

# NORTH CENTRAL REGION CLIMATE CHANGE ADAPTATION AND MITIGATION PLAN SUMMARY

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## Introduction

Land managers and the wider community in the North Central region are no strangers to the effects of climate change and climate variability. In recent times they have experienced major climate events including the Millennium drought and the 2010/11 floods. While the floods caused major damage in some areas they also brought significant benefits to biodiversity, especially in our rivers and wetlands.

These events send a strong signal that we need to prepare now if the future climate change projections for the region are realised. Such events in the future will impact significantly on the region's environment, economy and community.

In order to better prepare for the future challenge of climate change the North Central Catchment Management Authority (CMA), with funding from the Australian Government, has worked



*Riparian zones along the region's main rivers have been identified as priority areas for revegetation to buffer these rivers from the impacts of the projected climate change for the region.*

with partner organisations to develop a regional climate change plan.

The plan aims to:

- Incorporate climate change adaptation and mitigation approaches in future planning
- Guide where bio-sequestration projects should be located in the landscape to maximise the benefits for biodiversity, water and agricultural production
- Identify priority landscapes for carbon plantings and strategies to build landscape integrity and guide adaptation and mitigation actions to address climate change impacts on natural ecosystems.

Protecting the natural assets of the region from climate change will require an integrated and coordinated effort from Government, the broader community and in particular, land managers.

## Climate Change Projections

The CSIRO and the Bureau of Meteorology (BoM) have released climate change projections for Australia that provide updated national and regional information on how the climate may change to the end of the 21st century (CSIRO, 2015).

The detailed projections help inform the impact assessment and planning required in the natural resource management sector. A summary of the projected changes in climate are outlined in Table 1.



*Modernisation in the north of the region is helping irrigators to adapt to the impacts of climate change.*



*Birds, particularly woodland birds, are at a greater risk from climate change than many other fauna species in the region.*

**Table 1** Climate projections for the North Central region (CSIRO and BoM, January 2015).

Climate projections for the North Central region	Level of confidence
Average temperatures will continue to increase in all seasons	Very high
More hot days and warm spells	Very high
Fewer, but possibly damaging, frosts	High
By late in the century, less rainfall during the cool season	High
Rainfall will remain unchanged in the warm season	Medium
Even though mean annual rainfall is projected to decline, heavy rainfall intensity is projected to increase	High
A harsher fire-weather climate in the future	High



## Regional Catchment Strategy and Climate Change

The Plan is a sub-strategy of the Regional Catchment Strategy (RCS) and considers how best to protect the region's high priority natural assets in the face of a climate that is likely to be warmer, drier and more variable in the future. The Plan will support the implementation of the RCS and coordinate effort by landholders, partner organisations and the wider community to enable improved adaptation and mitigation responses to climate change.

### About the Plan

This Plan is the product of strong scientific and technical input, and wide community and stakeholder engagement. It draws on:

- The most recent climate change projections
- Review of Australian and international literature on climate change impacts, opportunities and adaptation options
- A vulnerability assessment for natural assets
- An assessment of the impacts of climate change on existing threats.

This Plan has been developed to identify robust and feasible options for climate change adaptation and mitigation for the region's natural assets.

An intergenerational planning timeframe has been used, looking out beyond 2050, to examine the potential issues and opportunities arising from climate change on the natural assets of the region.

Drawing on recent research and investigation as well as local knowledge has provided a strong platform on which to assess adaptation options and mitigation responses to asset vulnerability and the socio-economic factors relevant to the North Central region.

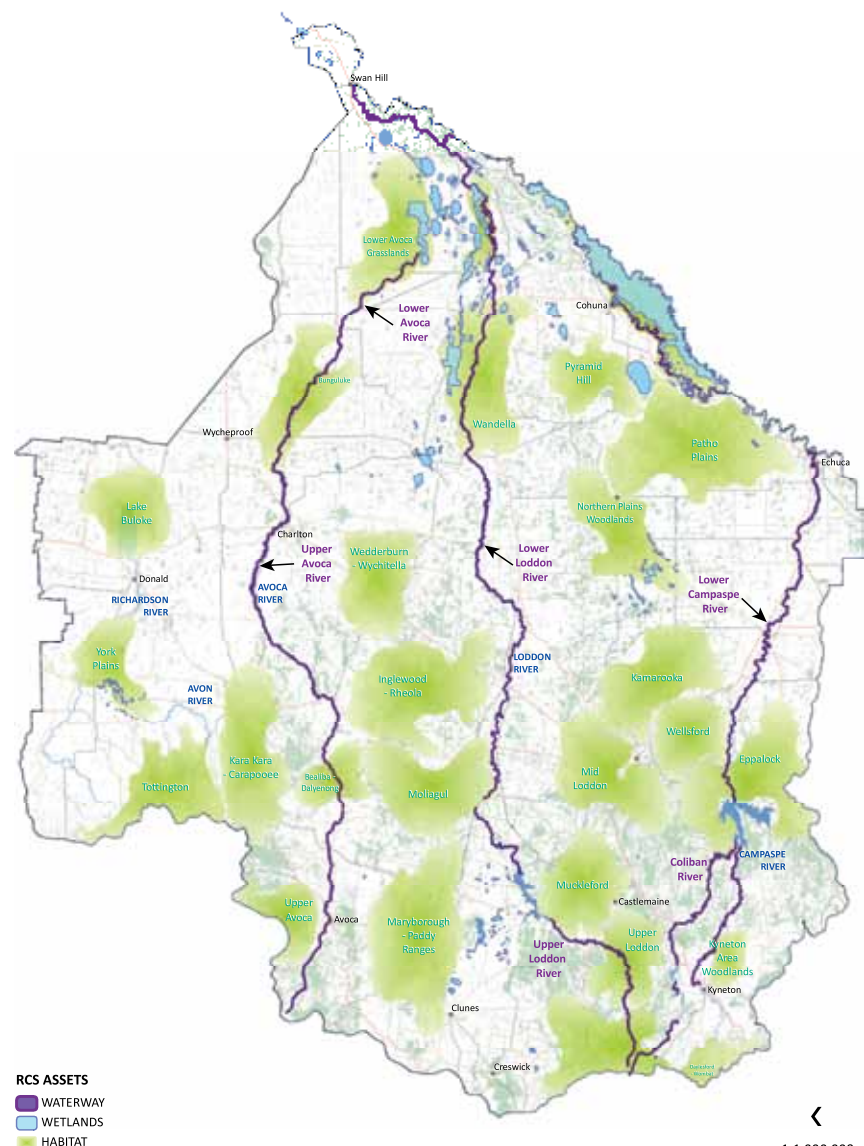
## Climate Change Projections and threats to the natural environment

Climate change will continue to affect the natural environment in a variety of ways. Rivers and wetlands will be impacted by changes in the available water quantity (drought, flood, rainfall intensity and the subsequent rate of surface runoff) and also the quality of the available water resource. Water storages and regulated flows can be managed to some extent to mitigate some of these effects.

Climate change will affect native flora and fauna in complex and often unpredictable ways. Current threats to biodiversity, including the impact of

habitat loss, weeds, pest animals and drought, are expected to intensify. The more vulnerable ecosystems in the region are areas that are vulnerable to moisture stress and increased risk of bushfires.

Species that have survived previous climatic changes have done so by evolving, changing their behaviour, taking refuge in local areas that are buffered from the changes, or moving to areas where the climate is more suitable. Native plants and animals might find it more difficult to use these coping strategies when the change is rapid, especially where their habitat has been degraded, isolated or lost. Climate change won't cause all species to decline. However, changes in climate could lead to new opportunities for the establishment of invasive species, such as weeds and pest animals, as well as some native species.



**Figure 1** The North Central CMA region and priority natural assets.

In developing the Plan a key focus was on identifying and assessing practical, flexible and feasible adaptation options for land managers and communities. Options focused on improving the adaptive capacity of natural assets are described in Table 2.

**Table 2** Adaptation options for each broad type of natural asset assessed against climate change variables.

		Climate Change Variables			
		Reduced and more variable rainfall	Increased temperatures, and extreme heat	Increased intensity and frequency of rainfall events (including flooding)	Increased frequency and intensity of fire
ADAPTATION OPTIONS	Rivers and floodplains	<p>Increase extent of riparian vegetation.</p> <p>Improve connectivity of corridors to provide shading of rivers.</p> <p>Provide environmental flows.</p> <p>Protect summer base flows (regulation of timing / magnitude of extraction).</p>	<p>Protect refuge areas for fish and aquatic fauna in conjunction with pest species programs.</p> <p>Establish riparian vegetation.</p> <p>Restore in- stream habitat.</p> <p>Control competing aquatic species (plant and animal).</p>	<p>Maintain groundcover in strategic areas.</p> <p>Support geomorphic recovery through works (vegetation and structural).</p> <p>Manage flashy surface water inflows in urban / agricultural environments (swale drains and constructed wetlands).</p> <p>Explore large-scale floodplain restoration to buffer against flooding.</p>	<p>Focus fuel reduction burning to protect vulnerable/fire sensitive vegetation along rivers and floodplains.</p> <p>Plan to mitigate the potential impacts of fuel reduction burning and wildfire on sediment/ pollutant runoff to rivers.</p>
	Wetlands	<p>Remove existing artificial barriers or lowering 'commence to fill' levels.</p> <p>Explore opportunities to deliver water to isolated wetlands through irrigation infrastructure.</p> <p>Prevent disturbance to those wetlands subject to over grazing or land use intensification/ cropping.</p>	<p>Control weeds and pests to improve condition and adaptive capacity.</p> <p>Improve connectivity between wetland habitats.</p> <p>Establish buffers of native vegetation and reinstate wetland vegetation.</p>	<p>Reinstate, where possible, natural hydrology to allow for movement and retention of floodwaters.</p> <p>Manage 'flashy' surface water inflows in urban / agricultural environments (swale drains and constructed wetlands).</p>	<p>Focus fuel reduction burning to protect vulnerable/fire sensitive vegetation around wetlands.</p> <p>Consider fire management in wetland planning.</p>
	Biodiversity	<p>Protect high quality remnants as reservoirs of regeneration potential.</p> <p>Control weeds to improve quality and condition.</p> <p>Use and range of seed provenances in revegetation programs to maintain/extend genetic diversity.</p> <p>Plan and implement revegetation activities to better match local and seasonal climatic conditions.</p> <p>Improve connectivity through targeted revegetation and remnant management.</p> <p>Actively manage to reduce threats (e.g. over grazing) on existing remnants.</p> <p>Develop and integrate productive tree (and perennial vegetation) systems, including farm forestry, that provide significant benefits in terms of carbon sequestration, run-off, watertable control and water quality.</p>		<p>Increase extent and connectivity of riparian and floodplain vegetation to reduce impact of extreme events.</p> <p>Where appropriate, promote natural regeneration in riparian and floodplain environments.</p>	<p>Match burning / fire regimes to tolerable fire intervals.</p> <p>Identify and protect ecosystems with high sensitivity to fire.</p>
	Soils	<p>Change soil management practices that reduce compaction (minimum tillage, and retain stubble).</p> <p>Change to rotational grazing in order to increase soil carbon and improve water retention.</p> <p>Increase on-farm water storage capacity.</p> <p>Increase irrigation efficiency and re-use where applicable.</p> <p>Spread production over a range of areas within the region to different irrigation or rainfall zones.</p> <p>Adopt new varieties more tolerant of water stress. Change crops to more water efficient varieties.</p>	<p>Provide shelter and shade from extreme heat, through vegetation establishment or use of shade structures.</p> <p>Provide sheltered watering points.</p> <p>Trial new pasture and crop varieties.</p> <p>Increase groundcover through grazing management.</p> <p>Shift joining time to avoid birth and lactation during summer periods.</p>	<p>Improve and increase flood warning systems.</p> <p>Maintain groundcover to mitigate against erosion.</p> <p>Adopt alternative grazing strategies.</p> <p>Consider timing of planned burns and risk of rainfall events / flooding to reduce downstream impacts.</p> <p>Use cover crops to protect paddocks at time of high flood risk.</p>	<p>Implement on-farm strategies to protect assets (e.g. firebreaks), fuel reduction burning on freehold land.</p> <p>Purchase additional insurance.</p> <p>Develop property level fire management plans.</p> <p>Increase control of invasive plants and animals after fires.</p>

## Supporting mitigation – carbon plantings and connectivity

Revegetation efforts by land managers, Landcare and community groups over recent decades have already made a significant contribution to increasing carbon stores, creating new habitat and protecting land and water assets. This together with active natural regeneration, especially through the Goldfields bioregion, is already mitigating climate change.

Future impacts on biodiversity under a warmer, drier climate will pose additional challenges and be felt at local and regional scales. Rebuilding connected, functioning landscapes and maximising the benefits provided by areas of high habitat value, will require further strategic linkages to be established across the region. These linkages will have benefits for local wildlife, for example woodland birds, support the movement of migratory species, and importantly provide a refuge for species impacted by the effects of climate change in areas beyond north central. They will also improve the resilience of riparian and terrestrial habitat and contribute to supporting essential ecosystems services.

The region's rivers are particularly important for future connectivity options, largely because of their existing intact riparian vegetation.

Wildlife corridors can help conserve biodiversity and strengthen landscapes in the face of climate change. They also help insure against climatic uncertainty through the conservation of a diversity of species and provision of alternative pathways for species' movement and adaptation. Naturally connected landscapes and ecosystems are generally healthier and can store carbon more effectively than degraded landscapes.



*Landholder participation in field days and farm walks provides the opportunity to share knowledge about adapting to climate change.*

**Climate adaptation** – the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities, or to cope with the consequences.

**Climate change mitigation** – efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behaviour. It can be as complex as a plan for a new city, or as a simple as improvements to a cook stove design. Initiatives underway around the world include planting trees; energy efficient housing, lighting and appliances; and adoption of renewable energy.

## Supporting communities to adapt

Adaptation is already happening on many levels – land managers and communities have been responding to drought, flood and fire through a range of actions that minimise future risk, improving water security and conserve high value agricultural soils. The work of many Landcare and community groups to buffer remnant vegetation and improve landscape connectivity is supporting adaptation of natural assets though improved participation and coordinated action.

Five broad areas have been identified where similar options apply because of generally similar land use and socio-demographic factors in the area. The strategic adaptation options are described as those that apply to the:

- Region as a whole
- Upper catchments in region's south
- Goldfields
- Irrigated areas on northern plains
- Broadacre farming in the west.

(See Figure 2).

The options outlined here have been identified to support existing programs and initiatives of the RCS, but with a view to longer term 'climate proofing' of the region's most valuable natural assets.



## Region-wide

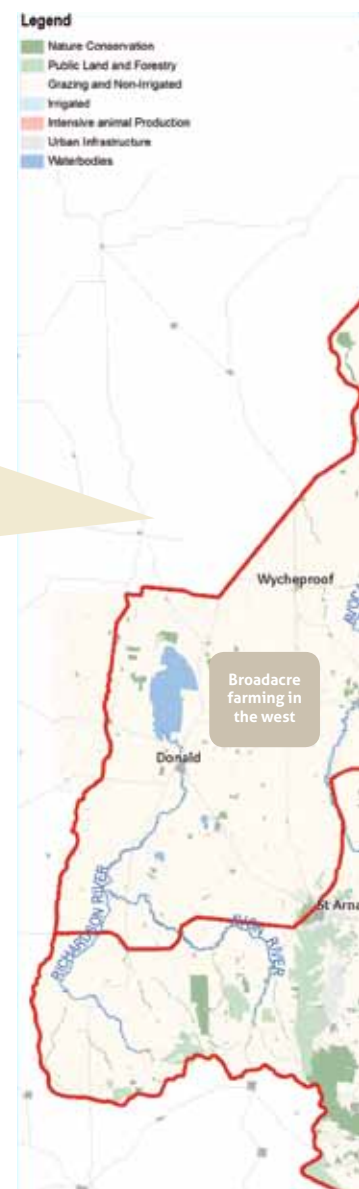
### Strategic options:

- Extension: Technology transfer, education, communication, demonstrations, support for community networks with a focus on land managers
- Incentives: grants and direct financial support
- Research and development: Development of improved land management options
- Planning Instruments: working with local government and responsible authorities
- Knowledge brokering: coordination of information provision and delivery across agencies and institutions
- Capacity building: support for increased community participation and involvement.

## Broadacre farming in the west

### Strategic options:

- Support adaptation of agricultural enterprises through a range of tools that may include extension, incentives and trials
- Work with R&D sector to develop improved crop varieties for use in this area
- Use water from the Wimmera Mallee pipeline for intensive agriculture
- Adopt low input and low risk grazing systems for both productivity and conservation
- Increase the summer dominance of the grasslands by strategic grazing
- Explore the modification of floodplain infrastructure to reinstate more natural hydrology where feasible
- Allow large-scale natural regeneration on the floodplain for carbon storage
- Explore the use of drier country species into the existing Red Gum system (e.g. Black Box, Eumong) through strategic revegetation
- Establish farm forestry plantations for firewood, carbon storage, bioenergy etc
- Support strategic purchase of properties or management rights for conservation benefits (and use local management) in collaboration with NGOs such as Trust for Nature, Bush Heritage.

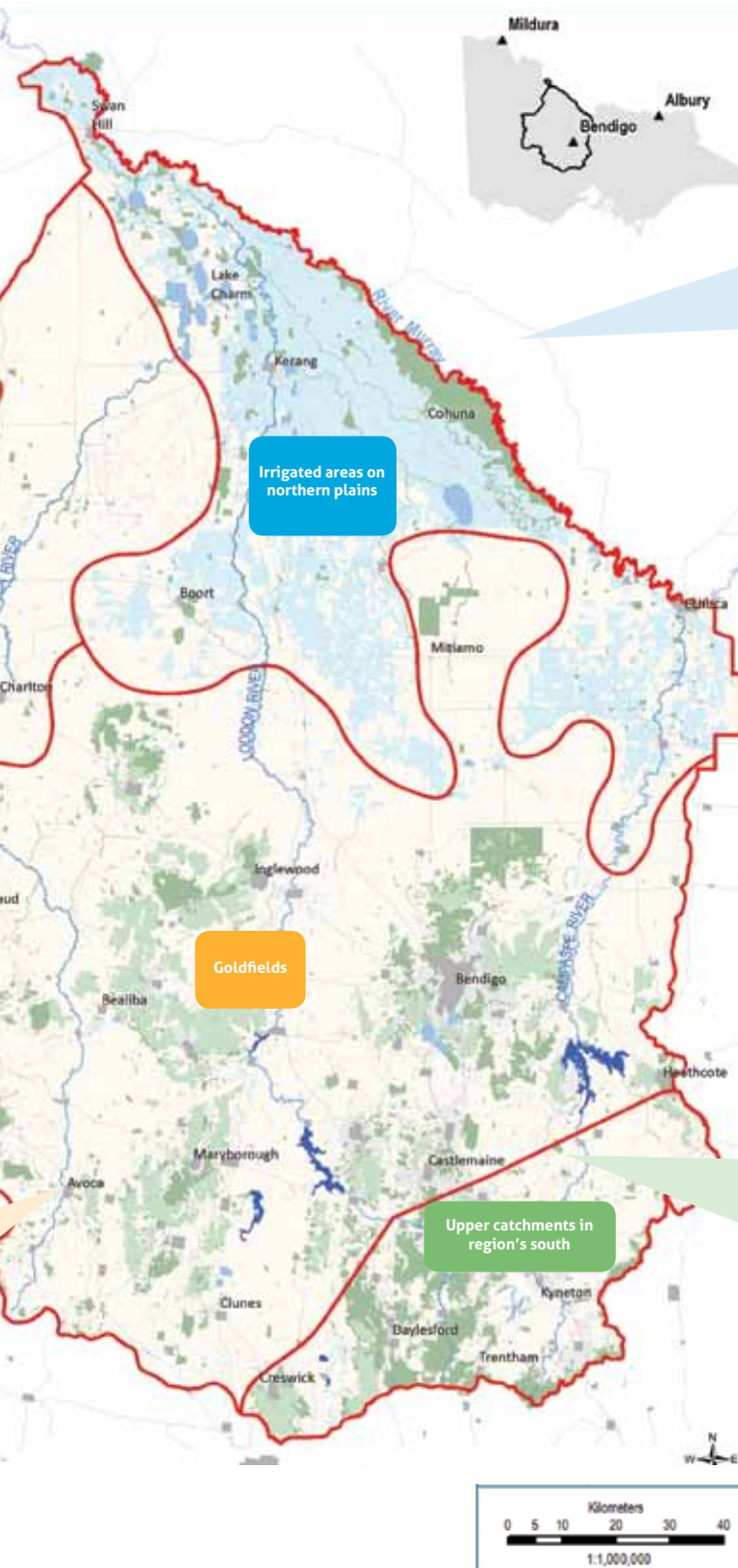


## Goldfields

### Strategic options:

- Implement a property planning and education program (with a sustainability focus) for landowners
- Enable an ecological thinning program on both public and private land
- Implement a scientifically rigorous, biodiversity monitoring program using woodland birds as a key indicator of ecosystem health
- Implement an on-ground restoration program that achieves connectivity and increases the extent of native vegetation
- Include some drier climate species and wider genetic material of existing species in revegetation programs
- Put stricter controls on development in bushland areas or adjacent to public land
- Support the risk based approach to prescribed burns to protect the community and natural assets
- Manage grazing pressure along rivers to protect the riparian zone
- Support the development of mechanisms in local government planning schemes and the Victorian Planning Provisions that identify and enable strategic biolinks
- Implement large-scale carbon sequestration across the landscape.

**Figure 2** Strategic options for climate change adaptation and mitigation in particular areas within the North Central region.



## Irrigated areas on northern plains

### Strategic options:

- Support initiatives to improve water security for irrigators whilst protecting flows for environmental outcomes
- Support adaptation of agricultural enterprises through extension, incentives and trials
- Support initiatives to improve on-farm water security (groundwater and surface water) and improve the environmental outcomes for wetlands
- Build or modify infrastructure to manage regulated or unregulated flows of water into the wetlands
- Opportunities for farm forestry, carbon planting on non-irrigated land
- Develop a set of protocols for how the wetlands may be adaptively managed, recognising that their values might change under a future climate
- Implement a knowledge sharing program focused on best practice grazing management of the wetlands (recognising stock need water)
- Implement a Farming Systems program for all farmers in the area based on preparedness for the predicted climate change scenario (e.g. new variety trials).

## Upper catchments in region's south

### Strategic options:

- Support programs that aim to reduce fire risk to communities and natural assets across public and freehold land
- Introduce codes of practice that reduce demand for water and support self-sufficient water use (both agricultural and semi-urban properties)
- Establish large-scale carbon sequestration by planting biodiverse plantations/trees on poorer soils or along the riparian zone. Examine drier country species for inclusion in the plantings
- Identify and protect existing biodiversity hotspots and refugia
- Examine the groundwater resources available to secure a future water supply
- Implement an incentive program to stabilise soils on agricultural land in water supply catchments.

# The Way Forward

The options outlined in Table 3 are a selected subset from the Plan that have been identified as immediate priorities for implementation. A Coordinating Group will oversee implementation of the Plan. (This group will show leadership on climate change adaptation and mitigation, share knowledge and facilitate collaboration between key organisations working to protect and enhance the region's highest priority natural assets).

**Table 3 The Way Forward**

	Region-wide	Upper catchments in the south of the region	Goldfields	Broadacre farming in the west	Irrigated areas on the Northern Plains
Strategic Options	<p><b>Research and development:</b></p> <p>Develop improved land management options that maintain and improve the natural asset base under future climate change, including extended periods of reduced rainfall and extreme climatic events.</p> <p><b>Knowledge brokering:</b></p> <p>Coordinate information provision and delivery across agencies and institutions. North Central CMA to play the lead role in the provision and integration of climate related information across the NRM sector.</p> <p><b>Capacity building:</b></p> <p>North Central CMA to continue providing support for increased community participation in NRM and asset protection under a variable and changing climate.</p>	<p>Support programs that reduce fire risk to communities and natural assets across public and freehold land by:</p> <ul style="list-style-type: none"> <li>Working in partnership with key fire management agencies</li> <li>Utilising best available scientific and expert knowledge to aid evidence based decision making.</li> </ul> <p>Improve land use in water supply catchments to secure both water quality and quantity.</p> <p>Identify and protect existing biodiversity hotspots and refugia, including the use and application of available biodiversity mapping and local knowledge.</p>	<p>Explore the benefits of ecological thinning as a future vegetation management option in response to climate change.</p> <p>Implement a scientifically rigorous, biodiversity monitoring program using woodland birds as a key indicator of ecosystem health.</p> <p>Implement an on-ground restoration program that achieves connectivity and increases the extent of native vegetation.</p>	<p>Work with R&amp;D sector to develop improved crop varieties for use in this area.</p> <p>Increase the adoption of low input and low risk grazing systems for both productivity and conservation.</p> <p>Establish farm forestry plantations for firewood, carbon storage, bioenergy etc.</p>	<p>Support initiatives to improve on-farm water security and improve the environmental outcomes for wetlands.</p> <p>Build or modify infrastructure to manage regulated or unregulated flows of water into the wetlands.</p> <p>Implement a Farming Systems program for all farmers in the area based on preparedness for the projected climate change scenario.</p>
Key Action(s)	<p>Commencing January 2016 convene a coordinating group comprising key agencies and other relevant stakeholders.</p> <p>Host an annual forum and share the latest knowledge of climate change science and agency activity in this space.</p> <p>Liaise with key statewide and national agencies (CSIRO, BoM) to ensure best use of available data and knowledge.</p> <p>Conduct regular consultations with landholders across the region to understand current perceptions and behaviours in climate related land and water management – as they relate to management of risk.</p> <p>Identify joint project opportunities that both mitigate against climate change and meet the aspirations of Traditional Owners and aboriginal people.</p>	<p>Develop and implement an Integrated Catchment Plan for the Upper Coliban catchment.</p> <p>Coordinate the provision of a citizen science program that makes biodiversity information more widely available, maps biodiversity assets at risk under future climate scenarios, and communicates about how to implement management options for these assets.</p>	<p>Liaise with Parks Victoria to understand the impacts of a recent ecological thinning trial program to inform future vegetation management options.</p> <p>Convene an expert workshop to:</p> <ul style="list-style-type: none"> <li>Share knowledge and understanding of past work on ecological thinning (including results of monitoring)</li> <li>Explore the feasibility of undertaking an expanded trial of ecological thinning on public and private land in collaboration with State agencies and research institutions.</li> </ul> <p>Support community networks and NGOs (e.g. Connecting Country, Birdlife) to share information on the status and trends of woodland bird populations.</p>	<p>Undertake an economic analysis of the adoption of low input and low risk grazing systems for both productivity and conservation. Compare with conventional high input systems.</p> <p>Use ADOPT, Public Private Benefits Framework and peer reviewed ecological models/frameworks to evaluate specific options.</p>	<p>Continue to deliver environmental water to priority wetlands, and explore opportunities to provide e-water to other wetland systems.</p> <p>Seek funding to explore a Joint Management Model (involving Parks Victoria and local land managers) for the Kamarooka wetlands, and document the learnings that arise.</p>

The full Plan document is available at [www.nccma.vic.gov.au](http://www.nccma.vic.gov.au)

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