Nature
- DELWP Hume Region
- Paul Ryan

General comments

- Partners supportive and most key ones actively responded.
- Acknowledgement that no other CMA has such a strategy and that the CMA remains a leading NRM region in this field.
- Extremely different comments on what matters from different partners – not necessarily conflicting, just different details matter to different partners. Highlights the broad church that is biodiversity and the need for Goulburn Broken CMA to be strong about the high-level (strategic) direction so that it is easily conveyed, shared and updated, with many of the details to be sorted at the implementation level.
- Some expressed support for progressing issues via SESs – seems good – and significant detail was provided to throw into the SES planning mix in various parts of the catchment.
  - Endorses local (SES) planning (some useful submissions to consider for particular SESs, especially Southern Forests).
  - Need to reinforce the role/scope of strategy (not an implementation plan).

Key feedback themes from submissions (not comprehensive)

- Public land management processes might be having significant impacts on biodiversity in the south of the catchment.
- Greater emphasis on the reservation of native vegetation is needed (highlighted in one partner's submission).
- Greater emphasis is needed on responding to climate change.
- Ongoing partnerships are critical, such as those between the Goulburn Broken CMA, local government, Goulburn-Murray Water, Trust for Nature, Parks Victoria, DELWP, landholders, and scientists.

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

BAP was developed for the Goulburn Broken Catchment between 2003 and 2008 to identify and map biodiversity assets in the catchment. Conservation Plans were prepared for 18 zones. 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). Focal species in BAP were flora and fauna, and the 20 species target species includes flora (see Appendix 9).

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

Table 2: Focal Species and their Habitat Requirements – Barmah Landscape Zone

	**Grey-crowned Babbler (*Pomatostomus temporalis*) (e)**	
	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
	**Bush Stone-curlew (*Burhinus grallarius*) (e)**	
	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
	**Superb Parrot (*Polytelis swainsonii*) (e)**	
	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
	**Brown Treecreeper (*Climacteris picumnus*) (k)**	
	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
	**Tree Goanna (*Varanus varius*) (v)**	
	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
	**Brolga (*Grus rubicunda*) (v)**	
	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, *Eleocharis spp*
	**Squirrel Glider (*Petaurus norfolcensis*) (e)**	
	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#

** 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, 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 Victorian 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 many species, including other threatened species.

A method for identifying flagship species in the Goulburn Broken Catchment

The Goulburn Broken CMA's 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 method of selecting species to focus attention (but not to the exclusion of other species or systems) is being developed, and relevant documentation will be available publically on the Goulburn Broken CMA website by June 2017. This provides transparency of the decision making process, and the process will allow for adaptive management, and annual reporting of monitoring strategies for each species and reports on changes to species viability. The assumptions behind decisions will be recorded to inform research gaps.

The process so far has been that, a range of agency staff, researchers and community representatives were involved selecting the twenty flagship species (15 fauna and five flora) to report on progress towards the target. Method: 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 information is available for. It is not possible to manage a species if its basic ecology and biology

is unknown, however, identifying a list of species for which we do not have any information is valuable for informing future monitoring and research priorities/opportunities. Then, with the reduced list, species were identified for further scrutiny, based on a range of criteria, such as its endemism in the catchment, its social appeal, priorities for other groups (eg, cultural significance) and the ecosystem with which it is associated. The objective is to identify species that occur in each of six major ecosystem types in the catchment: alpine, woodlands, wetlands, waterways/riparian and forests, and to have all taxa represented that are on the FFG list (note therefore, not fungi). The aim is that for each of the 20 species identified, a project plan will be produced that outlines monitoring methods, existing known data/information, key contacts and definition of viability. Projects can then be further developed in consultation with community that 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 flagship species.

This project will be finalised after the completion of this strategy.

STRATEGY ENDS