



Blueprint for Action

Restoring Landscapes with Community

Version 1 July 2023





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Many people have shared their expertise and knowledge in supporting this process. The Blueprint was authored and compiled by Kristie Smith, with significant contributions from the Interim Chair, Ken Beasley. Other contributors included Peter Rose, Terri Williams, Owen Hayden, Adrian Martins, Liam Sibly, Colin Smith and RMCG.

Special thanks to scientific chapter contributions from:

- **Dr. Nathan Robinson**
Senior Research Fellow of Soil Science, Centre for eResearch and Digital Innovation, Federation University Australia.
- **Dr. Alison Pouliot**
Natural historian, environmental photographer, and Honorary Fellow at the Australian National University.

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Photo credits: Peter Weaving, Chris Tzaros, Geoff Park, Adrian Martins, Julie Radford and JCAG.

Project Partners



Acknowledgement of Country

We acknowledge the Djaara and Taungurung people as the Traditional Owners of the Country on which this project was conducted. We recognise their continuing connection to land, waters and culture and pay our respects to their Elders past, present and emerging. Moreover, we express gratitude for the knowledge and insight that Traditional Owner and other Aboriginal and Torres Strait Islander people contribute to our shared work.

We recognise the importance of caring for Country and support the aspirations of Traditional Owners as outlined in the Dhelkunya Dja Country Plan, and the Taungurung Country Plan.

Photo credit: Peter Weaving



Introduction

Nature Network

In 2021 seven conservation groups pledged their support for a Network and facilitator to cover the eastern and southern groups of Bendigo.

The Network was mandated to support environmental volunteer groups to increase community engagement, deliver landscape-scale projects and strengthen environmental outcomes.

The Member Groups established an Interim Steering Committee (ISC) and Governance Sub-committee to guide the formation of the Nature Network. The Governance Sub-committee recommended that the following model be adopted - 'A combined skill-based Governance Model comprising representation from at least four Network Member Groups, in addition to two or more community positions based on skills-gaps'.

The ISC created vision and purpose statements that emphasise the Nature Network's role in supporting its Member Groups, and the role of people in its environmental aspirations:

Axe Creek Landcare

Longlea and District Landcare

Mandurang Landcare

Northern Bendigo Landcare

FOSSALs *Friends of Strathfieldsaye Streams and Land*

JCAG *Junortoun Community Action Group*

Friends of the Whipstick

Ironbark Gully Friends Landcare

Vision

A Landcare Network that is actively supporting conservation groups to restore ecosystems and connect the community to the landscape.

Purpose

Protect and enhance our landscape by reconnecting people with the natural environment, through coordinated and collaborative efforts with our member groups, community and partners.

Many of the groups in the network area are experiencing similar threats to their environment, with the most significant threat being urbanisation. The groups tend to occupy urban and peri-urban locations that are increasingly experiencing development of small acreage and residential plots, on land that is degraded by European land-use activities.

Unique to central Victorian environmental groups is the legacy of mining, with significant portions of the Box-Ironbark Forests cleared. Some of these forests have regenerated, albeit structurally altered and unable to support the abundant flora and fauna described by the Traditional Owners of this Country, the Dja Dja Wurrung and Taungurung people.

However, in the Information Age and with a growing emphasis on climate change, an influx of diverse demographics presents opportunities to develop innovative environmental solutions. While humans are often to blame for the current state of the environment, the Nature Network aims to support people to be the solution.





Nature Network

Environmental assessment

This Blueprint provides a high-level overview of biodiversity within the Nature Network region.

Landform

Land use

Native flora

Native fauna

Climate change

Native fungi

Biodiversity threats and priorities



This Blueprint provides a high-level overview of biodiversity within the Nature Network region. This analysis covers the entire Nature Network region, including areas without Member Group activity.

Environmental assessment

Landform

Soils

Regional characteristics

The Nature Network region is dominated by dissected uplands (predominantly a northerly aspect) of Lower Paleozoic deposits. Metamorphic rocks have formed steeply sloped peaks and ridges. A variety of relatively poor soils are dominant with yellow, grey and brown texture contrast soils, and minor occurrences of friable earths (DELWP, 2022).

Soils are mostly derived from ancient Ordovician sedimentary sandstones, siltstones and shales, which are typically shallow and stony, of low fertility and inherently poor water holding capacity. There are granite hills and rises in southern extents of the network. Colluvial sands are found on the lower granitic slopes and around the interface of the northern plains. On the lowest part of the plains near waterways are the deepest and most fertile alluvial soils¹.

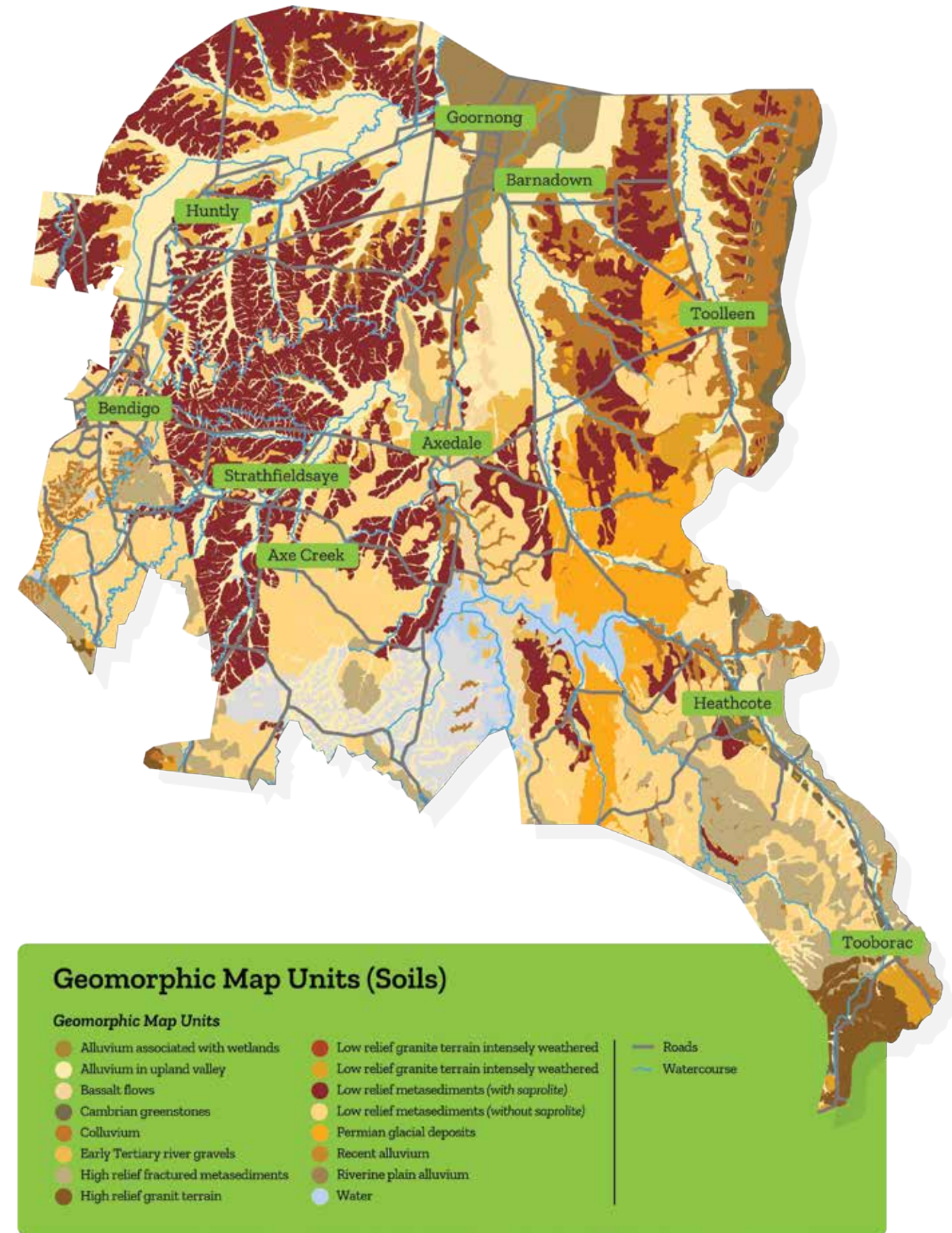
Within the Nature Network focus area, there is variation in soil type across the landscape. The water courses and drainage depressions extending north into the flood plain areas support various alluviums comprising a mix of silt, clay and loam with more gravelly deposits close to the creeks.

The variation of soils across the landscape has influenced the types of vegetation that occur supporting a wide range of flora and fauna as discussed in further sections. All soils are susceptible to erosion when ground cover is not maintained.

Geomorphology and landscapes

The Nature Network occurs at a junction of gentle to steep landscapes of the Victorian Western Uplands² and the Northern Riverine Plain deposits³ that extend northwards to the Murray River⁴. The Network area is dominated by a sequence of ridges and escarpments leading to hills and low hills including valley floors and plains⁵. Volcanic landscapes⁶ include basalt flows of the Newer Volcanics that have filled many of the ancient watercourses and valleys as the lava flowed to the north. On the southern perimeter of the region are granitic plutons and associated landscapes (hills, low hills, rises and plains⁷) including the surrounding steep metasediment ridges, escarpments and hills⁸. Along the eastern boundary of the Network there are also hills and low hills of sedimentary origin and the Mt Camel Range as a Cambrian greenstone belt that runs north-south.

Colluvial deposits associated with high terrain landforms (ridges, hills and low hills) are distributed throughout the area while more recent alluvial deposits occur in valley floors and depressions⁹ before leading to more expansive sedimentary deposits of the Riverine Plains in the north¹⁰.



Soils

The Network area is dominated by texture contrast soils with a sandy topsoil (A horizon) overlying a clayey subsoil (B horizon). These texture contrast soils are widespread and occur with variants including red, brown, yellow and grey subsoils. Chromosols (texture contrast with an alkaline subsoil pH) are extremely common whereas in higher rainfall parts of the Network, Kurosols (acidic subsoil) are also common. These texture contrast soils also occur with sodic (exchangeable sodium percentage >6%) subsoils and are extremely prone to slaking and dispersion if exposed. These Sodosols are more common on gently undulating plains and rises that are also widespread as part of the riverine plains in the north.

Where there is little change in texture between the topsoil and subsoil, Dermosols (having a well-structured subsoil) and Ferrosols are associated with metasediments, plains and rises through the region. Ferrosols (containing high free iron in the subsoil) are commonly found associated with volcanic landscapes and ridges and escarpments of metasediments. Kandosols also are noted to occur as deeper profiles associated with alluvial sedimentary sequences.

Clayey soils (Vertosols) occur on gentle to undulating landform elements of the volcanic flows. These clayey soils tend to have light clay topsoil overlying a medium to heavy clay subsoil. Gilgai microrelief (e.g. crab-holes) is common and the depth of these clay soils is variable due to the presence of floaters and differential bedrock weathering.

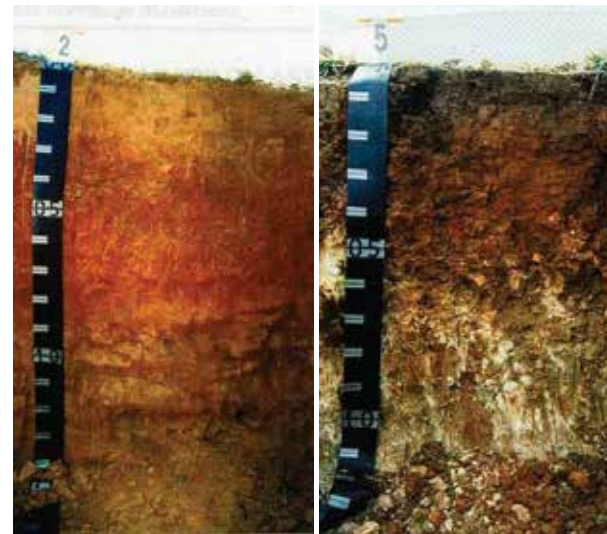
Associated with the steeper landforms of granitic and metasediments are weakly developed soils known as Rudosols. The granitic soils are sandy to loamy textured and often less than 1m deep. For the sedimentary terrain with steep slopes, soils tend to be loamy and shallow with depth to a clayey subsoil variable depending upon weathering patterns of bedrock.

For the lower depressions and wetlands, Vertosols and Hydrosols (soils with prolonged saturation) also occur.

Soil sites of the Network

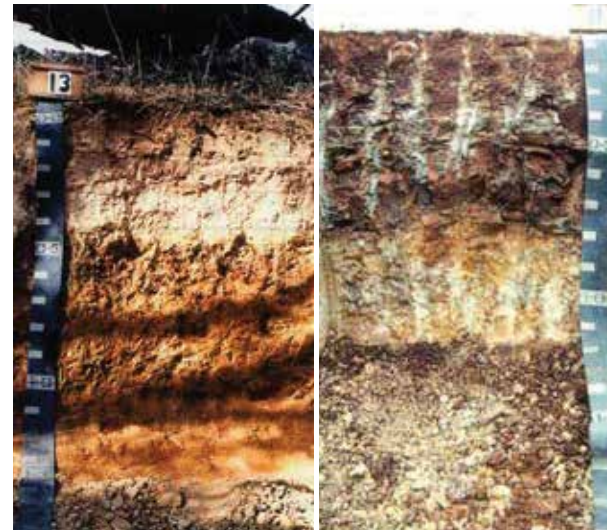
Note sites are from the Victorian Soil Information System: Source DEECA.

Major soil types of the landcare network¹¹



Red Chromosol

Red Dermosol on bedrock



Yellow Sodosol

Red Ferrosol on volcanic bedrock

Map unit ¹⁷	Equivalent land system ¹⁸	Dominant soil types ¹⁹	Major degradation issues
Alluvium associated with wetlands	Axe Creek (AC)	Vertosols, Dermosols, Hydrosols	Compaction; gully erosion; salting in depressions
Alluvium in wetland valley		Dermosols, Chromosols, Kurosols, Sodosols	Waterlogging; compaction, stream bank erosion
Basalt flows	Marydale (MI)	Dermosols, Ferrosols, Vertosols – of variable depth	Minor streambank erosion
Cambrian greenstones	Camel Range (CR)	Red Dermosols, Ferrosols and Sodosols	Sheet erosion on slopes
Colluvium	Myola East (ME)	Shallow stony Chromosols and Sodosols	Sheet / rill erosion on slopes; topsoil compaction
Early Tertiary river gravels	White Hills (WH)	Rudosols, Chromosols and rocky equivalents	Cemented hardpans; Dispersive and prone to gully; leaching common
High relief fractured metasediments	Ida (Ia) James (Js)	Rudosols, Dermosols, shallow Kurosols	Sheet / rill erosion on slopes
High relief granitic terrain	Threaden Hill (TH) Sutton Grange (SG)	Rudosols, deep sands	Extremely prone to sheet / rill erosion; dispersive (sodic) subsoils; mass movement
Low relief granitic terrain	Sidonia (Sa)	Chromosols, Tenosols, Rudosols, Arenosols	Gully / tunnel erosion; nutrient leaching
Low relief granitic terrain, intensely weathered	Lonsdale (Le)	Chromosols, Sodosols	Topsoil leaching; wind erosion
Low relief metasediments (with saprolite)	Wellsford (Wd) Glen Cooe (GC)	Sodosols, Chromosols, Kurosols, Dermosols	Hard setting topsoil; sheet / gully erosion
Low relief metasediments (without saprolite)	Muskerry (My) Kimbolton (Kn)	Sodosols, Chromosols, Kurosols, Dermosols	Vulnerable to sheet erosion; gully erosion where subsoils are exposed; salting in lower depressions / slopes
Permian glacial deposits	Knowsley (Ky)	Sodosols, Chromosols, Rudosols	Sheet erosion; gully erosion / salting
Recent alluvium	Runnymede (Re)	Chromosols, Kandosols	Compaction; gully erosion; wind erosion
Riverine plain alluvium	Runnymede (Re)	Chromosols, Sodosols, Dermosols	Compaction and surface sealing; minor wind erosion

Current soil conditions

Soils and landscapes of the Network have been used for various purposes since European settlement. While there have been studies contrasting soil conditions for 'pasture' and 'undisturbed' sites¹², there are few accounts for the degree of soil removal and degradation through-out this period. Exceptions include accounts of sludge removal due to mining¹³.

It is presumed that through historical land clearance and vegetation removal, there has been extensive loss of soil organic matter and topsoil from many of the region's landscapes. Soil loss no matter whether it is facilitated or transported via wind or water is significant as it will ultimately, over time, impact the drainage lines, watercourses and streams with siltation and silt and sand slugs as well as saline flows from some of the soils.

Soil erosion remains a key issue with significant costs to infrastructure and loss of valuable soil as a habitat and resource for agricultural and ecosystem purposes. Wind erosion remains a national sustainability priority.

A recent assessment¹⁴ estimated an annual erosion rate of 0.29 Mg/ha/yr for 2001 to 2020. This is consistent with soil erosion monitoring sites¹⁵. There are significant variations in wind erosion rates relative to seasonal and monthly differences across Australia. This equates to losses of approximately 1-2 mm per year lost with natural rates of soil formation of 0.02-0.5 mm/year meaning there is a net loss of soil each year¹⁶.

Market driven changes such as changes from pasture to cropping may be significant with changes in climate if it results in landscape scale erosion (more intense summer events) – and who knows what may happen in the future under a significantly changed climate. Other changes such as urbanisation and semi-rural small blocks can bring issues such as accelerated erosion from hard stand areas, inappropriate land use and development together with drainage with faster water movement off site.

Soils section contributed by Dr Nathan Robinson, Senior Research Fellow of Soil Science, Centre for eResearch and Digital Innovation, Federation University Australia. Contributions to the Regional Characteristics provided by RMCG.



Highly impacted Grassland Woodland EVC. Photo credit: Adrian Martins

Soil order	Key diagnostics	Key associated difficulties and constraints
Vertosol	Clay rich soils (>35% clay throughout) with shrink-swell properties and prone to cracking	<ul style="list-style-type: none"> High shrink-swell soils causing local irregular ground surface (melonhole/gilgai) for livestock. Can cause rooting depth limitations. Can be calcareous (soft segregations or nodules) and/or sodic at depth. Subsoils can be dense and compacted. Surfaces can be self-repairing from compaction.
Sodosol	Soils strongly influenced by sodium (sodic B horizon) and strong texture contrast between A and B horizon	<ul style="list-style-type: none"> Sodic and dense subsoil limiting root access and penetration. Can be cracking. Potential surface sealing and compaction, water repellency. Subsoils can be calcareous. Surface often have low soil strength.
Dermosol	Well-structured soils and lack a clear textural change with depth	<ul style="list-style-type: none"> Can be stony and of variable depth. Surface and sub-surface compaction can occur, limiting water and air movement.
Chromosol	Soils with a strong texture contrast between A and B horizons and are not sodic or strongly acidic	<ul style="list-style-type: none"> Surfaces can experience water repellency and nutrient loss where sandy. Compaction of surface and sub-surface may occur in wet conditions. Strongly dense subsoils may limit root growth and water extraction. May be shrink-swell due to clay rich B horizon.
Ferrosol	Soils that are high in free iron oxide in the subsoil and lack a texture contrast between A and B horizons	<ul style="list-style-type: none"> Stoniness may vary along with depth of soil. High clay content and compaction may occur due to trafficking. Can be strongly acidic in the surface.
Kurosol	A strong texture contrast between the A and B horizons and strongly acid in the subsoil	<ul style="list-style-type: none"> Strongly acidic throughout – limiting plant and animal nutrition. Can be highly prone to water erosion – often located in high rainfall environments. Periodic waterlogging often occurs due to dense subsoils. Gravels may occur, also the surface may be quite weak under animal and machinery trafficking.
Tenosol	Soil that are weakly pedal that have deep sandy profiles	<ul style="list-style-type: none"> Water repellency is a major issue along with nutrient deficiency and leaching. Sub-surface pan may be present – limiting root growth and water movement into the subsoil. May be acidic in higher rainfall environments.
Kandosol	Strongly weathered soils with a weak to massive subsoil and little to no texture change with depth	<ul style="list-style-type: none"> Soils can be quite deep and tend to be well drained (whole coloured). Ironstone nodules and gravels are common. Surface can be easily degraded by trafficking leading to surface crusting and sealing. Tend to have low nutrition, hence predominantly native pastures.

Soil order	Key diagnostics	Key associated difficulties and constraints
Hydrosol	Saturation of the greater part of the profile for prolonged periods (2-3+ months)	<ul style="list-style-type: none"> Seasonally or permanently wet soils that are generally unsuitable for grazing. Waterlogging is common, often with clay rich subsoils that can shrink-swell.
Podosol	Sandy soils with a Bh (organic-aluminium), Bhs (organic-aluminium or iron) or Bs (iron) horizon	<ul style="list-style-type: none"> Nutrient deficiency and leaching and water repellency are major limitations of these sandy soils. Sub-surface pan may be present – limiting root growth and water movement into the subsoil. Tend to be acidic throughout with variable amounts of aluminium or organic compounds.
Rudosol	Negligible pedological organisation	<ul style="list-style-type: none"> Nutrient retention is a limitation of these shallow soils. Low water holding capabilities. May have variable stone content.
Calcarosol	Calcareous throughout	<ul style="list-style-type: none"> Surfaces can be water repellent and can be prone to wind erosion. Sodicity at depth is very common, limiting water access to plants. Often weak to poorly structured in the surface and are vulnerable to structure decline due to trafficking. Calcareous gravels and segregations may occur.
Organosol	Dominantly organic soil material	<ul style="list-style-type: none"> Seasonally or permanently wet soils with peaty surfaces that are largely unsuitable for grazing. Poorly drained, often with artificial drainage to remove water for agricultural purposes. Quite acidic throughout the profile.
Anthroposol	Soils significantly impacted or altered by human activities including mixing, truncation, or burial	<ul style="list-style-type: none"> Variable limitations, however, not used often for agricultural purposes (mainly urban development).
Arenosol	Deep sandy soils with <15% clay within the upper 1m of the profile	<ul style="list-style-type: none"> Nutrient deficiency and leaching and water repellency are major limitations of these deep sandy soils. Vulnerable to wind erosion with little structure throughout the profile.



Photo credit: Adrian Martins



How to help our soils and landscapes

Understand and align with existing strategies

- Understand the objectives of the Dhelkunya Dja Country Plan, the Reimagining Bendigo Creek Plan, and the North Central CMA's Regional Catchment Strategy²⁰, Soil Health Action Plan²¹, Waterway Strategy²² and Soils Guide²³.

Conduct landscape scale actions

- Revegetate riparian zones of 40 m to filter and slow water run-off.
- Increase vegetation buffers and landscape cover to reduce water velocity and erosion as well as increasing biodiversity.
- Prioritise soil rehabilitation in climate change adaptation activities.

Engage and educate private landowners

- Assist landholders to understand and implement erosion minimization and control measures.
- Fence off waterways and establish vegetative buffers to minimize erosion.
- Strategically target audience segments to grow human attachment and value for soils.
- Work with developers to understand, value and minimize erosion both on-site and off-site.

Bring-in the broader community

- Facilitate, educate and reward community behaviour-change leading to soil health.
- Monitor water quality and sediment deposition at set points in the landscape.
- Facilitate community connection to soil through education, recreation opportunities, interpretive signage, and Citizen Science.
- Advocate for better environmental planning in urban development to minimize soil erosion and maintain soil cover.



Waterways

The main waterways in the Nature Network are the Campaspe River and Bendigo Creek which form part of the upper catchment of the Murray Darling Basin. There are ephemeral tributaries throughout these catchments that provide important connections for biodiversity, as well as recreational and agricultural value. "The activities around these smaller creeks impact the quality of water for downstream communities and ecosystems²⁴".

Waterways play an integral role in the ecosystem function within the Network landscape. Historically they supported an abundance of life including kingfishers, platypus, native fish and dingoes. They were once considered "the healthy arteries of a catchment system that carried the environmental lifeblood from waterways to floodplains²⁵".

Waterways are critical places for the Dja Dja Wurrung, described in the *Dhelkunya Dja Country Plan 2014-2034* as "the veins of Country, [that] provide food and medicine, and places to camp, hunt, fish, swim and hold ceremonies. They are places that are central to our creation stories, and many of our cultural heritage sites are associated with waterways – burial sites, birthing sites and middens. Our waterways are places that we connect with our ancestors and pass traditional knowledge on to our children and grandchildren²⁶".

For 60,000 years prior to colonisation, these waterways were cared for and managed by the Dja Dja Wurrung people. Historical references including Djaara stories and knowledge, describe creeks connected by a chain of clear pools that were reported to hold permanent water and provide habitat for abundant wildlife²⁷. Anecdotal evidence suggests that deep permanent pools still exist today in Axe Creek, albeit disconnected and in poor condition.

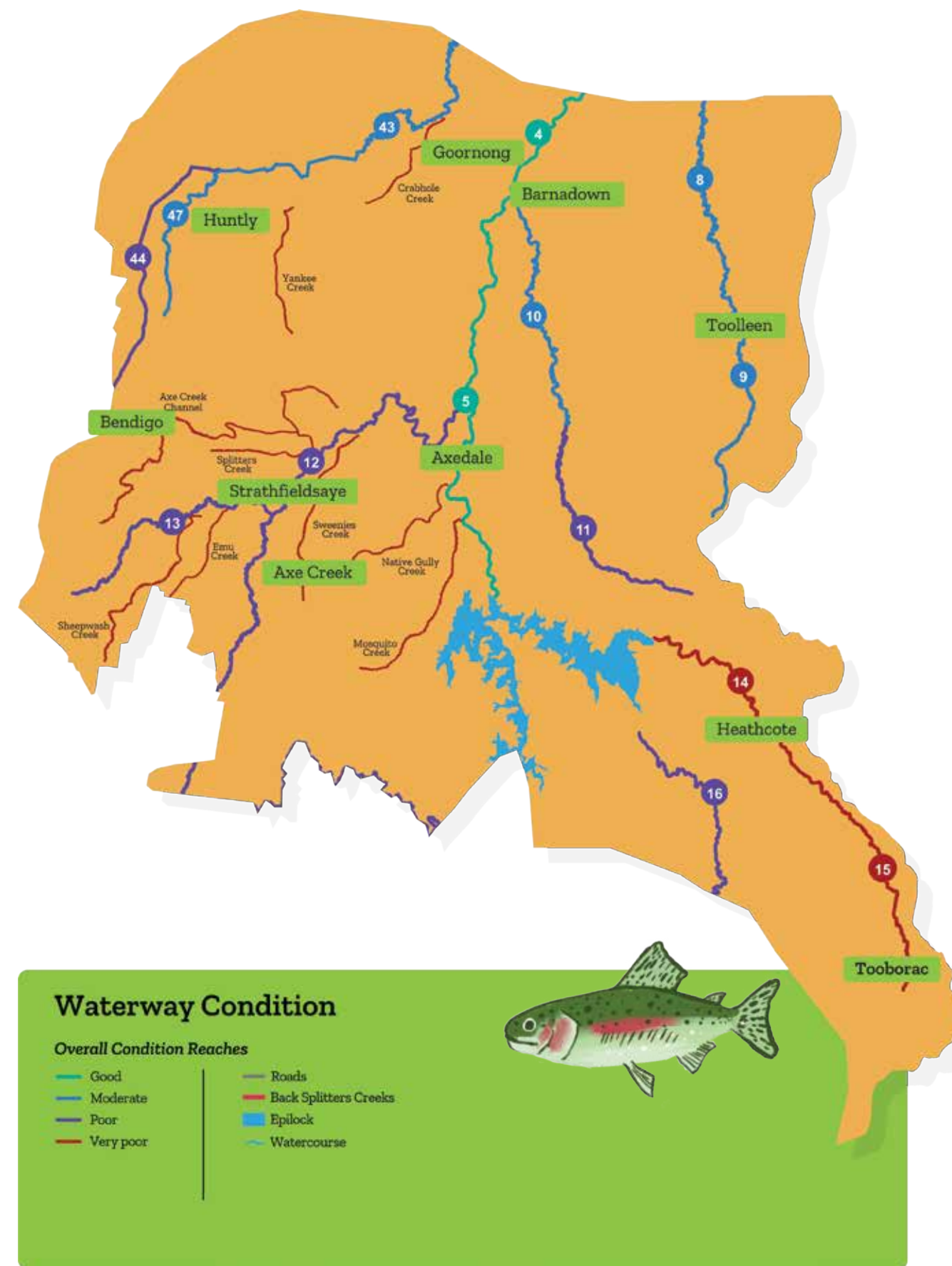
Colonial activities brought about rapid and drastic alterations to the catchment landscape with mass land clearing, and sedimentation in waterways from mining and agriculture. Waterways have been

contaminated by mining sludge and agricultural run-off. These pressures have reduced water quality and impacted aquatic biodiversity.

More recently, population growth in Greater Bendigo has outpaced the Victorian average²⁸ and is one of the fastest developing regional cities in Victoria. High growth corridors are leading to an increase in development and stress along ephemeral waterways including, Bendigo Creek, Back Creek, Axe Creek, Emu Creek, Splitters Creek and Sheepwash Creek.

A growth trend in small acreage lifestyle properties is being experienced in peri-urban locations, where former agricultural land is being sub-divided into hobby farms of approximately 5 – 20 acres. These properties change the hydrology of the landscape by intercepting water with new dams and reducing resilience to drought conditions. Issues are also arising from a proliferation of domestic and stock bores without licences [increasing] the pressure on aquifer systems²⁹.

Urban creeks play an important role in climate change mitigation and urbanisation, particularly as flood events become more frequent and extreme. The Australian Government recognises the importance of urban streams stating they are "an important feature in our cities and suburbs and play a major role in stormwater management and flood control³⁰". They provide an important opportunity for connecting corridors that can act as refuges for fauna as temperatures rise, as well as provide green spaces for human health and wellbeing.



Waterway Condition

Overall Condition Reaches

- Good
- Moderate
- Poor
- Very poor
- Roads
- Back Splitters Creeks
- Epilock
- Watercourse



Threats to waterways

The combination of these threats continues to alter the hydrology in the Network area and continues to create negative environmental impacts such as flash floods and erosion, low flows in drought, bank instability, mature tree loss, habitat fragmentation and poor water quality. Ultimately these impacts contribute to the loss of endangered species and increase the threat level to other flora and fauna species.

Recent flood events, such as the 2022 October flood, demonstrated the importance of small ephemeral creeks in managing intensified run-off in a landscape that is becoming increasingly built-up and unable to absorb water. Floodwaters destroyed road infrastructure, eroded creek banks, swept vehicles and equipment downstream, and threatened lives and livelihoods.

According to the Third Index of Stream Condition Report 2010 (ISC), the streams within the Network are in poor to very poor condition, with the exception of the Campaspe River which is rated as moderate. However, closer analysis of the five sub-categories reveals that there is a long stretch of the Campaspe in very poor condition.

Using the ISC tool, agencies and community can better understand changes to stream condition over time. However, as demonstrated by the Campaspe River example above, it is important to look a little deeper at the data and analyse the 23 metrics contributing to the overall rating. These metrics are broadly categorized under the following sub-indexes: amount of water, riverbank condition and instream habitat, riparian vegetation extent and quality, water quality and macroinvertebrate life³¹.

Best approach to planning and management should use the detailed sub-index scores to understand the issues and priority actions for each stream. More information can be found at www.water.vic.gov.au

The map on the opposite page, shows Third ISC rating (2010) for each of the creeks in the Network area. Where data has not been collected, local Landcare groups have used the sub-index scale to estimate the stream condition.

Regional priorities

The North Central CMA highlights three program areas within the Nature Network area:

- Upper Campaspe, including Heathcote
- Lower Campaspe, including Axedale, Elmore, Toolleen, Mandurang, Axe Creek and Strathfieldsaye
- Loddon Eastern tributaries, including Bendigo, Huntly and Goornong

The North Central Waterway Strategy³² has set objectives to improve the Upper and Lower Campaspe ISC condition from a baseline of moderate/poor/very poor to good. While also striving to increase the condition of riparian zones by one point in the streamside zone sub-index scale.

The regional focus for the Loddon Eastern Tributaries Program Area casts its gaze further downstream to Tang Tang and Thunder Swamps. While these swamps are not in the Nature Network area, it is important for Nature Network environmental groups to recognise that efforts on local streams will support the North Central CMA to deliver important environmental outcomes downstream.

The North Central RCS recognises the role that the community plays in restoring waterways with a priority direction around "build[ing] community awareness and capacity around the management of water resources and waterways, in the context of climate change³³" and "Support, improve and expand the environmental volunteering sector, including Landcare, to enable adaptation to demographic shifts, to continue their important role in natural resource management³⁴."

"Creeks that were frequently flowing streams are often little more than deeply-eroded drains quickly removing water from local landscapes."

By Stuart Andrews, Natural Sequence Farming³⁵

Threats to waterways in the network area

Threats	Impacts
Urbanisation and development	<ul style="list-style-type: none"> • Stormwater directed to ephemeral creeks, leading to contamination, erosion and flash flooding. • Land clearing and built-up areas lead to less soil absorption and increased run-off at higher velocity.
Pest animal and plant infestation	<ul style="list-style-type: none"> • Pest plants out-compete native plants reducing valuable food resources and habitat for native animals, including important species such as the critically endangered swift parrot. • Reduces accessibility for humans to connect with waterways.
Agricultural impacts	<ul style="list-style-type: none"> • Stock access contaminates water and erodes embankments and riparian zones. • Chemical run-off leads to contamination and poor water quality for flora and fauna to flourish. • Over allocation or unlawful extraction of water reduces stream flow and the ability of flora and fauna to survive drought periods.
Fragmentation	<ul style="list-style-type: none"> • Lack of connectivity impacts biodiversity and success of important fauna species such as platypus, brush-tailed phascogales and native fish. • Limits the ability of species to adapt and survive climate change.
Climate change	<ul style="list-style-type: none"> • Occurs faster than adaptation and limits species ability to survive increased temperatures and dry. • The CSIRO reports that the majority of the streamflow gauges in the Loddon River catchment show long-term declines in streamflow.
Private property activities	<ul style="list-style-type: none"> • "Land cleaning" along waterways reduces tree root protection and leads to tree stress and erosion. • Unlawful extraction of water reduces stream flow and the ability of flora and fauna to survive drought periods.
Human connection	<ul style="list-style-type: none"> • Limited human interaction leads to an undervaluation of waterways, particularly small ephemeral streams that are providing a stormwater drain function. • A deeper human connection to waterways could have significant outcomes to waterway condition.



How to help our waterways

Understand and align with existing strategies

- Understand and work to the objectives of the Dhelkunya Dja Country Plan, the Reimagining Bendigo Creek Plan and the North Central CMA Waterway Strategy and Regional Catchment Strategy³⁶.
- Reintroduce native fish in line with the Native Fish Recovery Plan³⁷.

Conduct landscape scale actions

- Create aquatic habitat diversity and connectivity including deep pools.
- Increase aquatic habitat to reduce water velocity and erosion and increase biodiversity.
- Revegetate riparian zones of 40 m to filter and slow water run-off.
- Prioritise waterway rehabilitation in climate change adaptation activities.

Engage and educate private landowners

- Utilise private dams for habitat and native fish breeding.
- Work with developers to understand and value native vegetation.
- Assist landholders to fence off waterways.
- Carve a niche from the waterways that are not prioritized in regional plans.
- Strategically target audience segments to grow human attachment and value for waterways.

Bring-in the broader community

- Facilitate, educate and reward community behaviour-change leading to waterway health.
- Facilitate community connection to waterways through education, recreation opportunities, interpretive signage and Citizen Science.
- Monitor water quality and water bugs through Citizen Science (e.g., Water Watch and River Detectives).
- Advocate for better environmental planning in urban development.

Environmental assessment

Climate change

What's happening now?

"The science is unequivocal: our future depends on achieving steep and genuine emissions reductions this decade³⁸"

Climate Council, 2023

Since 1910, Australia has warmed by an average of 1.47 ± 0.24 °C with the most warming occurring since 1950, and the last eight out of ten years ranking as the warmest on record³⁹.

The Bureau of Meteorology and CSIRO have tracked a thirty-year period pointing to a decrease in annual rainfall, unreliable summer falls, and a delay in the normal autumn rainfall break, in the Nature Network area.

Frosts are more frequent and occur later in the season. Consecutive hot days are also more frequent⁴⁰, and the length of the fire season has increased along with extreme fire weather⁴¹.

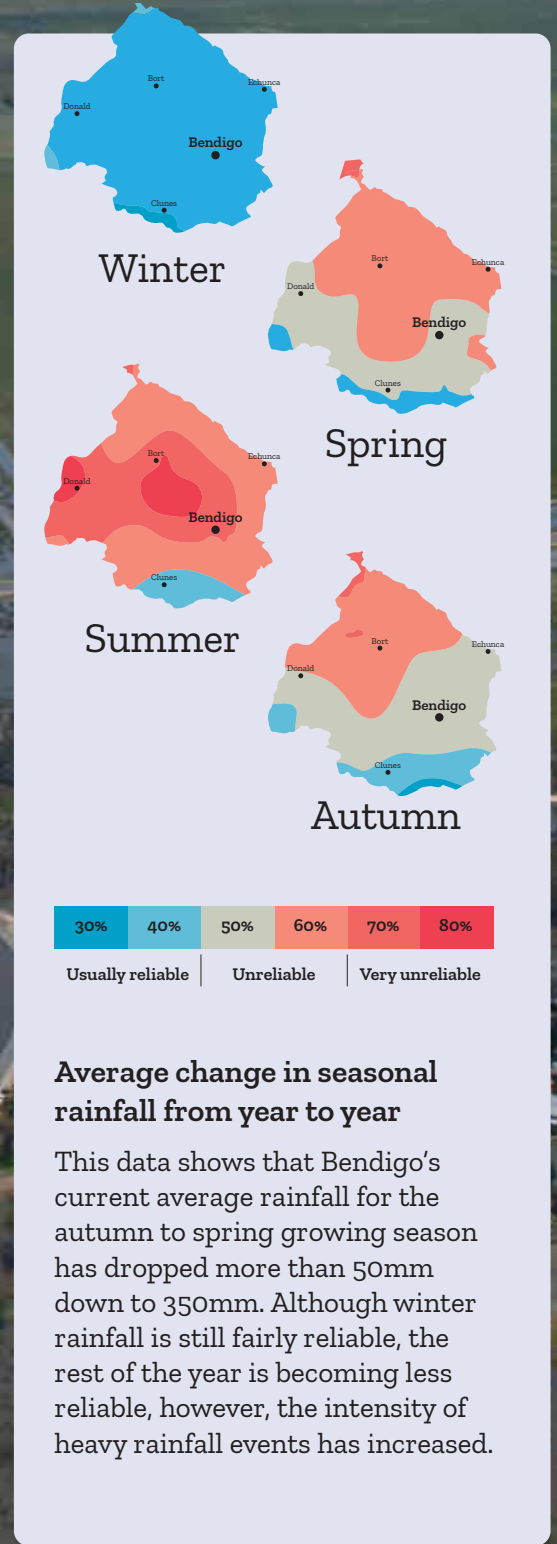
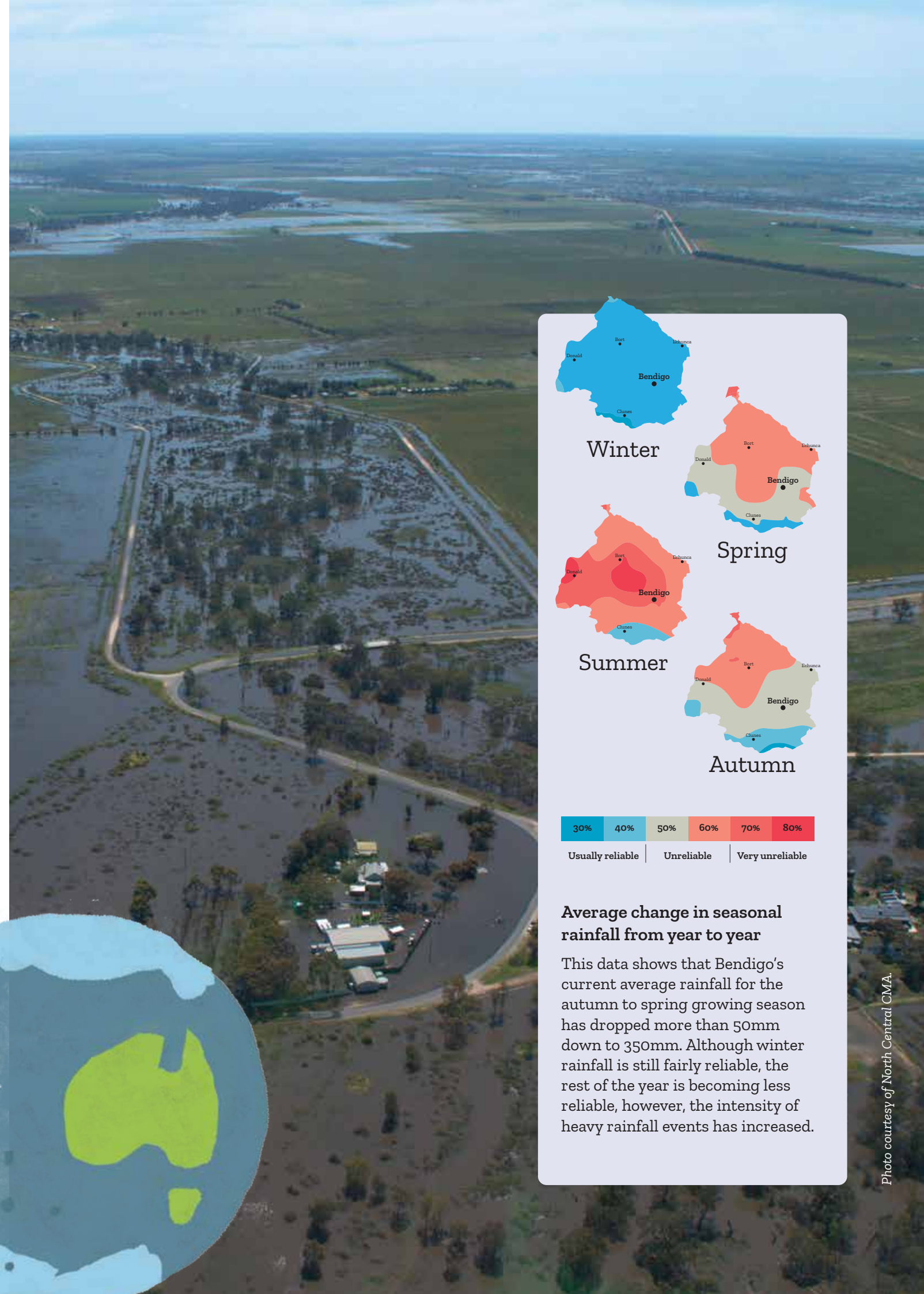
The CSIRO also reports that most of the streamflow gauges in the Loddon River catchment show long-term declines⁴².

Climate change presents the community with a significant challenge and the statistics can be disheartening. However, threats present opportunities. The Blueprint for Action promotes ways the Bendigo community has, is, and can, act to reduce emissions and adapt to climate change.

The Nature Network support structure has potential to increase the capacity of environmental groups and the wider community, to act for the environment, reduce climate change impacts, and implement strategies for accelerated adaptation.

It is important to recognise that the Traditional Owners of this Country cared for the landscape for tens of thousands of years, in a way that did not accelerate climate change; through a symbiotic relationship with the environment that recognised when people care for Country, Country cares for people.

The Dja Dja Wurrung people understand how this Country needs to be healed, and their values play a significant role in climate change mitigation. There is an opportunity for the Nature Network to recognise the wisdom and expertise of the Dja Dja Wurrung people and seek their guidance.



What we can expect

A lot depends on the level of emission reductions and temperature stabilisation the world can achieve, and how quickly. The Victorian State Government and the CSIRO have worked on modelling to help predict climatic changes in the Loddon Campaspe region.

Temperature

Modeling indicates that a high emission scenario could lead to a median increase in maximum temperatures of 1.4°C by the 2030s based on 1986-2005 data. If emissions continue this trajectory, the Network area can expect a mid-century rise of 2.4°C.

Minimum temperatures are expected to rise by 0.8°C by the 2030's and 1.5°C by mid-century under this scenario⁴⁴.

Rainfall

Regardless of natural high variability in rainfall in the network area, under high emissions the CSIRO predicts a 24% decrease in annual total rainfalls, and 33% decrease in important spring rainfall⁴⁵.

Fire

With a new summer season extending from October to April⁴⁶, the number of days where the Forest Fire Danger Index is extreme in the Network area is expected to increase by 11 days or 62% by mid-century under a high emissions scenario. This is due to an expected longer fire season that commences earlier⁴⁷.

The projections from the Vic Government's *Loddon Campaspe Climate Projections 2019* suggest that the Bendigo climate could reflect the current climate in Shepparton by 2050⁴³.

Extreme heat

The hottest summer day temperatures are set to increase by a median of 2.4°C under a high emission scenario, or by 1.5°C in a medium emission scenario. The number of days per year exceeding 38°C, is set to jump from 4.2 days to somewhere between 8 and 16 days, in high emission modelling.

The increase in temperature is expected to generate an increase in heavy rainfall events.

Frost

Under a high emissions scenario, the number of days below 0°C in Bendigo is predicted to decline from 11 days per year to 4-6.5 days per year. However, there is some speculation that an increase in clear cold nights could increase frost risk in the shorter-term. This will eventually be overpowered by the increase in minimum temperature⁴⁸.

North Central CMA state in the North Central Regional Catchment Strategy (RCS) that even a small change can "place species near the limits of their physiological tolerance"⁴⁹.

They go on to explain that changes great or small can create shifts in species distribution across the landscape and that systems already under stress will likely experience accelerated changes to ecological communities.

Although not obvious in the Nature Network landscape, emissions generated in this area contribute to ocean temperatures, rises in sea level and downward trends in snow depth. The activities of the Nature Network and its members groups should be viewed in the larger scheme of climate change.

What do these projections mean for the Network Area?

Threats	Impacts
Increased minimum and maximum temperatures	<ul style="list-style-type: none"> • Longer fire seasons and more intense fires.
Reduced streamflow in already struggling ephemeral tributaries	<ul style="list-style-type: none"> • Fragmentation reducing genetic diversity, promoting disease and local extinctions.
Unpredictable rainfall	<ul style="list-style-type: none"> • Decrease in rainfall during the produce growing season.
Extreme rainfall events will become more intense and frequent	<ul style="list-style-type: none"> • Increased flooding and erosion. • Stress on large old trees. • Threats to life and infrastructure from the impacts of flooding.
Disruptions to natural ecosystem reproductive cycles	<ul style="list-style-type: none"> • Further flora and fauna extinctions.
Accelerated climate change	<ul style="list-style-type: none"> • Inability for flora and fauna species to keep pace to adapt and survive.
Extreme weather events and landscape degradation	<ul style="list-style-type: none"> • Impacts humans physically and psychologically, especially vulnerable people with disabilities, chronic illnesses, low income, children, pregnant women, elderly, First Nations people and the elderly.
Shifting climate patterns	<ul style="list-style-type: none"> • Insecure food supply. • Increase in vector borne disease.

A word on "offsets"

The Australian Climate Council cautions against the growing demand for carbon offset schemes, warning that "while there may be some limited instances where it is appropriate to use carbon offsets, they are no substitutes for doing everything possible to reduce and eliminate emissions in the first place. Anything less is courting climate catastrophe."⁵⁰ Recently the Australian Competition and Consumer Commission (ACCC) has cracked down on 'greenwashing' schemes to put tighter measures around "offset" schemes⁵¹.

The Nature Network has an opportunity to provide bipartisan opinion to the offset conversation and provide a balanced view to its member groups, placing a priority on *preserving* and *enhancing* existing environmental assets over offsetting.

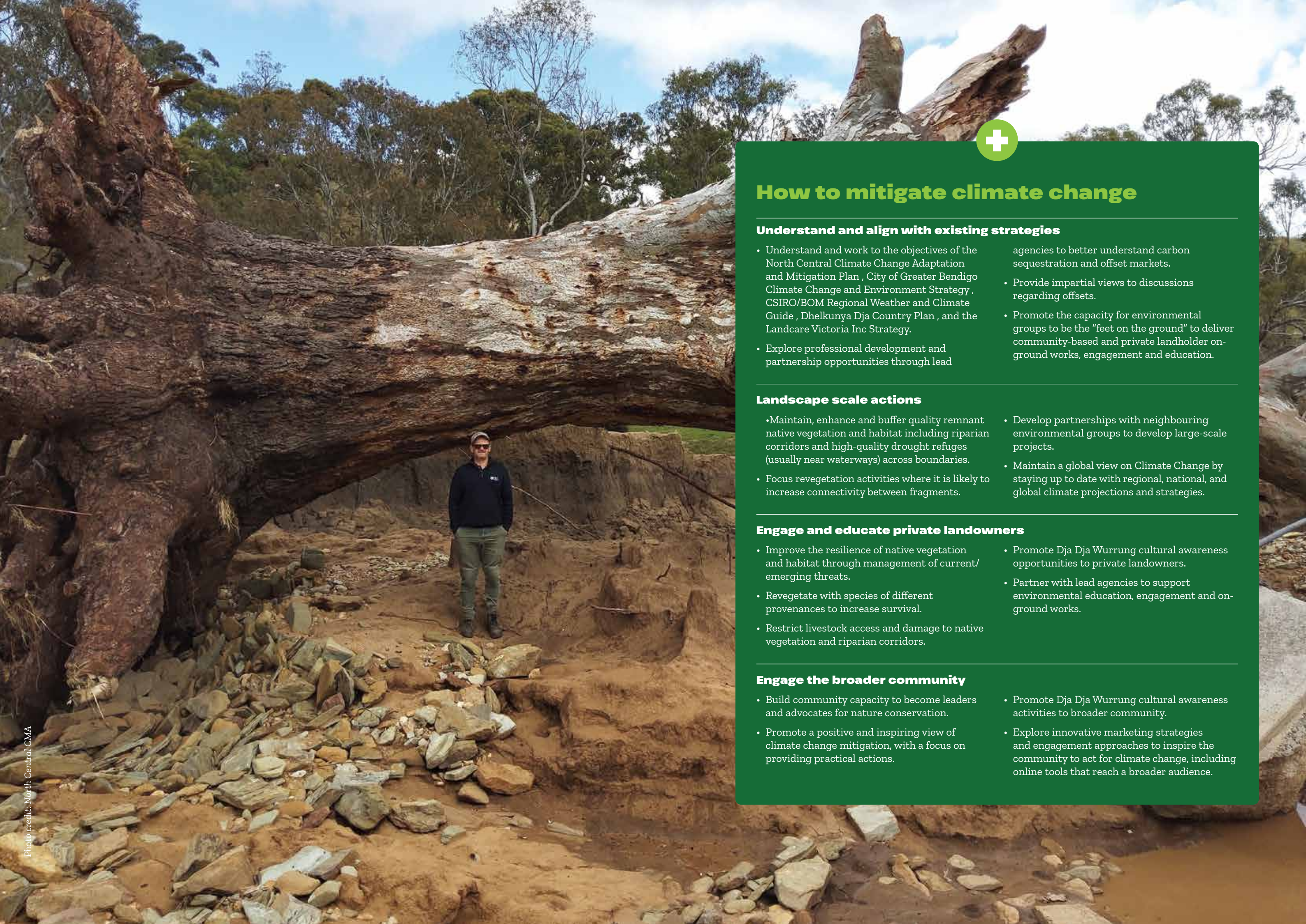


Photo credit: North Central CMA



How to mitigate climate change

Understand and align with existing strategies

- Understand and work to the objectives of the North Central Climate Change Adaptation and Mitigation Plan , City of Greater Bendigo Climate Change and Environment Strategy , CSIRO/BOM Regional Weather and Climate Guide , Dhelkunya Dja Country Plan , and the Landcare Victoria Inc Strategy.
- Explore professional development and partnership opportunities through lead agencies to better understand carbon sequestration and offset markets.
- Provide impartial views to discussions regarding offsets.
- Promote the capacity for environmental groups to be the “feet on the ground” to deliver community-based and private landholder on-ground works, engagement and education.

Landscape scale actions

- Maintain, enhance and buffer quality remnant native vegetation and habitat including riparian corridors and high-quality drought refuges (usually near waterways) across boundaries.
- Focus revegetation activities where it is likely to increase connectivity between fragments.
- Develop partnerships with neighbouring environmental groups to develop large-scale projects.
- Maintain a global view on Climate Change by staying up to date with regional, national, and global climate projections and strategies.

Engage and educate private landowners

- Improve the resilience of native vegetation and habitat through management of current/ emerging threats.
- Revegetate with species of different provenances to increase survival.
- Restrict livestock access and damage to native vegetation and riparian corridors.
- Promote Dja Dja Wurrung cultural awareness opportunities to private landowners.
- Partner with lead agencies to support environmental education, engagement and on-ground works.

Engage the broader community

- Build community capacity to become leaders and advocates for nature conservation.
- Promote a positive and inspiring view of climate change mitigation, with a focus on providing practical actions.
- Promote Dja Dja Wurrung cultural awareness activities to broader community.
- Explore innovative marketing strategies and engagement approaches to inspire the community to act for climate change, including online tools that reach a broader audience.

Environmental Assessment

Land use

Prior to European settlement, the Nature Network area supported the Djaara people and an abundant diversity of flora and fauna, including many now critically endangered and vulnerable species. The land provided plants and wildlife for food, medicine, tools, and shelter.

Historical

The Traditional Owners were the first gardeners and custodians of this land, they cared for and used this Country "in a way that [made] provision for future needs", understanding the interdependency between people and their environment.

The discovery of gold in 1851 was followed by an influx of migrants and a significant period of unsustainable land use practices that disrupted natural ecological processes. The development of intensive agriculture and rapidly expanding mining industry led to widespread clearing of forests to provide timber for buildings, domestic firewood, fuel and mining.

Waterways were polluted with mining waste and topsoil was removed. The land became known as "upside down Country" by Traditional Owners⁵².

"Dja Dja Wurrung Country is host to some of the most profoundly altered landscapes in Victoria."⁵³

From the Dhelkunya Dja Country Plan

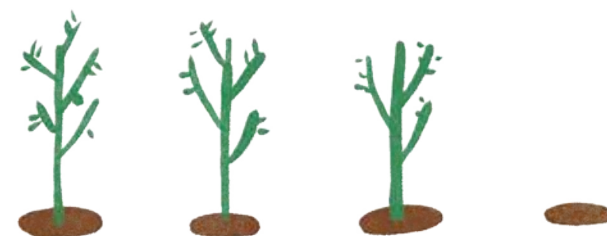
Current

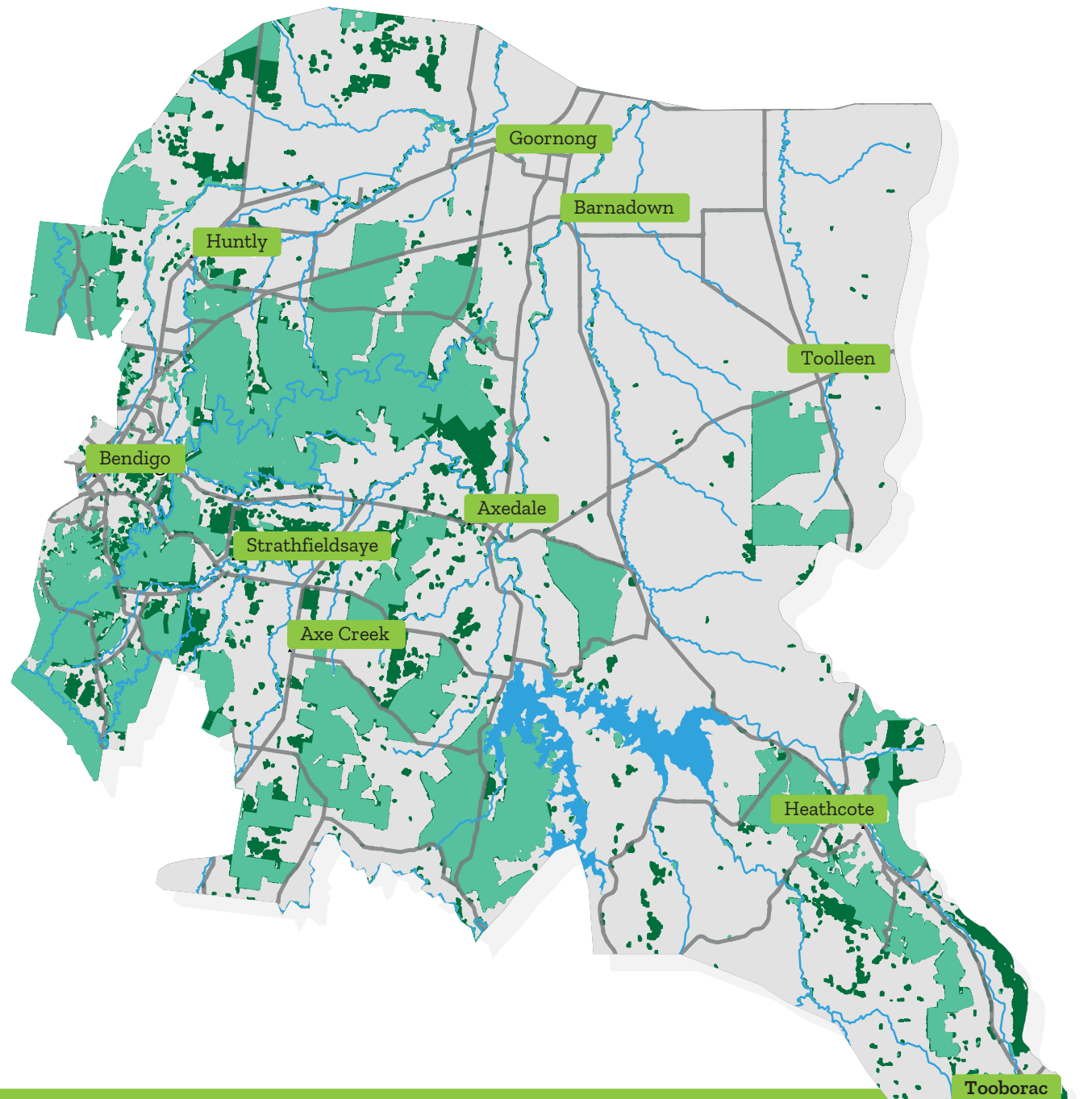
The legacy of colonial activities, along with urban development and changing weather patterns, has resulted in extensive modification of the landscape. Native vegetation in the Nature Network area is predominantly regrowth except for some high-quality remnant vegetation pockets on roadsides and in Bendigo's parks, forests, and reserves. These pockets are often highly fragmented and generally in poor condition.

Legacy impacts also extend to the condition of streams, depleted soils, groundwater contamination, and a list of threatened species⁵⁴.

While Bendigo has a colonial history of over-using the forests and woodlands, Bendigo remains uniquely, a city in the forest, surrounded by national, state and regional parks and reserves (refer to Tree Cover Public vs Private map on pages 32-33).

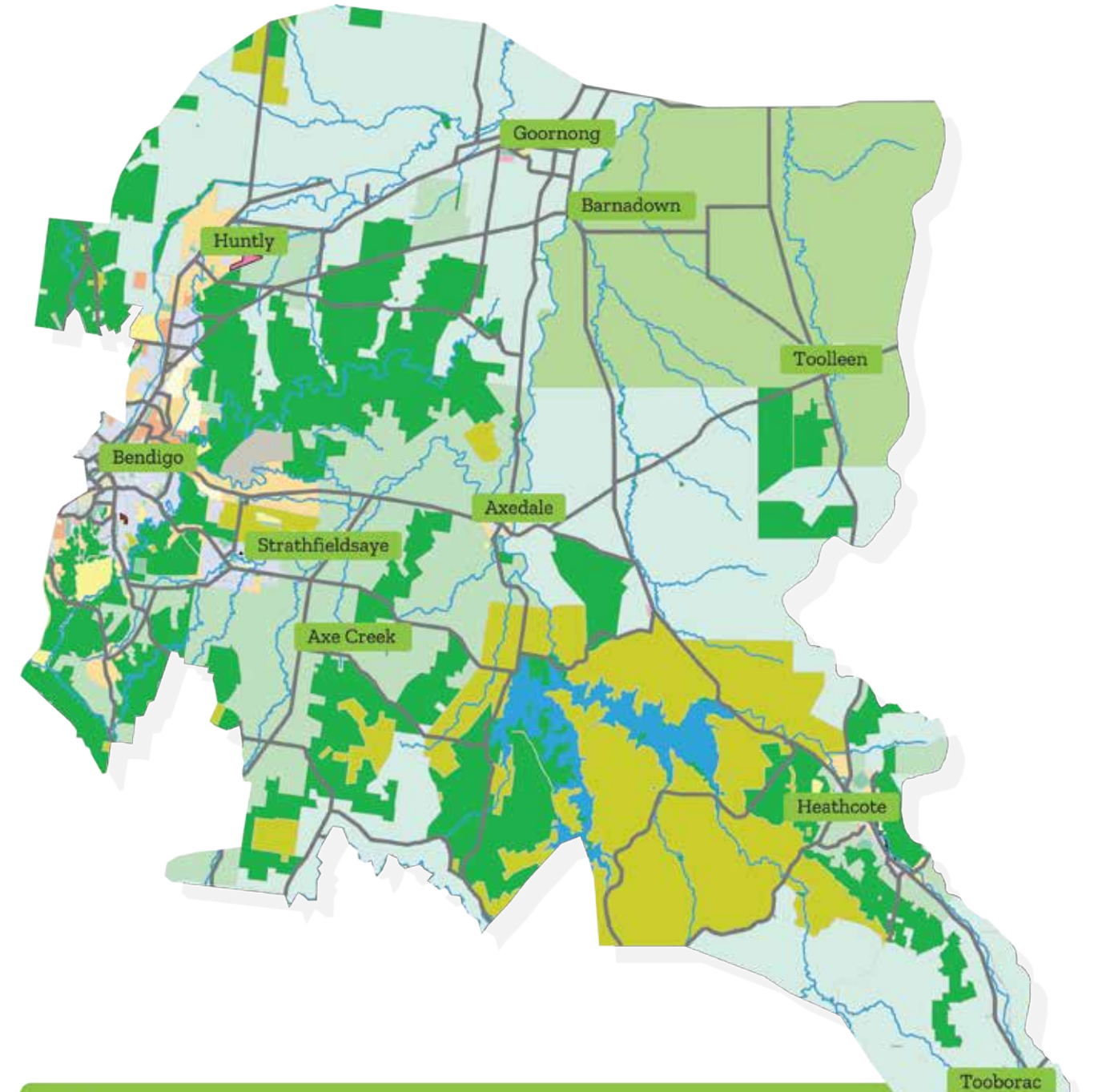
The forests are now structurally different to the "open forests and woodlands" described by Traditional Owners⁵⁵. Regrowth is often characterised as overly dense trees of similar age, dominated by one or two species, and includes significant coppice regrowth. This structure out-competes understory species and reduces habitat for important fauna species.





Tree Cover Public vs Private

- Tree Cover on Public Land
- Tree Cover on Private Land
- Roads
- Epilock
- Watercourse



Planning Zones as at 2021

Planning Zones 2021

- Commercial zones
- Commonwealth
- Farming zone
- Farming zones
- General residential zone
- Industrial zones
- Low density residential zone
- Mixed use zones
- Public conservation & resource zone
- Public park & recreation zone
- Public use zones (utility, education, health etc)
- Residential growth zones
- Road zone
- Rural conservation zones
- Rural living zones
- Special use zones
- Township zone
- Urban floodway zone
- Urban growth zone
- Roads
- Epilock
- Watercourse

Mining

Mining still features in our landscape with the largest local mine located at Posterville, east of Bendigo and north of Axedale. It is now primarily an underground gold mine; however, it was an open cut or surface mine during its initial years of operation.

Several exploration licenses are held by different organisations for minerals such as gold, platinum, silver and antimony in the east Bendigo region. One mine is proposing to treat mine tailings in the Bendigo Creek, Huntly Streamside Reserve. More information can be found at Earth Resources Victoria⁵⁶.

Urbanisation

Greater Bendigo is experiencing one of the highest growth rates in Victoria⁵⁷ and has adopted the *Loddon Mallee South Regional Growth Plan* which includes a population target of 200,000 by 2050⁵⁸. Greater Bendigo must build an average of 820 new dwellings per annum between 2014 and 2031 to meet forecasted demand⁵⁹.

2014 data highlighted that 15% of Greater Bendigo's demand for new homes is being met by development in Heathcote, Elmore, Marong, Axedale and rural areas. Pertinent to the Nature Network area, is the identification of Huntly pushing south and east, and Strathfieldsaye pushing south, as key urban development zones in the *Bendigo Residential Development Strategy 2014*⁶⁰ (refer to *Planning Zones as at 2021 map on page 32*).

In addition to the data and strategies provided by government agencies, Nature Network member groups report strong development growth in areas such as Mandurang, Junortoun, Axe Creek, Emu Creek, Sedgwick and Eaglehawk; with much of these areas now zoned as Rural Living.

Towards the inner east and south of Bendigo, large agricultural and rural living blocks are being subdivided into smaller rural residential blocks or "lifestyle" properties. The property goals for these new lifestyle properties can be roughly segmented into bush blocks for conservation; equine properties; or, small producers, including commercial micro-production, permaculture, and small numbers of livestock for personal consumption.

The creep of urbanisation into rural landscapes to accommodate increasing population, is recognised at a local and international level, with peak organisations like UNESCO stating that "changes

within these areas can have significant impacts upon agricultural uses and productivity, environmental amenity and natural habitat, supply and quality of water and water and energy consumption.⁶¹"

Through the *Bendigo Residential Development Strategy*, the City of Greater Bendigo has committed to protect the environmental assets of Greater Bendigo, and in particular Crown Land and areas with significant biodiversity values⁶².

City of Greater Bendigo also has a Greening Greater Bendigo Action Plan which aims to improve the health of urban forest and increase community engagement in environmental stewardship⁶³; and is due to release a Biodiversity Strategy and Action Plan to guide the management and protection of our local unique landscapes and species⁶⁴.

Under the City of Greater Bendigo Bushcare Incentive Program⁶⁵, landholders are encouraged to covenant their property, with a 100% annual rate rebate and a one-off payment of \$25 per hectare. This incentive program is supported by Trust for Nature Victoria. A similar scheme exists in the Mitchell Shire south of Heathcote/Tooborac.

A Trust for Nature (TFN) covenant is a permanent and legally binding agreement, voluntarily entered by landholders, to ensure native vegetation is protected in perpetuity.

According to TFN's State-wide Conservation Plan, Box ironbark forest, herb-rich woodlands, plains woodlands, and wetlands are ecosystems with the highest proportion of their extent on private land and with the least amount of covenant protection. Some of these are dominant ecosystems in the Nature Network area.

Land use threats to the nature network area

Threats	Impacts
Development and urbanisation	<ul style="list-style-type: none"> • Significant population growth and urban planning pushing urbanisation further into rural areas, leading to increased clearing, fragmentation, soil degradation, waterway pollution and hydrology changes. • Interruptions to natural fire regimes due to increased life and property risk analysis. • Property "cleaning" reduces important habitat for native fauna, flora and fungi. • Introduction of pest flora and fauna species. • Reduction in biolinks for climate change resilience and genetic diversity.
Changing land use	<ul style="list-style-type: none"> • Increase in "lifestyle" properties leading to greater audience and more diverse property goals. • Change of demographic brings changing attitude to land and requires additional education. • Increase in small producer activities increase biosecurity risks. • Improper management techniques lead to further declines in topsoil, soil health and increases chemical inputs.
Mining	<ul style="list-style-type: none"> • Continuing mining activity leading to further 'upside down Country' and clearing of important habitat. • Contamination risks.
Soil degradation	<ul style="list-style-type: none"> • Depleted, compacted and contaminated soils become inhospitable for native plant species. • Changes to soil structure prevents water retention.
Land clearing	<ul style="list-style-type: none"> • Technology, sedentary and inactive lifestyles lead to disconnection with nature and inaction. • Unawareness and unfamiliarity of nature leads to poor land management, powerlessness, and inaction.
Human connection	<ul style="list-style-type: none"> • Technology, sedentary and inactive lifestyles lead to disconnection with nature and inaction. • Unawareness and unfamiliarity of nature leads to poor land management, powerlessness, and inaction.



Photo credit: Peter Weaving



People

Public land is used for recreational purposes including motor bike riding, mountain bike riding, bushwalking, camping, bird watching and health and wellbeing activities. Survey responses from Nature Network member groups indicate that people are keen to understand the environment better and participate in activities that build their connection to, and stewardship of nature.

The Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) is developing an environmental ecosystem accounting framework to estimate the economic and social value of the environment⁶⁶. It has identified that ecosystem services play a significant role in the health and wellbeing of people.

Traditional owners

The Dja Dja Wurrung People recognise the importance of connection to nature and continue to advocate for their right to care for Country.

In 2013 the Dja Dja Wurrung group of clans were recognised by the Victorian Government through the Recognition and Settlement Agreement⁶⁷, as the Traditional Owners of most of the Nature Network landscape. In 2018 the Taungurung group were recognised as the Traditional Owners of the southernmost part of the Nature Network area around Heathcote and beyond⁶⁸.

Djaara have secured rights to joint management of the Greater Bendigo National Park, however they are still restricted in their practices, particularly around fire. Djaara continue to advocate for their "inherent right to heal, restore and decolonise Country", including the Nature Network area⁶⁹.

Food for thought

In 2019 Bendigo joined Melbourne, Geelong, Sydney, Adelaide and Ballarat, to become a UNESCO Creative City of Gastronomy. Through this membership, Bendigo is recognised for its commitment to "environmental sustainability, sustainable agriculture and food production while tackling climate change⁷⁰".

This membership has bolstered interest in micro production projects on small scale farms and presents an opportunity for conservation groups to support the link between a changing demographic, biodiversity, sustainable living, and food.

Public land

The Nature Network area covers several public land parks and reserves including:

- Garden Gully Reserve
- Bendigo Regional Park
- Wellsford State Forest
- Lyell State Forest
- Sedgwick State Forest
- Pilchers Bridge Nature Conservation Reserve
- Longlea State Forest
- Greater Bendigo National Park (jointly managed with Djaara)
- Bendigo Creek Streamside Reserve
- Huntly Streamside Reserve
- Whipstick Nature Conservation Reserve
- Strathfieldsaye Streamside Reserve

These areas are fragmented across the landscape. Cooperation and participation from landowners along corridors between and adjoining parks could lead to improved natural values, genetic diversity of species and connectivity. Maintaining genetic diversity is critical to enable fauna and flora to be able to adapt to a changing climate.





How to mitigate land use impacts

Understand and align with existing strategies

- Understand the land management objectives of Traditional Owners through the' Dhelkunya Dja Country Plan⁷¹, Galk-galk Dhelkunya Forest Gardening Strategy⁷², and Joint Management Plan for the Dja Dja Wurrung Parks: Strategy⁷³, Bendigo Residential Development Strategy 2014⁷⁴, Greening Greater Bendigo Action Plan⁷⁵, and City of Greater Bendigo Biodiversity Plan⁷⁶.
- Use the DCCEEW environmental ecosystem accounting framework to present a case for community engagement activities and planning input.

Landscape scale actions

- Understand the changes to planning and urbanisation in the Nature Network area.
- Advocate for minimal land clearing for development and urbanisation.
- Emphasise the importance of enhancing biolinks across the landscape.

Engage and educate private landowners

- Seek insights from private landowners to understand changing demographics.
- Develop education programs and resources for private landowners to learn environmental property stewardship.
- Support existing projects and agencies to deliver small-property strategies e.g. Bendigo Gastronomy and Healthy Landscapes.
- Promote opportunity for individual landholders to have their property recognised for its ecological/biodiversity values through organisations such as TFN and Land for Wildlife⁷⁷.

Engage the broader community

- Contribute to mining sector community consultation processes.
- Contribute to planning and development activities with government agencies.



Environmental assessment

Native flora

The Nature Network region is part of the Goldfields bioregion. Prior to colonisation it was dominated by important Ecological Vegetation Class (EVC) including Box Ironbark Forests, Heathy Dry Forests, Grassy Woodlands and Plains Woodlands.

These four EVC formed part of a continuous belt of temperate eucalypt woodlands that once covered southeast Australia⁷⁸ (refer to Pre-colonial vegetation map, page 46) and was described by Djaara people as "open forests and woodlands"⁷⁹.

The Traditional Owners of this area utilised the abundant flora for a multitude of purposes including lomandra for basket weaving; buloke and red gum for tools; and nardoo, yam daisies and wattle seed for food and medicine.

The Box-Ironbark Forests, Heathy Dry Forests and Grassy Woodlands EVC remain the dominant classes

Trees and shrubs of the box Ironbark forest, heathy dry forest and grassy Woodland

These forests are generally characterised by dominating tree species such as ironbark, grey-box, yellow box, red box, white box, red stringybark, river red gum and some mallee eucalypts. These are some of the most prolific flowering eucalypts and are a food source for many resident and migratory birds such as lorikeets, honeyeaters and the critically endangered swift parrot.

Ground covers of the box ironbark and grasslands

The groundcover contains a mixture of plants which includes some of the largest concentrations of orchids of any Victorian ecosystem, such as wax-lips, sun-orchids, beard-orchids, onion-orchids, leopard-orchids. There are also several small herbs and shrubs which are most abundant in, or more-or-less restricted to the box ironbark region.

Critically endangered and endangered orchids have been observed in the Nature Network region including: the globe-hood sun-orchid,

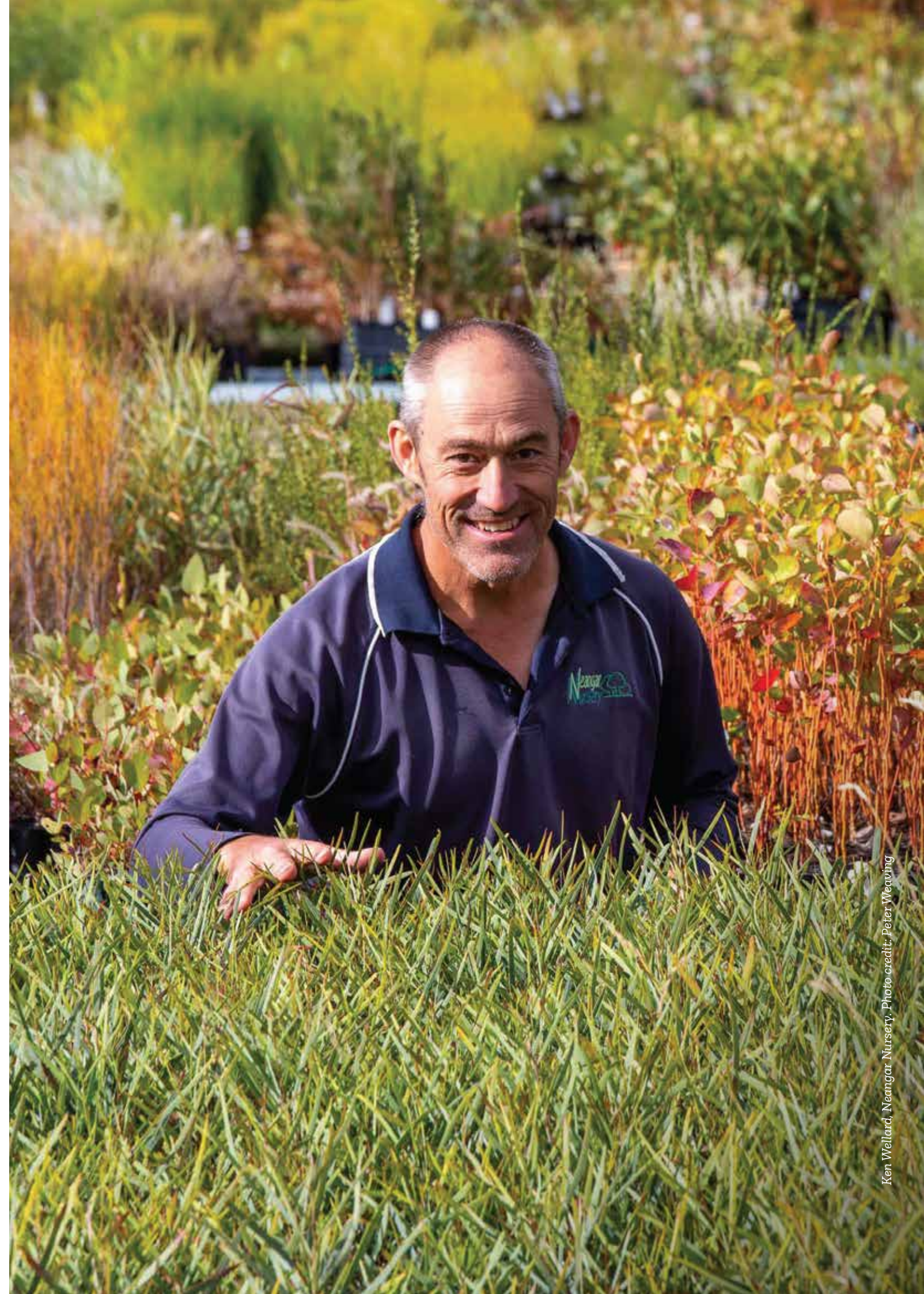
for the area, however they are highly fragmented and in poor condition due to legacy activities of colonisation⁸⁰ (refer to Current vegetation map, page 47). Plains Woodland is often now overlooked as a dominant EVC due to its significant degradation and loss.

Forests in this area are now overcrowded by dominant species which limit understorey species' ability to thrive. This in turn limits the ability of the forest to regenerate biodiversity and restricts ecosystem functions.

There are several acacias, cassinias, tea-trees, wattles and grevillias also found in the Box Ironbark Forests and some woodlands. Endangered trees and shrubs include the ausfeld's wattle and bent-leaf wattle, buxton gum, blue mallee, whirrakee wattle, whipstick westringa and dwarf and cottony cassinias⁸¹.

McIvor spider orchid, swamp Leek orchid and the tan leek-orchid, woodland Leek-orchid and the emerald lip greenhood⁸².

In small pockets of the Network area are Grassy Woodlands, which commonly support species such as wallaby grasses, spear grasses, spider grasses, windmill grass, panic grass, darling peas, daisies and saltbushes⁸³.



Ken Wellard, Neangar Nursery. Photo credit: Peter Weaving

Dominant EVCs

Box Ironbark Forest

Status: Depleted

Box Ironbark Forest grows in low rainfall areas on undulating rises and low hills on stony and naturally poor fertility soils.

It has an open canopy with 20m tall eucalypts, usually including an ironbark species. The midstory usually consists of a dense to open shrub or small tree layer. The ground layer is usually open with a range of herbs and grasses.

It dominates the Nature Network region, particularly in reserves and parks. Many midstory and ground story species are similar to those found in the Heathy Dry Forest.

The large patches of Box-Ironbark that occur throughout Bendigo, Axe Creek and Huntly. While the extent of this EVC is reasonable in comparison to some other EVC, colonial actions including widespread tree removal for mining and agriculture, have led to structural changes⁸⁴, reduced biodiversity and overall depletion.

Common species found in this EVC are:

Grey box – *Eucalyptus microcarpa*
Red box – *Eucalyptus polyanthemos*
Red Ironbark – *Eucalyptus tricarpa*
Yellow gum – *Eucalyptus leucoxydon*
Golden wattle – *Acacia pycnantha*
Drooping cassinia – *Cassinia arcuata*
Shining everlasting – *Xerochrysum viscosum*
Bristly wallaby grass – *Austrodanthonia setacea*

Heathy Dry Forest

Status: Least Concern

Heathy dry forest grows in rocky shallow soils on hills and exposed aspects of ridge tops and steep slopes, and on a range of elevations.

It is characterised by a low open eucalypt forest and an understory dominated by shrubs such as heaths and peas. Grasses are usually present in the ground layer but do not provide much cover.

Heathy Dry Forest is found in pockets within the Box Ironbark Forest, mostly to the south of Bendigo around Axe Creek, Mandurang, Junortoun, Longlea and Heathcote.

Common species found in this EVC are:

Red stringybark – *Eucalyptus macrorhyncha*
Red box – *Eucalyptus polyanthemos*
Red Ironbark – *Eucalyptus tricarpa*
Bundy – *Eucalyptus goniocalyx* s.s.
Golden wattle – *Acacia pycnantha*
Cats claw grevillea – *Grevillea alpina*
Supple spear grass – *Austrostipa mollis*
Grey tussock grass – *Poa sieberiana*

Grassy Woodland

Status: Vulnerable

Grassy Woodland is characterised by an open eucalypt woodland across a range of soil types. It is often found on poorly drained soils or fertile soils on undulating plains at low elevations.

The understory consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer.

It occurs in the Nature Network area throughout Axe Creek, Mandurang, Longlea, Axedale, Strathfieldsaye, Heathcote, Toolleen, Huntly and Goornong.

Common species found in this EVC are:

Grey box – *Eucalyptus microcarpa*
Yellow box – *Eucalyptus melliodora*
River red gum – *Eucalyptus camaldulensis*
Buloke – *Allocasuarina luehmannii*
Gold dust wattle – *Acacia acinacea* s.l.
Hard-head daisy – *Brachyscome lineariloba*
Wattle mat-rush – *Lomandra filiformis*
Bristly wallaby grass – *Austrodanthonia setacea*

Other important ecological vegetation classes

Also greatly impacted are important EVC that previously dominated waterways in the Network area, all of which are now highly degraded and classified Endangered⁸⁵:

Plains Woodland occurred along Axe Creek, Sheepwash Creek, and Emu Creeks in the southeast; Back Creek, Bendigo Creek, Crabhole Creek in the north; and Forest Creek and Mt Pleasant Creek in the east.

Alluvial Terraces Herb Rich Woodland/Creekline Grassy Woodland Mosaic occurred along Yankee Creek in the north, and Native Gully Creek and Mosquito Creek in the south.

Floodplain Riparian Woodland occurred along the Campaspe River and the northern end of McIvor Creek.

Damp Sands Herb-rich Woodland below Tooborac.



Key species within the network area



McIvor spider-orchid
(*Caladenia audasii*)
Status: Endangered⁸⁶

Habitat: It is found in box-ironbark forests and woodlands of central Victoria on sandstone. Its potential range covers EVCs throughout the entire Nature Network area as well as further west. They generally occur in fragmented areas.

Threats: weed invasions, grazing by native and introduced herbivores, inappropriate fire regimes and human impacts.



Ausfeld's wattle
(*Acacia ausfeldii*)
Status: Endangered⁸⁷

Habitat: It is found in dry forests mostly on gravels throughout central Victoria and has been observed in forests around the Nature Network region.

Main threats: development, inappropriate fire regimes for young plants.



Buloke
(*Allocasuarina luehmannii*)
Status: Critically Endangered⁸⁸

Habitat: It is found on roadsides and in paddocks throughout the Nature Network area. Several species have been observed in urban areas of Golden Gully, between Flora Hill and Strathfieldsaye and north of the network area between Axedale and Fosterville.

Main threats: lack of recruitment, habitat fragmentation, grazing, development, competition from weeds.

Photo credit: Geoff Park



Whirrakee wattle
(*Acacia williamsonii*)
Status: Vulnerable⁸⁹

Habitat: Endemic to the Bendigo region, this wattle is mainly found around the dry sclerophyll forests of Huntly and Whipstick.

Main threats: fragmentation, roadside clearing, development, and perceived fire threat.

Photo credit: Northern Bendigo



Goldfields grevillea
(*Grevillea dryophylla*)
Status: Endangered⁹⁰

Habitat: It is found in dry forests throughout the Nature Network area. Particularly in the more western parts of the network area between Golden Gully and Mandurang.

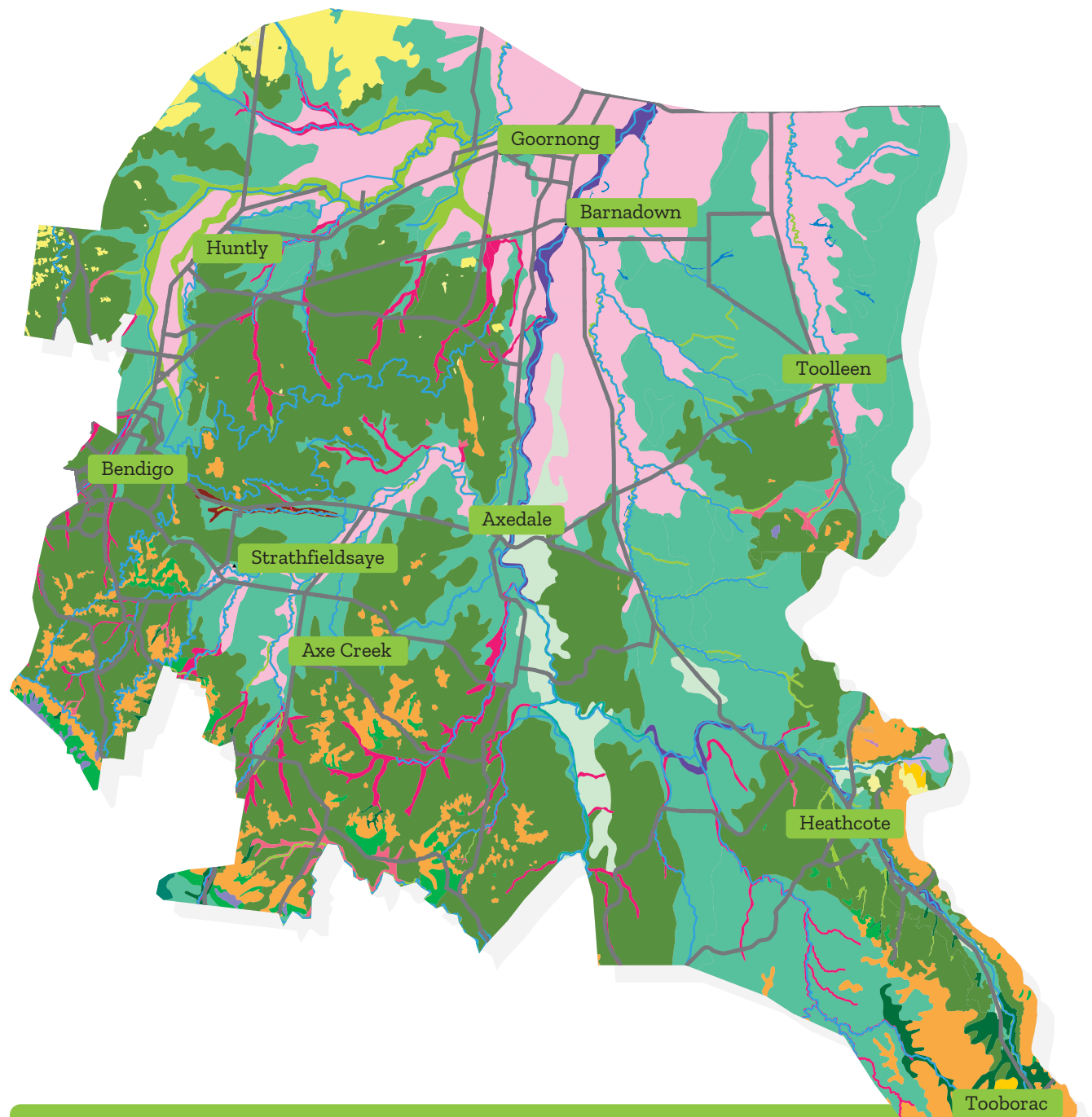
Main threats: development, inappropriate fire regimes, and weed invasion.

Photo credit: Adrian Martins

Threats to the Network area's EVCs remain significant today, particularly those relating to urbanisation in one of Victoria's fastest growing regional cities⁹¹. Bendigo growth corridors coincide with valuable patches and remnants of EVCs, leading to continued removal of large old trees and remnant vegetation, and fragmentation.

Threats to flora in the network area

Threats	Impacts
Planned burns	<ul style="list-style-type: none"> Hot fire at the wrong time may interrupt flora life cycles and eliminate important species.
Agriculture	<ul style="list-style-type: none"> Removal of valuable old trees. Stock access to EVCs can cause compaction and graze native plants. Application of chemicals and fertilisers reduce growing conditions for native species.
Urbanisation and development	<ul style="list-style-type: none"> Increased land clearing and fragmentation. Ground disturbance. "Land cleaning" removes important flora, fungi and habitat. Stormwater directed to important EVC zones along ephemeral streams. Land clearing and built-up areas lead to less soil absorption and increased run-off i.e. less water is retained in the soil.
Pest plant infestation	<ul style="list-style-type: none"> Introduction of invasive and exotic weeds. Escaping garden plants. e.g. Gazania
Pest animals	<ul style="list-style-type: none"> Introduced animal species place pressure on native plant resources e.g. rabbits. Concentrations of native animal species, particularly adjacent to urban environments can place pressure on native plant resources.
Climate Change	<ul style="list-style-type: none"> Occurs faster than adaptation and limits species ability to survive increased temperatures and unreliable rainfall conditions.
Equine land use	<ul style="list-style-type: none"> Compaction and grazing lead to inhospitable growing conditions.
Legacy soil degradation	<ul style="list-style-type: none"> Depleted, compacted and contaminated soils become inhospitable for native plant species. Changes to soil structure prevents water retention.
Forest & woodland structure	<ul style="list-style-type: none"> Mass clearing has led to overall changes in forest structure preventing some species from re-establishing and contributing to biodiversity values.
Human connection	<ul style="list-style-type: none"> Lack of understanding of how native flora 'should' look can lead to a lack of appreciation of biodiversity issues and inaction. Human disconnect from nature prevents people from understanding the holistic value of plants in ecosystems and human health.

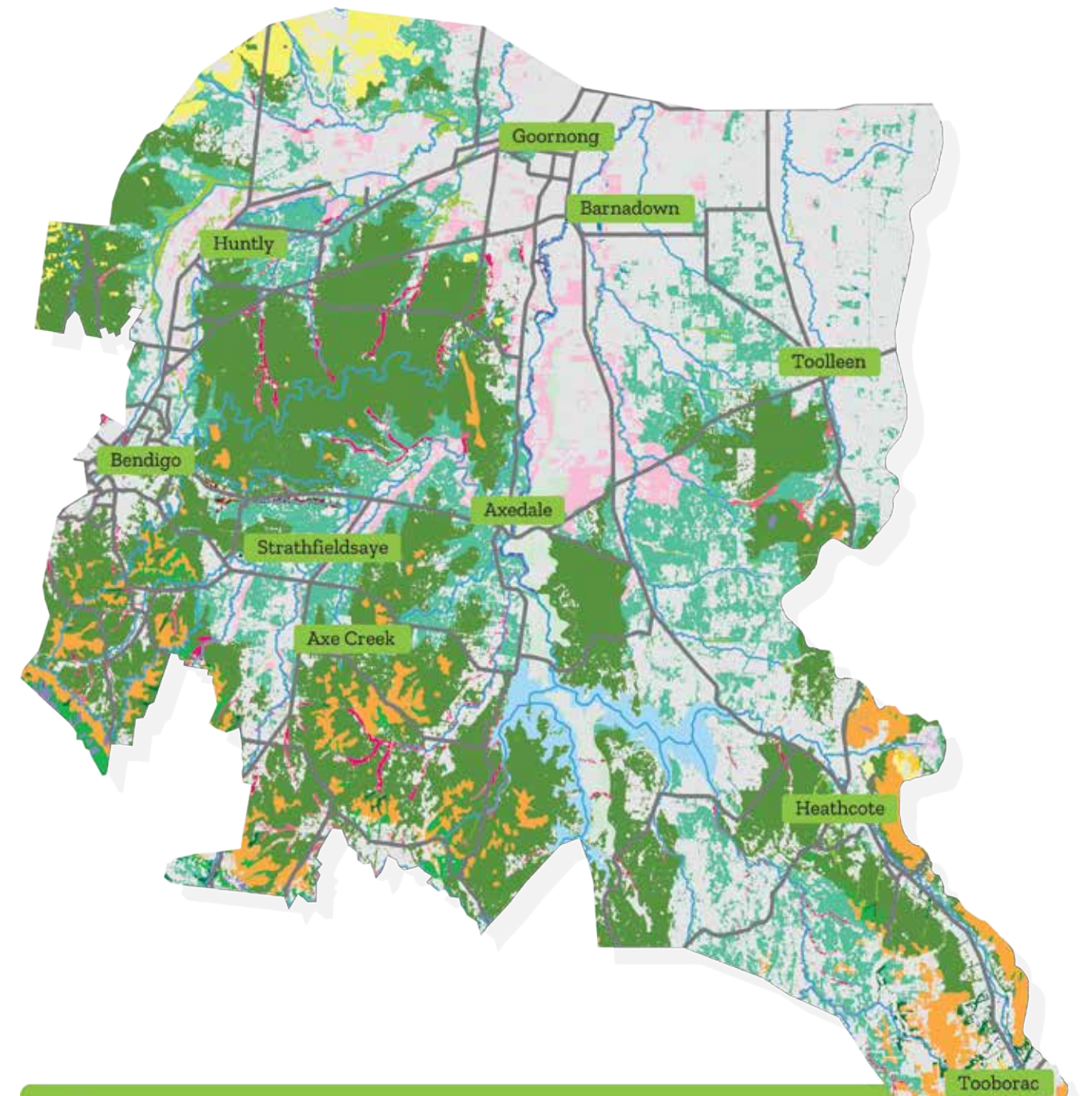


Pre-colonial vegetation

Ecological Vegetation Classes (EVC) - modelled 2005

- | | | |
|--|--------------------------------------|---|
| Valley heathy forest | Heathy woodland | Granitic Hills woodland |
| Creekline herb-rich woodland | Plains grassy woodland | Wetland formation |
| Grassy woodland | Floodplain riparian woodland | Grassy woodland |
| Heathy dry forest | Box Ironbark forest | Grassy woodland / Alluvial Terraces herb-rich woodland mosaic |
| Grassy dry forest | Sedge-rich woodland | Alluvial Terraces herb-rich woodland / Plains grassy woodland mosaic |
| Sedge-rich woodland / Spring Soak woodland mosaic | Alluvial terraces herb-rich woodland | Plains woodland |
| Plains woodland / Plains grassland / Gilgai wetland mosaic | Creekline grassy woodland | Alluvial terraces herb-rich woodland / Creekline grassy woodland mosaic |
| Damp sands herb-rich woodland | Metamorphic slopes shrubby woodland | Stream bank shrubland |
| Valley grassy forest | Hillcrest herb-rich woodland | Sandstone Ridge shrubland |
| | Hills herb-rich woodland | |

- Roads
- Watercourse



Current vegetation

Ecological Vegetation Classes (EVC) - modelled 2005

- | | | |
|-------------------------------|---|--|
| Valley heathy forest | Box Ironbark forest | Grassy woodland / Alluvial terraces herb-rich woodland |
| Grassy woodland | Sedge-rich woodland | Alluvial terraces herb-rich woodland / Plains grassy woodland mosaic |
| Heathy dry forest | Alluvial Terraces herb-rich woodland | Stream bank shrubland |
| Grassy dry forest | Creekline grassy woodland | Sandstone Ridge shrubland |
| Damp sands herb-rich woodland | Hillcrest herb-rich woodland | Water body - natural or man made |
| Valley Grassy Forest | Hills herb-rich woodland | |
| Heathy woodland | Wetland formation | |
| Plains grassy woodland | Plains woodland | |
| Floodplain riparian woodland | Alluvial terraces herb-rich woodland / Creekline grassy woodland mosaic | |

- Roads
- Watercourse



How to preserve, protect and enhance native flora

Understand and align with existing strategies

- Understand and work to the objectives of the Traditional Owners Dhelkunya Dja Country Plan⁹² and Galk-galk Dhelkunya Forest Gardening Strategy⁹³, Protecting Victoria's Biodiversity 2037 strategy⁹⁴, Australian Government's Threatened Species Action Plan⁹⁵, Recovery Plan for Twenty-five Threatened Orchid Taxa of Victoria, South Australia and New South Wales⁹⁶ and the upcoming City of Greater Bendigo Biodiversity Strategy.
- Provide input into the government assessment processes for threatened species and threatening species.

Landscape scale actions

- Create corridors for climate change and genetic diversity.
- Consider seed and plants from northern climates, subject to technical advice.
- Increase genetic diversity through Victorian seed exchange programs.
- Support the work of private ecologists to research and propagate key species.

Engage and educate private landowners

- Promote and support equicentral systems to rest pasture, support native grass growth and enhance biodiversity in boundaries.
- Plant native gardens.
- Remove weeds that compete with native flora, especially rare and endangered orchids.
- Encourage private landholders to reduce grazing pressures, fence-off important land, extend remnant vegetation, increase biodiversity on property and increase knowledge.
- Strategically target audience segments to build awareness and action for the environment.

Engage the broader community

- Facilitate, educate and reward community behaviour-change leading to waterway health.
- Increase community skills in Citizen Science.
- Facilitate community connection to forests and woodlands through education, recreation opportunities, and interpretive signage.
- Advocate for exemplar environmental planning in urban development.



Environmental assessment

Native fauna

The Dja Dja Wurrung people, and other historical records, describe the Nature Network area as a landscape that had abundant fauna, including now locally extinct species such as quoll and dingo⁹⁷.

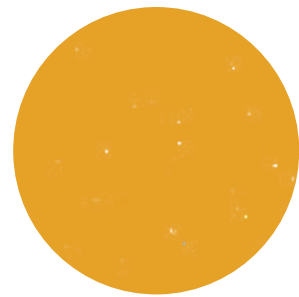
Traditional Owners tell how the Box Ironbark and grasslands were kept in balance by diverse fauna species that had special ecological functions, including:

- **Digging animals** that improved nutrient cycling, e.g., bandicoots
- **Seed dispersers** e.g. emu
- **Nutrient dispersers** that moved nutrients from high to low nutrient areas e.g. nesting birds
- **Mesopredators** that maintained populations of small animals e.g. quoll
- **Apex predators** that kept mesopredator populations in balance e.g. dingo⁹⁸.

European land use practices have resulted in significant ecological impacts with a reduction in habitat for native fauna. The forest and woodland Ecological Vegetation Class's (EVC) are now characterised by young dense trees that lack mid and lower storey and groundcover species. Topsoils are depleted and contribute to poor rates of recycling and water infiltration.⁹⁹

At 36% of its original extent (Goldfields Bioregion)¹⁰⁰ in its current condition, it's difficult for native vegetation to support the abundant and diverse fauna described in history. Threatening processes have led to the following impacts on the status of fauna species in Greater Bendigo¹⁰¹

It is important to note that the Nature Network area contains significant portions of Box-Ironbark Forest and Grassy Woodland EVC (refer to Current vegetation map, page 47) and therefore have the potential to play a significant role in enhancing habitat capacity for native fauna.



6
species of
threatened
reptiles

49
species of
threatened
birds

2
species of
threatened
amphibians

4
species of
threatened
fish

3
species of
threatened
invertebrates

6
species of
threatened
mammals



Brush-tailed phascogale. Photo credit: Geoff Park

Mammals and marsupials

Common species that inhabit the Box-Ironbark Forest, Healthy Dry Forest and Grassy Woodlands include common brush-tailed possum, krefft's (sugar) glider, lesser long-eared bat, short-beaked echidna, eastern grey kangaroo and swamp wallaby¹⁰².

Woodland specialists such as the brush-tailed phascogale (Vulnerable), yellow-footed antechinus, and the common dunnart (Vulnerable) also call the box ironbark vegetation home, however they have been declining in numbers¹⁰³¹⁰⁴. The yellow-footed antechinus and the common dunnart are now rarely seen in the Nature Network area¹⁰⁵.

Arboreal species generally stay in areas where there are hollow bearing trees. The region's placental mammals are insectivorous bats (microbats). There are two fruit eating bats; the grey headed flying fox and the little red fox.

The Vulnerable grey headed flying fox has colonised parts of the Box-Ironbark Forest and Rosalind Park in the centre of Bendigo during the past 10 years. Grey headed flying foxes (GHFF) migrate up and down the east coast of Australia seasonally. The summer fires of 2019-2020 wiped out an extensive range of their foraging and winter habitat in NSW¹⁰⁶.

Some local areas have become a refuge, and as more wildfires occur it is likely that the population distribution of the GHFF, as well as other migratory species, may change. Maintaining high quality foraging habitat for migratory species is critically important to prevent further decline.

Small insectivorous microbats make up the largest group of mammals in our region, with about a dozen species recorded. They mostly inhabit tree hollows or fissures in tree bark, although some may use caves and old mine tunnels¹⁰⁷. They are an important species in both urban and rural environments.

The short-beaked echidna is a common monotreme of the Nature Network area. The area was also home to a rarer monotreme, the platypus, which is now classed as Vulnerable. Platypus have been reported to have historically occupied some of the ephemeral streams including Axe Creek, Bendigo Creek and Emu Creek. However, it's range in the Network area is now mostly limited to the Campaspe River around Axedale.

The platypus requires permanent waterways or deep pools that have good water quality. They also require riparian vegetation and woody debris that promotes abundant supply of macroinvertebrates¹⁰⁸. Platypus have been described as "in direct competition with humans¹⁰⁹" for water as a resource, much of their habitat has been reduced so that it can no longer exist in ephemeral creeks.

These waterways are also home to the semi-aquatic rakali water rat. Rakali are more adaptable than platypus to the natural drying cycles of ephemeral waterways, however they require thick grass, low-growing shrubs, reed beds and large rocks near the banks¹¹⁰.

Reptiles

There are many reptiles that inhabit the forests and woodlands in the Nature Network area including turtles, geckos, legless lizards, skinks, dragons, goannas, and snakes.

The common long-necked turtle is the only aquatic reptile that frequents parts of the Nature Network Box Ironbark area. It stays near water courses, dams and adjacent terrestrial areas.

Major threats to lizards are incremental clearing, forest degradation and removal of the ground layer. For example, grazing, removing timber, rock removal, illegal killing or taking by humans, and altered burning regimes.

Dry country specialists such as the little whip snake, sand goanna, lace monitor, ragged snake-eyed skink and tree skink are present. Reptiles such as the tree goanna and woodland blind snake are considered temperate specialists but are less common in this area.

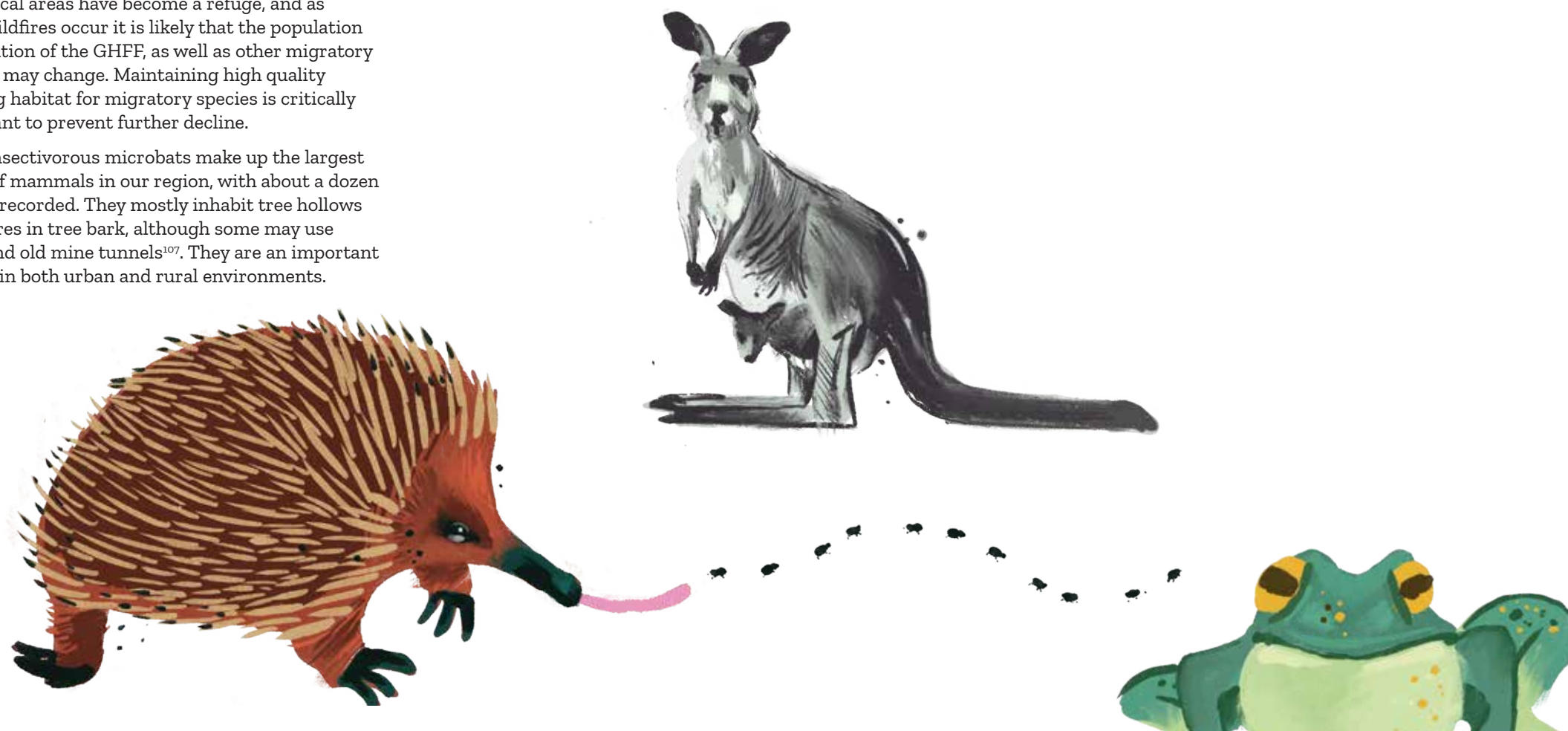
The marbled gecko, large-striped skink, garden skink, and common brown snake are widely distributed throughout the area. There are also records of the little whip snake, sand goannas and lace monitors in the Nature Network area.

Frogs

There are several species of frogs that are known to frequent the box ironbark in the Nature Network area. The bibron's toadlet, common spadefoot toad, and the eastern banjo frog shelter beneath debris and in underground burrows until it rains. The latter two are widely dispersed across the landscape, however bibron's toadlet is Endangered and suspected to be in decline¹¹⁴.

A population of the bibron's Toadlet was recently observed during an assessment of the Honeyeater Reserve in Junortoun¹¹⁵. Other frogs are generally found in moist areas near dams, creeks, waterholes, depressions and gullies that are seasonally inundated.

There are some species in the Nature Network area that have significantly declined in distribution and abundance, such as the sloane's froglet which is now listed as Endangered. The growing grass frog (Vulnerable) was once common across the area, it is now only known to occur at one remaining modified wetland on the edge of remnant box ironbark at Coliban Water's Bendigo Water Reclamation Plant.



Birds

Throughout the Nature Network area several bird species have been sighted and are known to call these forests and woodlands home, even if it's just for a short migratory period.

The regent honeyeater was reported as well distributed throughout box-ironbark forests in the Nature Network until the 1970s and is now Critically Endangered¹¹¹. The grey-crowned babbler (Vulnerable) has also significantly declined and is predominately isolated to areas in this region. Hooded robin (Vulnerable), speckled warbler (Endangered) and diamond firetail (Vulnerable) are widespread, but numbers are declining.

Some species are reported to have benefited from increased fragmentation and clearing such as the australasian magpie, crested pigeon, long-billed corella, galah, willie wagtail and little raven. The rainbow lorikeet, new holland honeyeater, red wattlebird and pied currawong have thrived with urbanisation and the increase of food sources from ornamental flowering and fruit trees.



A spectacular visitor from Indonesia and New Guinea is the rainbow bee-eater. This species has a status of Least Concern, however reported sightings have decreased by more than 50% during the past two decades¹¹². The rainbow bee-eater can be seen throughout the warmer months in the Huntly Streamside Reserve where the Northern Bendigo Landcare group have focused effort on revegetation.

Some birds inhabiting the Nature Network area feed on nectar as part of their diet, these include wattlebirds, friarbirds, honeyeaters, lorikeets and the swift parrot (Critically Endangered). Almost half of the Box Ironbark birds are ground foraging or ground nesting birds and are dependent on parts of the ground layer for their life cycle such as sparse grassy areas, woody and leafy debris and patchy understorey.

Important bird species also require hollows. These range from small species such as the striated pardalote, to those needing large hollows such as the powerful owl (Vulnerable), barking owl (Critically Endangered) and the kookaburra.

As composition in vegetation changes from threats such as climate change and development, threatened woodland birds are likely to be impacted further. Research shows that actions such as restoring woody vegetation particularly nearby existing vegetation, and providing a mature tree layer, will promote the return and recolonisation of bird species¹¹³.

Fish

Campaspe River system

Large fish species found in the Nature Network region, particularly in Lake Eppalock and the campaspe river system include golden perch, murray cod, and silver perch.

Common small fish species include australian smelt, flathead gudgeon, mountain galaxias and western carp gudgeon. Both silver perch and trout cod are protected species. Fish ecologist Peter Rose explains, "River blackfish are rare in the Campaspe system and were in fact thought to be extinct since 1981. They have recently been reintroduced by North Central CMA between Axedale and Elmore."

There are also several common introduced species, including brown trout, european carp, goldfish, eastern gambusia, rainbow trout, redfin, roach and tench.

Bendigo Creek and the Loddon River system

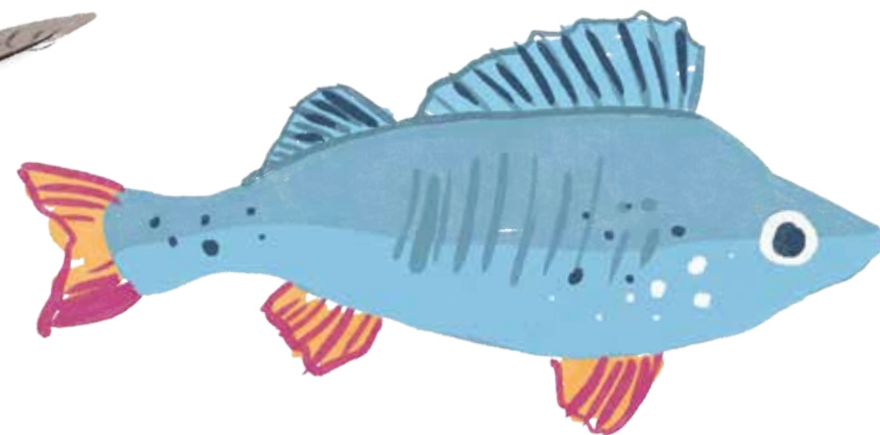
In the Loddon River system fish species found include the golden perch, bony bream, murray cod, australian smelt, blackfish, flathead gudgeon and mountain galaxias. Lake Weeroona contains mostly goldfish, redfin and catfish, and Kennington Reservoir is stocked with rainbow trout by the Victorian Fisheries Association¹¹⁶.

North of the Nature Network area, the North Central CMA is focusing on native fish recovery in the Loddon and Gunbower systems, including Bendigo Creek¹¹⁷. Bendigo Creek contains native species such as carp gudgeon and obscure galaxias, as well as exotic species such as european carp, redfin perch and eastern gambusia (mosquito fish).

In 2022 southern purple spotted gudgeon were released into the Riley Street wetland in East Bendigo. This species was once declared extinct in Victoria until it was found in lakes near Kerang in 2019. They have since been bred in dams and wetlands by councils and community groups.

The Vulnerable southern pygmy perch has been released in various locations in the Greater Bendigo area including Gold Leaf Reserve (Huntly), Number 7 Reservoir (Strathdale), Cadella Way Wetland (Strathfieldsaye), and the Murphy Street Wetland (Bendigo). Both pygmy perch and spotted gudgeon are breeding in local wetlands¹¹⁸.

Threats to native fish in the Nature Network area include exotic fish, degraded bank and riparian habitat, altered flow regimes, barriers to fish passage, water quality and degraded instream habitat including timber and aquatic plants.



"Our rivers are the veins of Country, and provide food and medicine, and places to camp, hunt, fish, swim and hold ceremonies."

Dja Dja Wurrung, Country Plan¹²⁹



Yellow-footed antechinus. Photo credit: Adrian Martins

Invertebrates

Invertebrates are a critical component of our ecological processes. The 'services' they perform include pollination, seed dispersal, food for wildlife, nutrient recycling, soil aeration, soil construction and maintenance, water cleaning, and reef construction. They are critical to life on our planet, without them whole ecosystems would collapse.

Invertebrates are widely regarded as a useful monitoring tool in environmental management because of their abundance, diversity, functional importance, sensitivity to perturbation, and the relative ease with which they can be sampled.

Invertebrates are often threatened by human activities due to our current chemical pesticide methodology for agricultural production and gardening. As we move into a phase of an increased focus and understanding of climate change impacts, it is important that we understand the complex interactions of invertebrate.



Key species

Eltham copper butterfly

The eltham copper butterfly is a small and attractive butterfly with bright copper colouring on the tops of its wings. It is only found in Victoria in a few geographically separate locations. It was considered extinct since the 1950's until rediscovered at Eltham in 1986.

It is a unique species due to its close symbiotic association with a group of ants from the genus *Notoncus* and the sweet sursaria shrub (*Bursaria spinosa*)¹¹⁹. Each night, in exchange for sugar secretions from larvae, the *Notoncus* ants usher the larvae from their nest where it has been sheltering from the elements¹²⁰, to feed on the sweet bursaria.

Currently there is little knowledge on the number and distribution of eltham copper butterfly within north central Victoria. However, populations have previously been recorded in the Mandurang Landcare area and around Big Hill. One population known to exist at Big Hill is reported to have been impacted by stormwater run-off from a new housing development.

Habitat destruction and loss is thought to be the prime reason for decline of this species, particularly loss of sweet bursaria and loss of habitat supporting *Notoncus* ants. Other threats include urbanisation, weed invasion, rubbish dumping, trampling, slashing of vegetation and grazing. Planned burning is also considered a major threat, as little is known about the effects of fire on this species.

Efforts to save the species are being supported by Connecting Country in partnership with volunteers, land managers, Traditional Owners and government agencies. The recent discovery of a population in the Wimmera has also led to a \$50,000 grant through the Victorian Government's Biodiversity On-Ground Action Icon Species¹²¹ Grants program, which funds targeted actions designed to protect and conserve Victoria's threatened species. Actions including mapping, surveying, developing Site Management Plans and building awareness.

Blue banded bee

Blue banded bees are one of Australia's most beautiful native bees. They are about 11 mm long and have bands of metallic blue fur across their black abdomens.

Blue banded bees are solitary bees. This means that each female bee mates and then builds a solitary nest by herself. She builds her nest in a shallow burrow in clay soil or sometimes in mudbricks. Many blue banded bees may build their nest burrows close to one another, like neighbouring houses in a village¹²².

Blue banded bees can perform a special type of pollination called 'buzz pollination'. Some flowers hide their pollen inside tiny capsules. A blue banded bee can grasp a flower of this type and shiver her flight muscles, causing the pollen to shoot out of the capsule. She can then collect the pollen for her nest and carry it from flower to flower, pollinating the flowers. Quite a few of our native Australian flowers require buzz pollination, for example *Hibbertia senna*¹²³.

Fauna species to look for in the Nature Network area



Brush-tailed phascogale
(*Phascogale tapoatafa*)

Status: Vulnerable under the Flora and Fauna Guarantee Act 1988.

Features: Black bottle brush tail with a deep grey on its head and back, pale cream belly with large naked ears. 230mm-400mm long.

Habitat: It is a small nocturnal, arboreal and carnivorous marsupial found in box-ironbark forests and woodlands of central Victoria. Their diet consists of large insects, spiders and centipedes. They nest in hollows of dead or live trees.

Threats: Modification of remnant habitat from firewood collection, grazing, inappropriate fire regimes and predation by foxes and cats.¹²⁴



Barking owl
(*Ninox connivens*)

Status: Critically Endangered under the Flora and Fauna Guarantee Act 1988.

Features: Medium sized brown owl with streaked breast and spots on its wings. Large forward directed eyes.

Habitat: It is found in open woodland and open forests including the box-ironbark and river redgum habitats near waterways or swamps, particularly where it adjoins farmland. Live hollow bearing trees are more likely to be on freehold land compared to public forests. A large component of their diet is the European rabbit because it is highly abundant.

Main threats: Loss of large alive hollow bearing trees (150-200 years old)¹²⁵.

Photo credit: Chris Tzaros



Lace monitor
(*Varanus varius*)

Status: Endangered under the Flora and Fauna Guarantee Act 1988.

Features: Dark grey to blueish black with scattered cream coloured spots. Black and yellow prominent bands on its snout and under chin. 140cm-210cm long.

Habitat: It is found in woodlands where there are large trees and hollow logs. They forage on the ground for insects, snakes, reptiles, small birds, frogs, eggs, rabbits, and small mammals. They are known to scale large trees when threatened.

Main threats: Habitat modification and loss of large trees.¹²⁶

Photo credit: Chris Tzaros



Bibron's toadlet
(*Pseudophryne bibronii*)

Status: Endangered under the Flora and Fauna Guarantee Act 1988.

Features: 3cm long, dark grey, blue grey or brown back with small black spots or patches with a red-orange stripe on its lower half.

Habitat: Eggs are laid under moist leaf litter, rocks, logs or moss. It is found in forests, heathlands and grasslands areas near waterbodies.

Main threats: Insecticides, drainage of dams and wetlands, removal of riparian vegetation / grazing, prolonged drought, chytrid fungus.¹²⁷

Photo credit: Chris Tzaros



Pygmy perch
(*Nannoperca australis*)

Status: Vulnerable under the Flora and Fauna Guarantee Act 1988.

Features: It is golden to olive-green with a silver white belly, and dark blotches on the upper body.

Habitat: It is found in slow flowing or still water with dense aquatic vegetation. Usually in streams, channels and billabongs / dams.

Main threats: Predation from brown trout, redfin, eastern gambusia, habitat modification, cold water pollution and changes to flow.¹²⁸



Eltham copper butterfly
(*Paralucia pyrodiscus lucida*)

Status: Endangered under the Flora and Fauna Guarantee Act 1988.

Features: An attractive butterfly about the size of a ten-cent coin, with triangular and bright copper-coloured wings.

Habitat: Open woodland containing Sweet Bursaria and colonies of Notoncus ants. Adult-nectar, larvae-sweet bursaria leaves.

Main threats: Habitat loss and degradation, fragmentation, fire regimes.

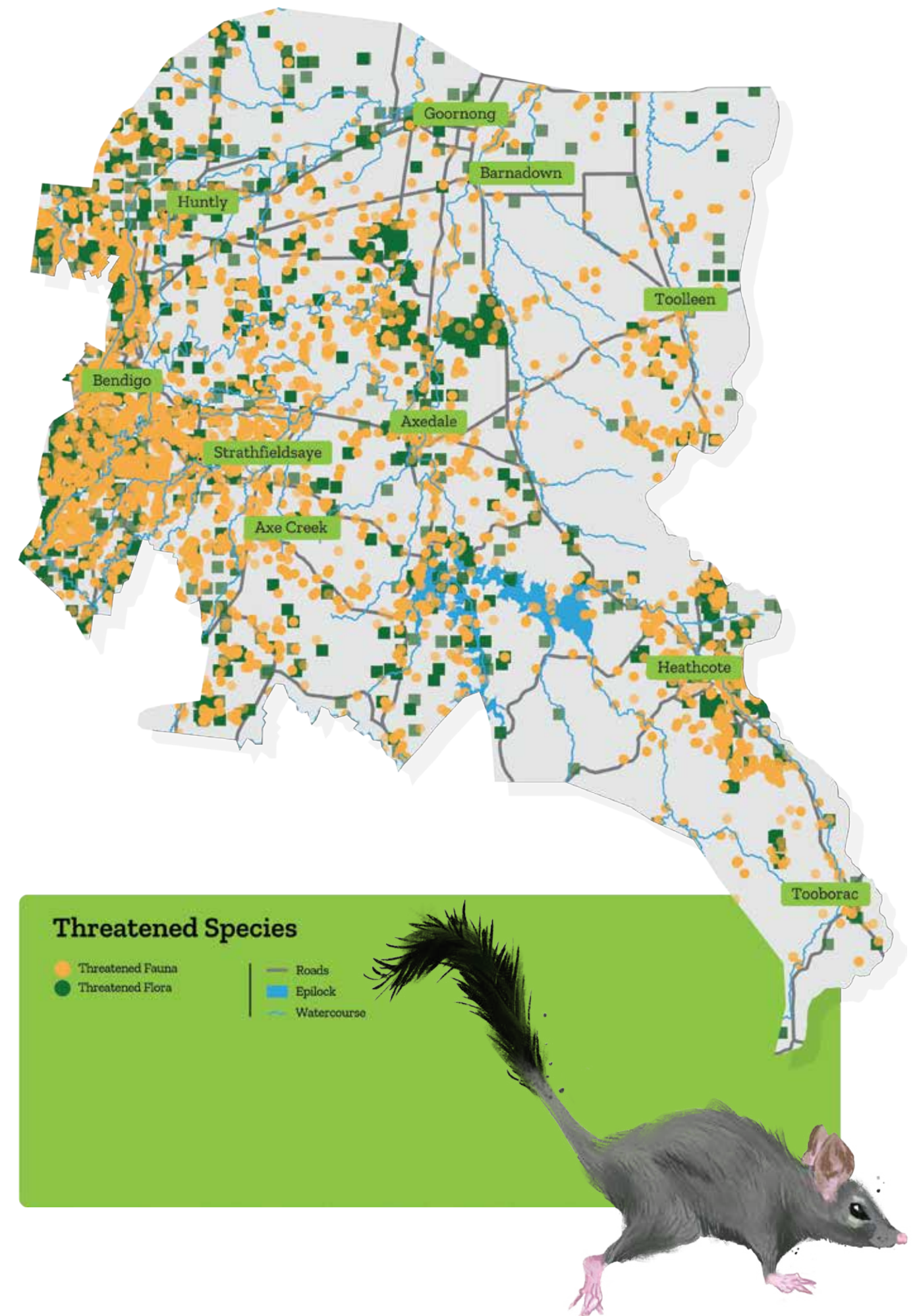
Photo credit: Julie Radford



Lace monitor - Photo credit: Adrian Martins

Threats to fauna in the network area

Threats	Impacts
Water scarcity	<ul style="list-style-type: none"> • Competing priorities for water between environment and private landholders. • Changes to groundwater levels. • Altered flow regimes and poor quality.
Fire	<ul style="list-style-type: none"> • Planned and wildfire reduce habitat and native fauna populations.
Agriculture	<ul style="list-style-type: none"> • Removal of old trees and other habitat. • Stock access reduces extent and quality of important habitat, especially along waterways (instream and riparian). • Application of chemicals and fertilisers contaminate habitat and kill species.
Urbanisation and development	<ul style="list-style-type: none"> • Land clearing, fragmentation and stormwater drainage reduces critical habitat and increases predation, in-breeding and disease. • Removal of large old trees reduces habitat resources. • Barriers to fish passage.
Weeds	<ul style="list-style-type: none"> • Introduction of weeds outcompete native habitat and reduce food resources.
Predators and pests	<ul style="list-style-type: none"> • Introduced predators such as cats and foxes. • Competition for food resources.
Climate change	<ul style="list-style-type: none"> • Occurs faster than adaptation and limits species resilience. • Unreliable rain and increased temperatures lead to prolonged periods of drought and reduction of habitat. • Increases in ultraviolet-B radiation.
Disease	<ul style="list-style-type: none"> • Spread of infectious disease e.g. Chytridiomycosis.
Legacy soil degradation	<ul style="list-style-type: none"> • Depleted, compacted and contaminated soils become inhospitable for native plant species.
Forest and woodland structure	<ul style="list-style-type: none"> • Overall changes in forest structure preventing some species from colonising, particularly understorey-dependent species.
Human connection	<ul style="list-style-type: none"> • Lack of awareness of fauna's ecosystem functions and how human activities impact native fauna.





How to preserve, protect and enhance native fauna

Understand and align with existing strategies

- Strategies include Dja Dja Wurrung's Dhelkunya Dja Country Plan¹³⁴, Restoring Spirit on Country plan, and Galk-galk Dhelkunya Forest Gardening Strategy¹³⁵, Protecting Victoria's Biodiversity 2037 strategy¹³⁶, Australian Government's Threatened Species Action Plan¹³⁷, North Central CMA Native Fish Recovery Plan¹³⁸, North Central Regional Catchment Strategy, and the City of Greater Bendigo Biodiversity Strategy.
- Support species or site-specific action plans.
- Utilise Victorian Government Action Statements¹³⁹.
- Provide input into the government assessment processes for threatened species.

Landscape scale actions

- Create corridors for climate change and genetic diversity.
- Participate in genetic diversification programs.
- Broadscale weed eradication.
- Support research projects to better understand native species.

Engage and educate private landowners

- Encourage planting of habitat, weed removal and a reduction in water dependence.
- Encourage private landholders to reduce predators and grazing pressures, fence-off important land, extend remnant vegetation, increase biodiversity on property, increase knowledge.
- Promote participation in programs such as Land for Wildlife and Species Recovery Plans.
- Strategically target audience segments to build awareness and action for native fauna.
- Enhance surrogate fish habitats, for example, farm dams.

Engage the broader community

- Facilitate, educate and encourage community behavior-change.
- Increase monitoring skills in Citizen Science.
- Facilitate community connection to forests and woodlands through education and interpretive signage.
- Advocate for environmental planning in urban development.
- Advocate for fishways, responsible fishing, water for the environment and conservation stocking.
- Promote species-specific events such as carp catch days and bird counts.



Environmental assessment

Native fungi

The Nature Network region incorporates a range of Ecological Vegetation Class (EVC) that support fungi, as well as parks and gardens. Fungi occupy particular niches within all these ecosystems.

Fungi habitat

Loss of forest age structure, especially the loss of large old trees, means fewer habitats for fungi. Diverse fungal communities require a range of organic matter that includes both standing and fallen trees; an abundant and varied understory and ground layer; and a litter layer of different species, age and size. The greater the range of substrate types, habitats and microclimates, the greater the diversity of fungi.

Although the area is experiencing rapid urban development, some local state forests and conservation reserves contain high quality remnant vegetation with mature trees. For example, the Wellsford State Forest has retained some large old hollow-bearing eucalypts, that are now listed on the National Trust's Significant Tree Register. Parts of the forest have considerable amounts of variously sized and aged woody debris on the forest floor that creates diverse substrates and habitats for fungi.

Other areas within the Nature Network region that support habitat types such as moss beds, fallen wood and especially wetter gully areas, often have the richest fungal diversity.

Species of the Nature Network region

Fungus survey data and other fungus records in repositories such as the Atlas of Living Australia and iNaturalist indicate that over 400 species of macrofungi (those visible to the naked eye) have been recorded in the Network region. Furthermore, given the region is poorly surveyed, many more species are likely to exist.

The dominant tree genus, Eucalyptus forms mycorrhizal relationships with many different fungus genera, among them earthballs (*pisolithus*), grisettes (*amanita*), webcaps (*cortinarius*), milkcaps (*lactarius*), brittlegills (*russula*), deceivers (*laccaria*) and austral forkgills (*austropaxillus*). A range of fungus species within these and further genera have been recorded.

Unlike many plants and animals, the conservation status of all but a small handful of Victorian fungi is unknown. Contribution of fungus sightings by Landcarers, citizen scientists and other community members helps build the bigger picture of fungal diversity and distribution in the region.

Given there is a mix of native and introduced plant species both native and introduced (and cosmopolitan) fungus species also exist. For example, in areas where soil has been disturbed, ruderal species (e.g. various *coprinus* and *coprinellus*) are common as well as native species that have presumably adapted to these environments, such as chip cherries (*leratiomyces ceres*) and golden tops (*psilocybe subaruginosa*).

Note that while some of the saprotrophic (recycling) fungi do persist in 'managed' parks and reserves, in contrast, many of the native ectomycorrhizal fungi such as various *amanita*, *cortinarius*, *lactarius* and *russula*, are generally only found in remnant vegetation. That is, many native fungi behave in similar ways to native plants in that they will only persist in areas that are explicitly managed for biodiversity.

When mushrooms aren't visible, the presence of fungi beneath the soil or within wood is still often evident in their various 'traces'. For example, signs of fungi are evident in the decomposition of wood. The presence of what is known as cubical rot caused by the lilac shelf fungus (*Rhodofomitopsis lilacinogilva*) is apparent as cubical pieces of decomposing wood as the fungus breaks down the cellulose and hemicellulose through enzyme secretion.

Other fungi provide an important food source for various invertebrates and mammal species found in the region such as swamp wallabies (*wallabia bicolor*),

tuans (*phascogale tapoatafa tapoatafa*), yellow-footed antechinus (*antechinus flavipes*), common brushtail possum (*trichosurus vulpecula*) and common ringtail possum (*pseudocheirus peregrinus*).

These mammals feed on fungi and especially favour hypogeous fungi (those that produce their reproductive structures underground, such as truffles). Evidence of their diggings in search of hypogeous fungi can often be observed. The tuan is a recognised hero species of the region. This small, nocturnal, arboreal marsupial mostly eats invertebrates but also eats fungi. It has been recorded at many locations including Greater Bendigo National Park, Wellsford State Forest, Kimbolton State Forest and Pilchers Bridge Nature Conservation Reserve (Pouliot, 2023).

Fungi section and photos contributed by author, photographer and ecologist, Alison Pouliot.



Photo credit: Peter Weaving



Environmental assessment

Biodiversity threats and priorities

Current land practices and processes are increasing pressure on the Box-Ironbark Forest and Grassy Woodlands in the Nature Network area. The level of resource usage, incremental fragmentation, and urban encroachment has resulted in ecosystem imbalance and loss of biodiversity value for this area.

The Victorian Government has identified several potentially threatening processes to biodiversity within the *Flora and Fauna Guarantee Act 1988*⁴⁰. From the list, the following eighteen threatening processes are relevant to the Nature Network area:

1. Alteration to the natural flow regimes of rivers and streams.
2. Alteration to the natural temperature regimes of rivers and streams.
3. Degradation of native riparian vegetation along Victorian rivers and streams.
4. Habitat fragmentation.
5. Inappropriate fire regimes causing disruption to sustainable ecosystem processes and resultant loss of biodiversity.
6. Infection of amphibians with chytrid fungus.
7. Input of toxic substances into Victorian rivers and streams.
8. Introduction of live fish into waterways outside their natural range.
9. Invasion of native vegetation by 'environmental weeds'.
10. Loss of coarse woody debris from Victorian native forests and woodlands.
11. Loss of hollow-bearing trees from Victorian native forests.
12. Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases.
13. Predation of native wildlife by the cat.
14. Predation of native wildlife by the introduced red fox.
15. Prevention of passage of aquatic biota as a result of the presence of instream structures.
16. Reduction in biodiversity resulting from Noisy Miner (*Manorina melanocephala*) populations in Victoria.
17. Reduction in biomass and biodiversity of native vegetation through grazing by the rabbit.
18. Threats to native flora and fauna arising from the use by the feral honeybee *apis mellifera* of nesting hollows and floral resources.

While the Nature Network area forms part of the ring of forest around Bendigo (the "city in the forest") many of these threatening processes can be attributed to urbanisation. Current and projected rates of urbanisation present significant challenges to the Nature Network's biodiversity.

Throughout this Blueprint, effort has been made to identify key threats and impacts to specific systems in the Nature Network area, and opportunities to create change. The key threats to the area are summarised below:

- Urbanisation (underpins some of the current and forecast threats).
- Fragmentation.
- Waterway and hydrology changes.
- Soil degradation.
- Habitat degradation.
- Clearing, especially mature tree and remnant vegetation removal.
- Competition for resources.
- Climate change.
- Human disconnect from nature.

These threats present opportunities for conservation groups to help the community overcome feelings of helplessness and disconnection, while providing health and wellbeing outcomes. As the Dja Dja Wurrung people have always recognised, the health of the people is intertwined with the health of their environment.





Highly impacted Grassy Woodland EVC. Photo credit: Adrian Martins

Priorities for Conservation

In his book, *Wildlife of the Box-Ironbark Country*, Chris Tzaros suggests the following landscape features should be prioritised for conservation¹⁴¹:

Lowlands and gullies

Often presenting as creeks and drainage lines, the lowest points in the landscape frequently have the most fertile and diverse habitats, presenting drought refuges for birds, marsupials and mammals.

In the Nature Network area, these features have been highly degraded and sometimes overlooked in priority of larger waterway projects. There is an opportunity for the Nature Network to play a key role in conserving habitat around ephemeral tributaries and utilising them as a basis for connectivity.

Mature trees

Trees over 60cm in diameter are three times more likely to be hollow bearing than smaller trees¹⁴². They also serve other ecological functions for its inhabitants such as deep crevices, deadwood, bark shedding and large crowns for roosting and abundant nectar. They play a crucial role in supporting some of the Nature Network's most vulnerable flora, fauna and fungi species.

In the Nature Network area large old trees are scarce and need to be protected and supported. Revegetation is not always a good substitute for remnant vegetation¹⁴³ and it is important to retain mature trees, dead or alive, particularly those adjacent to remnant vegetation.

There is an opportunity for the Nature Network to promote the value of mature trees to its members and develop projects that enhance habitat that will support their survival.

Structurally complex ground layers

Many mammals, birds, reptiles, frogs and fungi depend on ground layer habitats, including iconic species such as the brush-tailed phascogale. Undisturbed habitats have fallen branches, logs, rocks, leaf and bark litter.

Much of the Nature Network area is struggling to regenerate understorey vegetation after legacy land-use and ongoing removal of habitat, through grazing, firewood collection, rock removal, private property grooming and wildfire mitigation strategies.

There is an opportunity for the Nature Network to play a key role in revegetating complex understories, particularly on private land, to achieve connectivity and to support mature trees.



Father and son building nest box. Photo credit: Peter Weaving

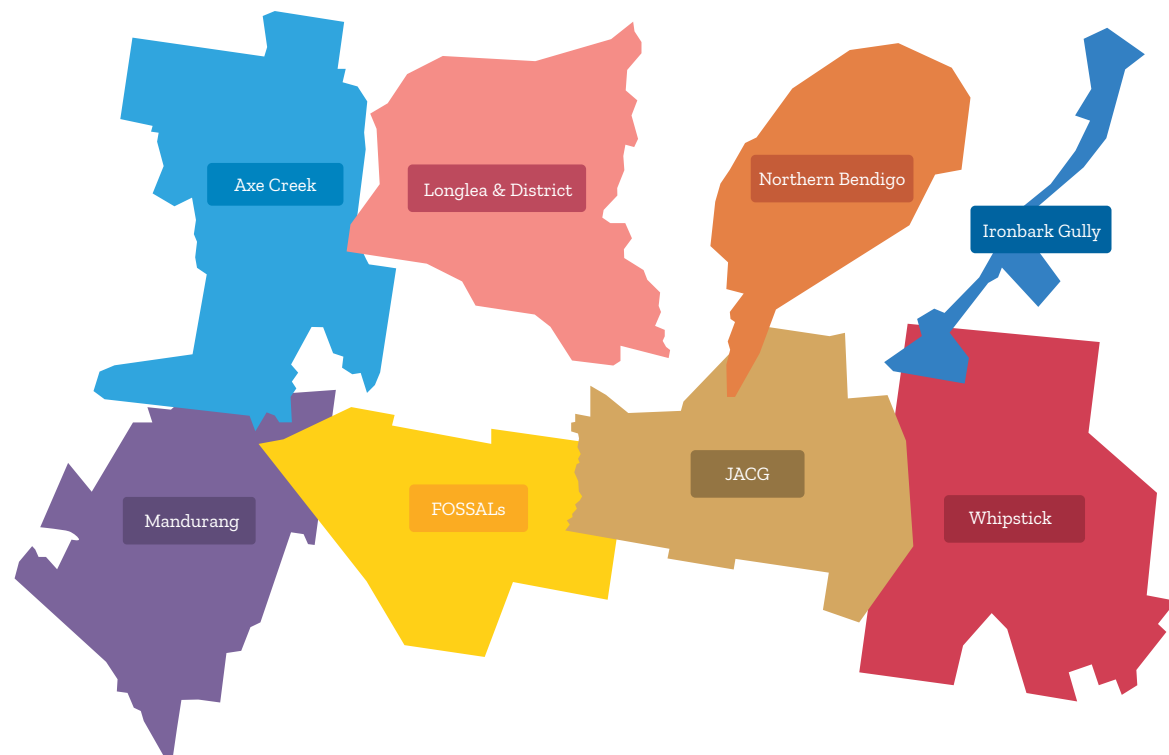
Nature Network

Member groups

Eight environmental groups have pledged their support for a Nature Network and facilitator to support their groups and extend their environmental impact.

These groups became the Member Groups of the Nature Network:

Axe Creek Landcare	Mandurang Landcare
Longlea and District Landcare	FOSSALs Friends of Strathfieldsaye Streams and Land
Northern Bendigo Landcare	JCAG Junortoun Community Action Group
Ironbark Gully Friends Landcare	Friends of the Whipstick



Member group snapshot

All Member Groups are working on linkages across the Nature Network area, and most are working on ephemeral waterways. With 160 members, direct communication to 360 database recipients, and a Facebook audience of more than 5,000 people, the Member Group's strength lies in their ability to tap an army of volunteers and generate effective and efficient environmental impacts quicker than any other organisation in the region.

Each group reports similar challenges around recruitment, skills shortages, funding acquisition, and marketing and engagement, particularly using online platforms and social media. There are underlying themes of time-poor volunteers deterred by administration and limited technological skills. Often active groups center around one or two primary volunteers who can feel overstretched at times.

The statistics show that there is room to grow the volunteer conservation audience further, through supported strategic planning, marketing and engagement, skills development, and recruitment.

It is critical that the focus of the Nature Network remains on building the capacity of its Member Groups, this is their core business. This will require the implementation of processes that create regular two-way communication between the network and its members, including Member Group representation on the Nature Network Board, regular surveys, input and exchange of strategic plans, project collaboration, cross-promotion, and team building events. It could extend to an online portal for information exchange and dialogue.

Another key role of the Nature Network will be to provide a conduit between Member Groups and government and private agencies who plan for biodiversity and require ground-truthing for their strategies. The Nature Network Member Groups have over 120 combined years' experience caring for and developing highly localised knowledge.



Axe Creek Landcare

Axe Creek Landcare (ACL) has been operating for 25 years. Their focus has been on improving and extending natural habitat at Pilchers Bridge Nature Conservation Reserve and developing connections along Axe Creek corridors. ACL have also focused energy on providing educational opportunities to their community through field days, workshops, and social media.

Through eventing, basic research efforts, social media and growth of a database, ACL has seen significant growth in diverse community participation over the past two years and tapped into younger and skilled volunteers.

Similar to other Nature Network Member Groups, ACL is experiencing increasing development in their area. Over the past few decades grazing land has been subdivided into "lifestyle" properties of approximately 8 to 24 hectares.

Property values have increased exponentially since COVID-19 and continues to attract professional families, who often don't rely on their property for primary income.

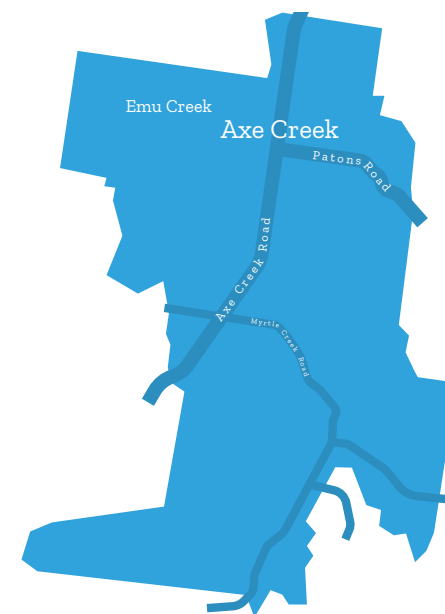
The new demographic can be broadly described as educated, having a disposable income, embracing strong nature values, and eager to absorb information about the environment, cultural heritage and sustainable land management practices.

This group actively seeks community feedback through surveys which indicate a demand from this demographic for environmental information. Property land-use goals can be broadly broken into bush blocks for regeneration, equine and micro-producers.

Survey insights were used to develop the *Love Your Land* event series which engaged 200 people from a "non-traditiona" volunteer audience. Workshops built

community capacity to act for nature and challenged participants to reimagine their own interests as conservation volunteering. Events included live-stream on-line events for indigenous cooking and DIY native bee hotels. As well as, forest-based events for nature journaling, environmental photography, fungi, birdwatching, watercolour painting, and leaf litter art.

ACL has also held successful *Spring at Pilchers Bridge* and *Mandurang* community education events focused on bee keeping, landscape in drought, bird walks and identification, propagation, and native fish.



Environmental Assets

The environmental assets in this area include roadside remnant vegetation patches, connectivity opportunities, some large old trees, cultural heritage, and Axe Creek. Revegetation of biodiversity corridors have shown encouraging outcomes such as the arrival of notable species including tree goanna, square-tailed kite, brush-tailed phascogale, and swift parrot.

Priorities

- More community engagement events and potentially in partnership with other organisations and programs.
- Roadside vegetation improvement projects along Gleeson Road to Mannes Lane to connect with works on Red Box Lane.
- Woody weed control for Axe Creek, particularly targeting blackberry, gorse, St John's Wort and broom.

Achievements

- Gorse (*Ulex europaeus*) removal along the Axe Creek corridor.
- Weed control and revegetation projects at Pilchers Bridge and on private land.
- Biodiversity corridor establishment and remnant restoration spanning four consecutive years.
- Community engagement and education through *Love your Land* events and *Spring at Pilcher's Bridge* and *Mandurang* events.



Dr Alison Pouliot teaching Environmental Photography.
Photo credit: Peter Weaving

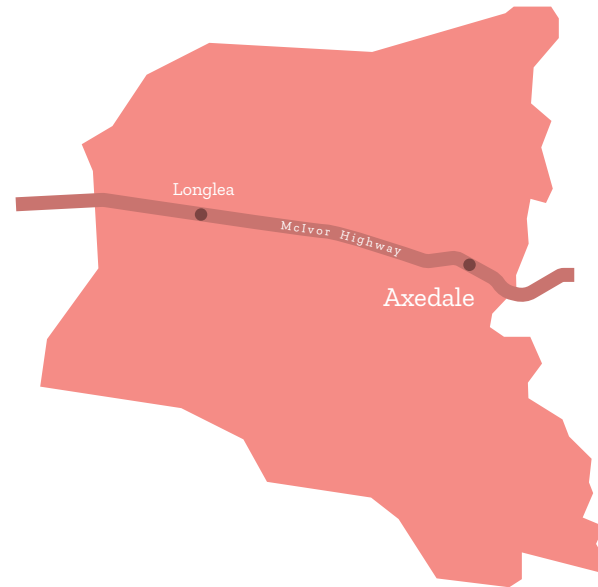
Longlea and District Landcare

Longlea and District Landcare (LDL) was established in 1997. The membership of the group is predominately made up of "lifestyle" properties ranging from 8 to 24 hectares. Like many other groups in the Nature Network, LDL is experiencing high population growth and subdivision of agricultural land for three general property-uses - bush blocks for regeneration, equine and micro-producers.

The new demographic can be broadly characterised as working professionals with an appreciation for nature.

This group participates in National Tree Day and plants up to 1,500 native plants annually, mostly on public land, and occasionally on private land. In recent years, works have focused on Axe Creek frontage, Longlea Recreational Reserve and the O'Keefe Rail Trail. The City of Greater Bendigo are partners in the project and provide the plants and mulch and assist with ground preparation and weed control.

LDL have also adopted a portion of Longlea Lane between Strathfieldsaye and Eppalock Road through the Adopt-A-Highway program. Several times a year and on special days such as Clean Up Australia Day, LDL removes litter from this section of road.



Dr Alison Pouliot teaching Fungi Foraging. Photo credit: Peter Weaving

Environmental Assets

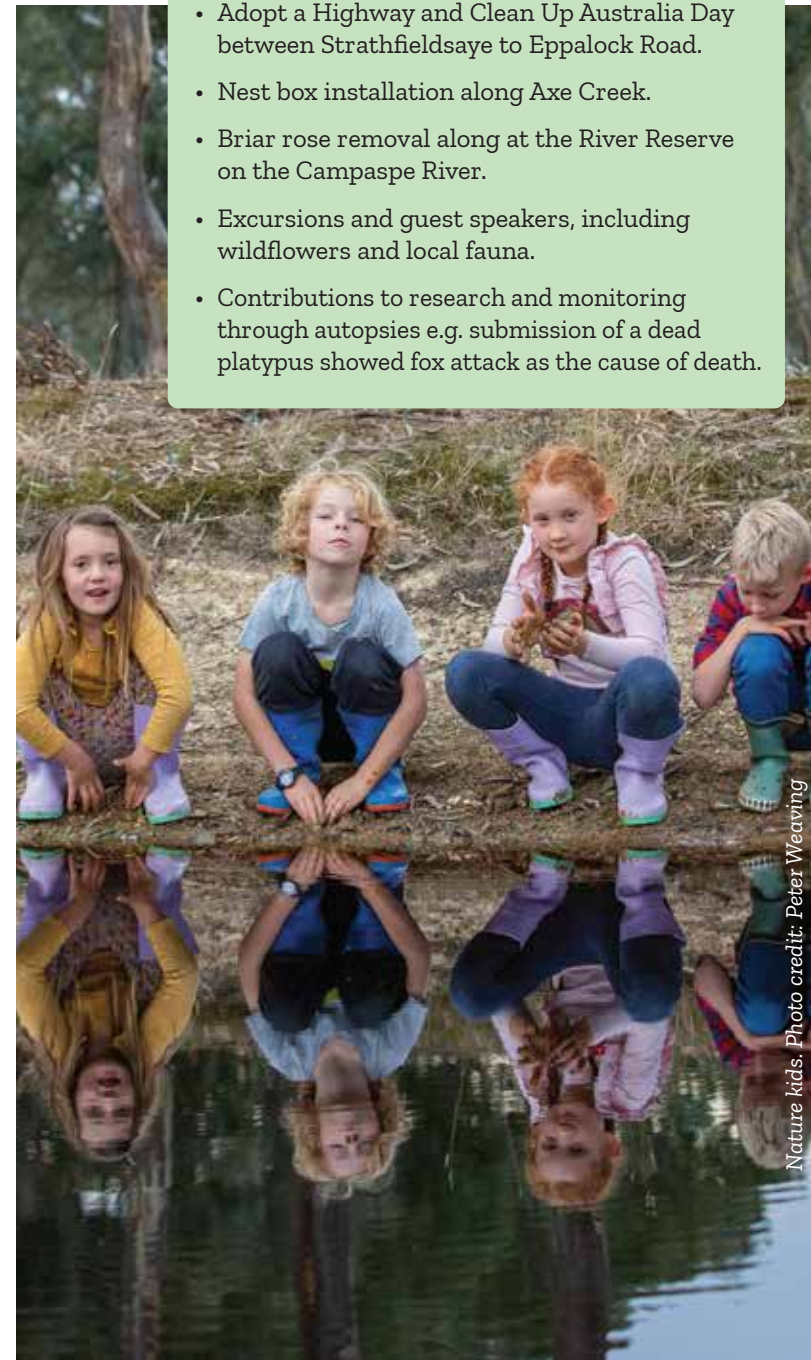
The LDL area takes in the Campaspe River and some tributaries including Axe Creek, Native Gully Creek, Mosquito Creek and Sweeney's Creek. These waterways are important biolinks, culturally significant, and play a critical role in biodiversity and climate change adaptation. Threatened species in the Nature Network will increasingly look to these waterways as drought refuges and corridors for genetic diversity.

Achievements

- Up to 1,500 trees planted annually on National Tree Day.
- Adopt a Highway and Clean Up Australia Day between Strathfieldsaye to Eppalock Road.
- Nest box installation along Axe Creek.
- Briar rose removal along at the River Reserve on the Campaspe River.
- Excursions and guest speakers, including wildflowers and local fauna.
- Contributions to research and monitoring through autopsies e.g. submission of a dead platypus showed fox attack as the cause of death.

Priorities

- Undertake landscape scale weed control on both private and public land.
- Establish a wildlife corridor along key waterways such as Axe Creek, including stock exclusion fencing.
- Continue revegetation, particularly in key corridor areas on both private and public land.
- Build local awareness of local environmental issues, such as weed ID incursions.
- Build skills of the membership group, particularly in native seed propagation.



Nature kids. Photo credit: Peter Weaving



Nestbox monitoring. Photo credit: Peter Weaving

Northern Bendigo Landcare

Northern Bendigo Landcare Group (NBLG) has been operating since 2007. The main focus being on environmental works and community education in Huntly and the broader Northern Bendigo corridor.

Although a small group, NBLG have a reputation for 'getting things done' by collaborating with schools, local government, community groups and businesses. They are passionate about connecting people to nature and open-minded about any activity that can build community through conservation.

The NBLG area is experiencing rapid urbanisation as they sit in a key growth corridor for the City of Greater Bendigo. Their demographic can be characterised as increasingly families with school aged children, or in a retirement phase of life.

The group has achieved a lot across their region since their inception. Habitat restoration within the Bendigo Creek Huntly Streamside Reserve, from Howard Street to Tennyson Road, involved nest box installation, pest plant management, understory revegetation and water quality monitoring.

The group demonstrated strengths in promotion and engagement through the production of *Fauna of the Bendigo Creek* brochure and awareness events, such as National Tree Day, Trees For Mum, Nature Play, and field trips for schools and tertiary institutes.

They also lead the way for developing engaging and interactive educational experiences for their community, including native demonstration gardens, and tree planting and nest box activities with Huntly Bush Kinder.

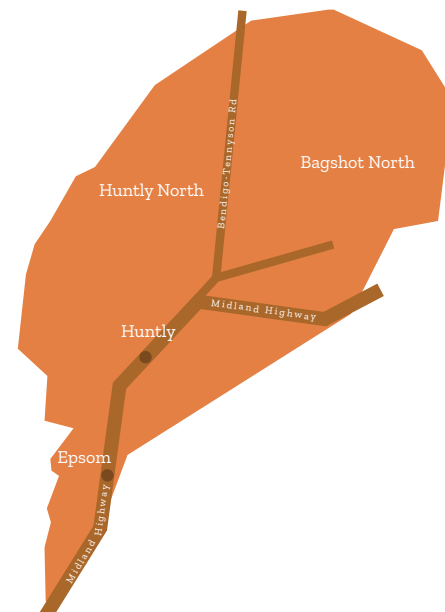
NBLG have developed a focus on the locally significant Whirrakee Wattle. They promote this species through seed collection, plant propagation, and sales. They have also collaborated with government agencies to feature the plant on town

signage, install a sculpture, and include in design features of the Huntly Train Station.

Goldleaf Wetland has recently become a site for increased activity. NBLG have coordinated revegetation works, nature play activities, and the release of small-bodied native fish in partnership with North Central CMA.

In 2022, over 6,000 aquatic and terrestrial plants were added to the wetland by 200 people at a National Tree Day event. This event was delivered in partnership with the City of Greater Bendigo, Bendigo Northern District Community Enterprise and Planet Ark Environmental Foundation.

NBLG has raised awareness of the pest bird species, Indian Myna, through media interviews, information displays and a brochure. This activity runs alongside a trap construction, sales, and community support program.



Environmental assets

NBLG is home to important waterways in the Nature Network area, such as Bendigo Creek, Back Creek, and Goldleaf Reserve. The creeks in this area once supported the Endangered Plains Woodland Ecological Vegetation Class (EVC).

These waterways provide important habitat for native species and migratory birds, such as the rainbow bee-eater, and play an important role in quality of life for the community. These waterways have strong cultural value to the Dja Dja Wurrung people, and impact wetlands and waterways further upstream, including the Murray River.

The NBLG also includes valuable remnants of vegetation and large old trees, that should be highlighted and protected in urban development planning.

Priorities

- Continue to enhance habitat values within the Bendigo Creek - Huntly Streamside Reserve under Parks Victoria's guidance.
- Connect with community to raise community environmental awareness and education.
- Work with City of Greater Bendigo and North Central CMA to enhance the habitat and recreational values of Goldleaf Wetland and see it reach its potential as a public greenspace asset.
- Advocate for the development of public space in our area to increase amenity, biodiversity, community wellness and enhance connectivity for environmental and recreational purposes.

Achievements

- Habitat restoration within the Bendigo Creek - Huntly Streamside Reserve.
- Annual coordination of Keep Australia Beautiful - Adopt A Roadside events.
- Demonstration gardens featuring fire retardant native species.
- Huntly Bush Kinder program and Nature Week activities.
- Promotion of Whirrakee Wattle (*Acacia williamsonii*).
- Goldleaf Wetland with revegetation activities, native fish release and nature play.
- Indian Myna Trap project.



Ironbark Gully Friends Landcare

Ironbark Gully Friends (IGF) was established in 2013 as an Action Group of the Bendigo Sustainability Group, to connect the community and create a shared open space extending from Nolan Street to Eaglehawk Road..

It is the Nature Network's most urban conservation group, sitting in the heart of Bendigo amid residential prominence. The demographic can be generalised as a community in transition, moving from a working class to a middleclass, with a spread of retirees, empty nesters, and families.

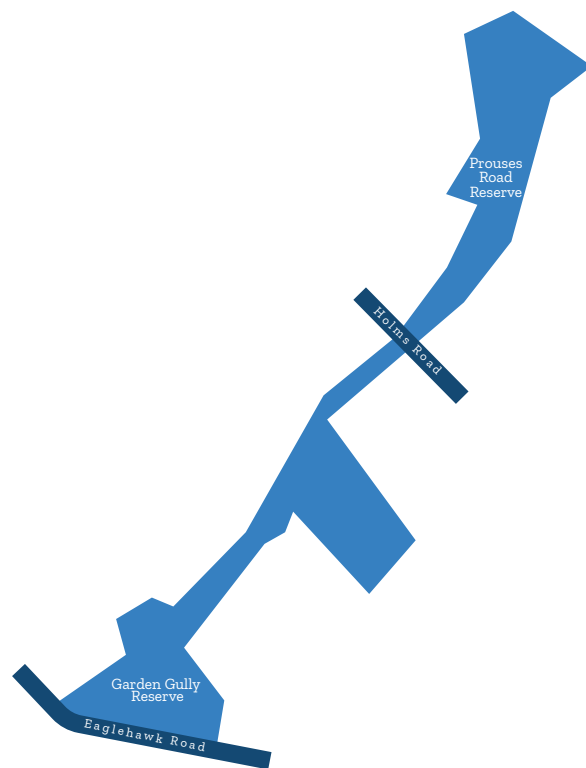
IGF has committed several years to advocacy, planning and community engagement to produce the Ironbark Gully Public Space Corridor Concept Plan in association with the City of Greater Bendigo. Council allocated \$500,000 in 2018/19 budget for design and planning, and implementation of Nolan Street to Holmes Road will be undertaken in 2023/2024.

Ironbark provides connectivity to other walking/cycling networks and has an opportunity to promote active transport and reduction in vehicular transport. This section will connect residential areas, schools, local businesses, and sport and recreation facilities.

IGF has strength in community engagement and aims to provide positive environmental, social, health and well-being outcomes for residents. In partnership with schools and Council, IGF has undertaken significant revegetation works extending from Victoria Street to Nolan Street.

Frog Ponds have been established in the Victoria Street Garden Gully precinct, in part, to provide a functional benefit of capturing urban run-off. The ponds also serve to improve diversity values for native wildlife, and provide a greenspace for nature connection, health and wellbeing whilst promoting environmental and education outcomes.

IGF has advocated for an upgrade of the Prouses Road play space, engaging with Kalianna Special School and La Trobe University to promote this potential opportunity. The project is informed by a community survey of over three hundred responses. IGF collaborated with La Trobe University students to develop the Prouses Road Recreation Reserve Proposal 2021, which has been submitted to COGB Council for consideration.



Environmental assets

IGF centres its activities around its greatest environmental asset, the Ironbark Gully. The gully has potential to provide otherwise inaccessible health, wellbeing and nature connections for its urban community. In this highly built-up environment, the gully also provides opportunity for a connected habitat corridor and a climate change refuge for important native species.

Achievements

- Advocacy, development, and implementation of the *Ironbark Gully Public Space Corridor Concept Plan*.
- Partnerships with COGB and DEECA to deliver significant revegetation works.
- School engagement to support revegetation works.
- National Tree Day events.
- Generating partnerships with government agencies and schools to revegetate sections of Ironbark Gully precinct extending from Nolan Street to Victoria Street.
- Victoria Street, Garden Gully Frog Ponds.
- Community 'Shindigs'.
- Community surveys.
- Engagement with La Trobe University students to deliver the *Prouses Road Recreation Reserve Proposal 2021*.

Priorities

- Advocacy and practical on-ground support for the implementation of the *Ironbark Gully Public Space Corridor Concept Plan*.
- Revegetation and weed control along the Ironbark Gully precinct, Eaglehawk Rd to Nolan St.
- Secure sites and funding for additional Frog Ponds.
- Create outdoor meeting places throughout the reserve and promote spaces for passive and active recreation.
- Community engagement, including Clean Up Australia Day, National Tree Day, Citizen Science, and regular community on-ground works activities.
- Advocacy for Prouses Road play space improvements.



Photo credit: Peter Weaving

Mandurang Landcare

Landcare groups have operated in the Mandurang Landcare area under several names since the original Sheepwash Creek Landcare inception in 1997. The Sheepwash Creek group formed to tackle problems of rabbits, weeds, salinity and habitat degradation.

Over the next two decades the group undertook several riparian restoration projects with landowners along the creek. Activities focused on weed control, fencing waterways, revegetation and nest box installation and monitoring.

The early 2000's saw significant lengths of the creek allocated for development and acquisition of some sections by COGB. With demographic changes, the group experienced declines in their membership and a winding-down, until the group elected to go into indefinite recess in 2016.

In 2008 the Mandurang Strathfieldsaye Landcare Network (MSLN) formed to provide a coordinated approach to community-based organisations actively working in environmental conservation. It included the then active Sheepwash Creek Landcare, The Otis Foundation, St Francis of the Fields Primary School, and Strathfieldsaye Primary School.

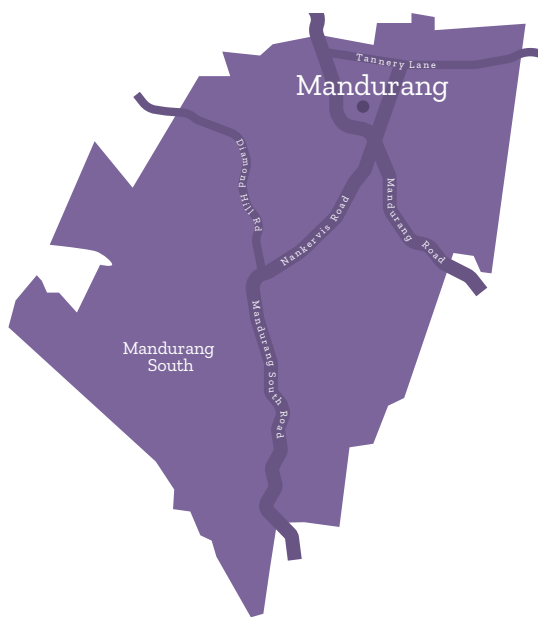
MSLN formed partnerships with Strathfieldsaye District Community Enterprise, Strathfieldsaye Scouts, South Mandurang Pony Club, Sedgwick Hall and Conservation Reserve, Axe Creek Landcare, North Harcourt Sedgwick Landcare Villawood property developers and Mandalay Recourses (Fosterville Goldmine).

This network and its partners successfully delivered a number of on-ground works and engagement events including, National Tree Day plantings with schools; field trips with La Trobe University Outdoor Education and Nature Tourism students;

GreenCorps program with Strathfieldsaye Primary School; and community festival exhibits.

The MSLN group opted-out of the Landcare Facilitator program in 2021 due to a lack of active membership, and to support the development of the Nature Network.

The Mandurang demographic can be broadly defined as highly educated, working professionals, that appreciate nature and life balance. Properties are around eight hectares and land-use goals can be broadly broken into bush blocks for regeneration, equine and micro-producers. Neighbouring environmental groups have attracted strong participation in nature-based educational workshops from the Mandurang area.



Environmental assets

The Mandurang Landcare area includes significant portions Greater Bendigo National Park and important ephemeral tributaries, including Sheepwash Creek and Emu Creek. Both of which connect to Axe Creek and the Campaspe River. The Coliban Channel also runs through Mandurang.

This landscape is reported to have had Eltham copper butterfly populations in the past, and forms part of the Bendigo Field Naturalists Club Nest Box Project¹⁴⁴. This project provides habitat for brush-tailed phascogales, where legacy land-use activities have reduced the number of available natural hollows.

Achievements

- Riparian restoration, stock exclusion and nest box installation along Sheepwash Creek.
- National Tree Day plantings with St Francis of the Fields.
- Partnerships toward better environmental outcomes with community groups and investors.
- Advocacy for greenspace in town planning.
- Engagement of education institutions.
- Exhibits at community festivals and events.

Priorities

- Mandurang Landcare has newly defined boundaries due the establishment of a new group in the Strathfieldsaye area. With high environmental assets, a new demographic, and network support, there is an opportunity for a Mandurang group to re-establish.



Dr Alison Pouliot in Mandurang. Photo credit: Peter Weaving

Friends Of Strathfieldsaye Streams And Land

The Strathfieldsaye & Districts Community Enterprise Foundation (SDCE) has operated in Strathfieldsaye since 2005 and has been instrumental in establishing community connections to nature, particularly paths along the creek and recreational facilities.

Through their activities, focus eventually shifted to making the creek more accessible and aesthetic to the community and native species, which led to the formation of their subsidiary group, Friends of Strathfieldsaye Streams and Land (FOSSALs).

The FOSSALs are an action-oriented environmental group of predominantly male retirees. The group has focused efforts on removing woody weeds from Axe Creek and rehabilitating natural habitat, with a vision to eventually draw native fish and Platypus back to the area.

The FOSSALs group provide important social and physical and mental health outcomes for its participants, providing a weekly place for retirees to gather, work and share morning tea. Many members have been recruited by chance, due to the location of the recreational track along high profile riparian work areas.

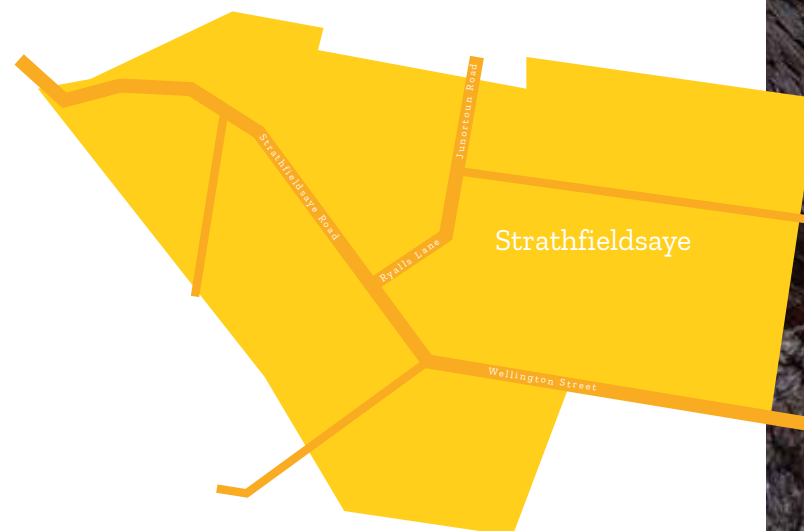
In 2022 the group registered as a Landcare group and began works on a larger scale project called the *Axe Creek Protection Project*. This project was funded by a nearby mine that saw an opportunity to give back to the community and the environment.

The \$450,000 project spans 25km of Axe Creek and will focus on weed removal, revegetation, stock exclusion and re-fencing boundaries, to achieve 10-20m riparian edge and permanent pools. The project requires considerable private landholder engagement and project management, therefore FOSSALs have contracted BushCo to assist with delivery.

Strathfieldsaye is a fast growth corridor for urban development in the City of Greater Bendigo's *Bendigo Residential Development Strategy 2014*¹⁴⁵. It is experiencing high rates of urbanisation which requires significant land clearing and stormwater impacts. The demographic tends to be primarily families with school age children.



Photo credit: Peter Weaving



Environmental Assets

The waterways in this area include Axe Creek and ephemeral tributaries Emu Creek and Sheepwash Creek. These are significant waterways that play an important role in habitat connectivity and climate change refuge.

The creeks in this area once supported the Endangered Plains Woodland Ecological Vegetation Class (EVC). They are also culturally significant waterways that support important species that are important to Dja Dja Wurrung people.

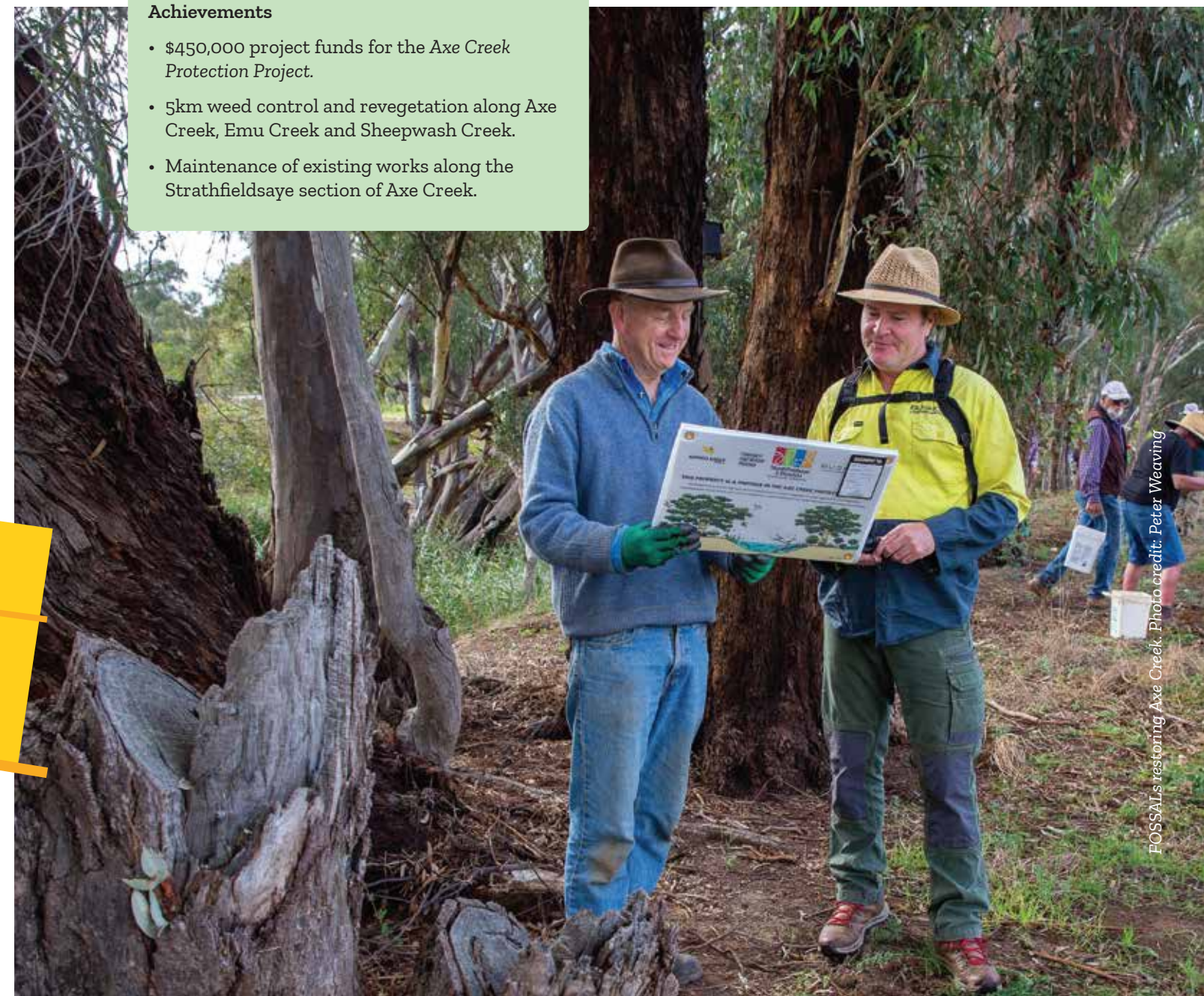
Anecdotal evidence suggests there could still be deep pools in Axe Creek that remain during prolonged drought periods.

Priorities

- Deliver the *Axe Creek Protection Project*.
- Weed control and revegetation projects along Emu and Sheepwash Creek.
- Maintenance of existing sites.
- Develop volunteer plant and weed identification skills.
- Increase volunteer capacity for chemical handling and animal baiting.
- Develop partnerships with neighbouring environmental groups to extend existing work.
- Create habitat for native fish and platypus.

Achievements

- \$450,000 project funds for the *Axe Creek Protection Project*.
- 5km weed control and revegetation along Axe Creek, Emu Creek and Sheepwash Creek.
- Maintenance of existing works along the Strathfieldsaye section of Axe Creek.



FOSSALs restoring Axe Creek. Photo credit: Peter Weaving

Junortoun Community Action Group

The Junortoun Community Action Group (JCAG) was established in 2012 to develop a community plan to ensure a safe, peaceful, and friendly place for their semi-rural community. The group has a broad focus and note that environmental work is one part of their activities. They also advocate for cycling paths, road upgrades, safe speed zones and community services such as playgrounds and public transport.

Their environmental focus has included several on-ground projects and engagement activities, as well as a management appointment for Honeyeater Reserve. Recently the group developed a management plan for the reserve which highlighted significant ecological values including "good cover of wetland plants and population of endangered Bibron's Toadlet¹⁴⁶".

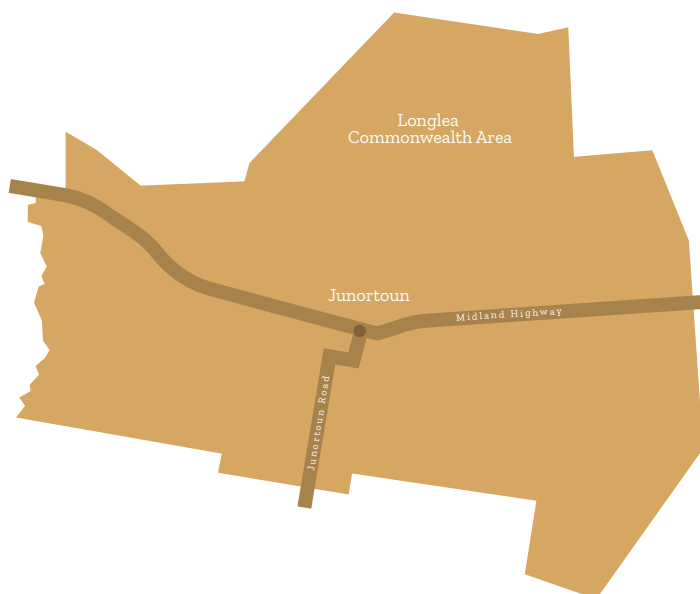
Junortoun has been marked as a high residential growth corridor in the City of Greater Bendigo's Bendigo Residential Development Strategy 2014¹⁴⁷. Under continuing development pressure, JCAG are keen to ensure that habitat connectivity is emphasised in urban and land management planning. In particular, the group sees opportunities for Honeyeater Reserve to be connected to Knul-Doorong Woodland Reserve and the O'Keefe Rail Trail.

The gullies, streams and rail trail in the JCAG area present a unique opportunity for a visionary project that could connect Axe Creek and Wellsford State Forest to the Whipstick Forest.

JCAG have recently been successful in obtaining a grant to revegetate Splitters Creek. This highly modified ephemeral tributary of Axe Creek now resembles a drain, but once supported Endangered Grassy Woodland/Alluvial Terraces Herb-rich Woodland Mosaic EVC (Ecological Vegetation Class). This was the only place this EVC was thought to occur in the Nature Network area.

The Splitters Creek Project aims to revegetate 6km's of creek from Splitters to Longlea Lane. It also includes an educational component, which aims to build community understanding of the creek's ecosystem values. The project hopes to engage private landholders along the creek and connect to the work of FOSSAL's Axe Creek Protection Project.

JCAG has demonstrated capacity to effectively engage their community, regularly conducting surveys, engaging the local school to build nest boxes, and coordinating an annual Welcome to Summer event. Their demographic is a mixture of "lifestylers" on small acreage, families on residential blocks, and retirees. The area attracts educated residents with nature values.



Environmental assets

Important ecological sites in this area include a flora and fauna reserve on Trotting Terrace, significant roadside vegetation, orchids, and wetlands. Rare and endangered species including Bibron's Toadlet and orchids occur.

Connective waterways and gullies include Splitters Creek and Axe Creek Channel. If restored, these features could become connective habitat and climate change refuges.

Achievements

- Construction and erection of 100 nest boxes along the O'Keefe Rail Trail.
- Weed control, maintenance and erection of interpretive signage at Manning Reserve.
- Development of the *Honeyeater Bushland Reserve Management Plan 2021-26*.
- Clean-up days at Manning Reserve, McIvor Highway and O'Keefe Rail Trail.

Priorities

- Management of Honeyeater Bushland Reserve.
- Biolinks to connect Honeyeater Reserve, Knul-Doorong Woodland Reserve, the O'Keefe Rail Trail, state forests and other conservation properties.
- Splitters Creek project – engage private landowners, community and neighbouring environmental groups.
- Develop resources and educational events to promote ecological value of environmental assets, native plant gardens, species lists and nest box Citizen Science.
- Native plant selection community education events.
- Expanded nest box monitoring and maintenance programs.



Boy holding scorpion. Photo credit: Peter Weaving



Honeyeater Reserve, Junortoun. Photo credit: JCAG

Friends of the Whipstick Landcare

A new and establishing group, the Friends of the Whipstick (FOW) registered as a Landcare group in 2022 with a view to raise awareness of the Whipstick Forest's unique ecological value and protect it from threats.

The Whipstick Forest sits within the Greater Bendigo National Park and adjoins densely urbanised areas, and pockets of Key Development Sites¹⁴⁸ nearby. Although plagued by legacy and modern land-use impacts, the forest retains significant ecological value.

The Friends of the Whipstick Landcare has recruited specialized skills to their committee and have an interest in sharing those skills with the wider community, to build capacity to care for and connect with the Whipstick.

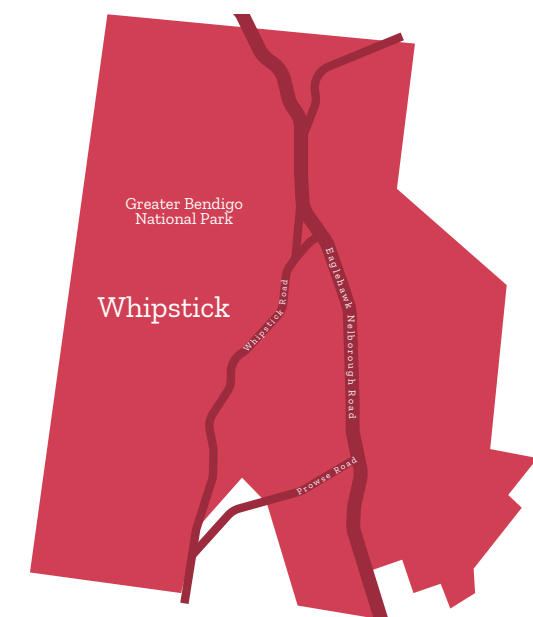
A member of FOW has recorded thousands of invertebrate species in this forest and has submitted them for review with the Victorian Biodiversity Atlas and Atlas of Living Australia. Submissions are reported

to include species that have not been recorded in Victoria before, have not been sighted for some time and others that are rare to see in this landscape.

Key threats to the Whipstick have been identified by FOW, including illegal rubbish dumping and four-wheel-driving, and planned burns. Evidence of inappropriate burning regimes exist in this forest, with a stark contrast visible from one side of Rifle Range Road to the other. This section presents an interesting study to researches at the University of Melbourne.



Photo credit: Peter Weaving



Environmental assets

The Whipstick Forest protects some of the highest quality Box-Ironbark forest in north-central Victoria, along with Mallee species and grassy woodlands. It's home to an amazing display of wildflowers, primarily in Spring time and an extensive range of invertebrates.

Achievements

- Recruited a committee and established a Landcare group.
- Contributed local knowledge to University of Melbourne's bushfire management research project.
- Guided flora and fauna walks.
- Species record contributions to Victorian Biodiversity Atlas and Atlas of Living Australia.
- Host rubbish collection days four times per year.

Priorities

- Community engagement and awareness raising events.
- Continuing to advocate for policy approaches that protect and enhance the Whipstick.
- Engage with Traditional Owners to understand cultural land management techniques.
- Reduce acts of rubbish dumping.



Photo credit: Peter Weaving

Partnership opportunities

The Nature Network model provides unique opportunities for partnerships and funding on behalf of its Member Groups.

There may be times when the Network will be able to provide economical and efficient environmental services to partners, through its combined army of volunteers, its direct feedback from grassroots, and its relative operational freedom. The Nature Network advocates for partnering with agencies to

extend existing projects and add breadth and depth to environmental outcomes. Through this Blueprint process the Nature Network has also taken steps to avoid duplication and pay respect to organisations already invested in specific environmental activities in the area.

Among many potential partnership opportunities, the Nature Network acknowledges the following groups and looks forward to exploring many more:

- Neighbouring Friends and Landcare groups, including Sutton Grange, Mid-Loddon Landcare Network, Connecting Country, and Loddon Plains Landcare Network.
- Traditional Owners - Dja Dja Wurrung and Taunguruang.
- Landcare Victoria Inc.
- Conservation and Environment groups, including Bendigo District Environment Council, Bendigo Climate Alliance, Bendigo Field Naturalists, Bendigo Native Plant Group, Cassinia, and BirdLife Australia.
- Regional networks and alliances, including Biolinks Alliance.
- Government agencies at Local, State and National levels.
- Research institutions and researchers – CSIRO, Arthur Rylah Institute, and Amaryllis Environmental.
- Education providers, including La Trobe University, Bendigo TAFE and schools.

Member Group partnerships

Nature Network Member Groups have expressed that partnership opportunities with each other are a key motivation for supporting the development of the Nature Network. They are keen to share resources, inspire project ideas and generate landscape scale environmental impacts.

Agencies

The City of Greater Bendigo (COGB) is currently developing a Biodiversity Strategy to supplement their Climate Change and Environment Strategy. Focus areas include:

- Connectivity across the landscape, particularly in the Box-Ironbark Forest, but also in grassland communities, and potentially along the Bendigo Creek, tributaries, and the Coliban Channel. There is interest in improving and creating biolinks in Sedgwick, Crusoe, North Harcourt, Bendigo Creek, Sheepwash Creek and Axe Creek.
- Empowering communities – COGB are also considering community education opportunities such as guided nature-based walks and information sessions that equip communities with knowledge and private land management skills for biodiversity.

There is opportunity to partner with COGB for these common goals. Other opportunities for partnership could include DEECA's Land for Wildlife, Trust for Nature, Biolinks Alliance and Resource Smart Schools.

North Central CMA has a comprehensive Citizen Science program targeting adults and children through its Waterwatch¹⁴⁹ and River Detectives¹⁵⁰ programs. They also have an on-going Native Fish Recovery Program¹⁵¹ focusing on re-establishing native species through the reinstatement of habitat and water for the environment.

Dja Dja Wurrung has developed a Forest Gardening Strategy¹⁵² and are working towards Restoring Spirit on Country. There is opportunity for the Nature Network to play a role in developing cultural awareness training and building capacity for groups to support Traditional Owner self-determination.

Opportunities with other networks

Mid-Loddon Landcare Network (MLLN)

MLLN has identified opportunities for improving and linking landscapes throughout the Bendigo region. They are focused on smaller projects due to current capacity limitations (volunteers, resources, time). MLLN are continuing their sustainable farming project and have recently completed a project to move logs for bushstone curlew breeding and release habitat.

In association with COGB, MLLN are also working on aquatic plant propagation for revegetation of private dams and public waterways. Nature Network could work with MLLN to extend this project.

Connecting Country

Connecting Country are delivering training for Landcare groups e.g., pollinators and grant writing. They are open to co-delivering these opportunities to extend the reach to more participants. Some of their groups are also working on specific landscape projects:

- Harcourt Valley Landcare is focused on revegetation and weed control. There is potential to partner with groups in the Nature Network area to extend these projects. The Nature Network may have a particular partnership interest in the emerging threat of St John's Wort, as it spreads from Mt Alexander into Axe Creek and Sedgwick.
- North Harcourt and Sedgwick Landcare Group are running a Silver Banksia project to increase genetic diversity and recolonise this once endemic species.
- The pollinator project operating in the north of this network area has the potential to be expanded into the Nature Network area to create pollinator corridors.

Biolinks Alliance

Biolinks Alliance is open to new partnerships from interested community groups and agencies across Central Victoria. As a member of Biolinks Alliance, Nature Network would have access to resources and events. Their focus is on building landscape connectivity and community capacity. They have a current project in Heathcote and there are opportunities to extend this work or develop a new landscape project in partnership with Nature Network.

Strategic alignment

The Victorian Government's Biodiversity 2037 Strategy¹⁵³ provides a roadmap to reduce the decline of our native species and ecological communities.

The strategy outlines two potential pathways to contribute to Biodiversity 2037 - on-ground works and community engagement. Specifically, to achieve better protection and management of biodiversity, and a healthy environment for Victorians.

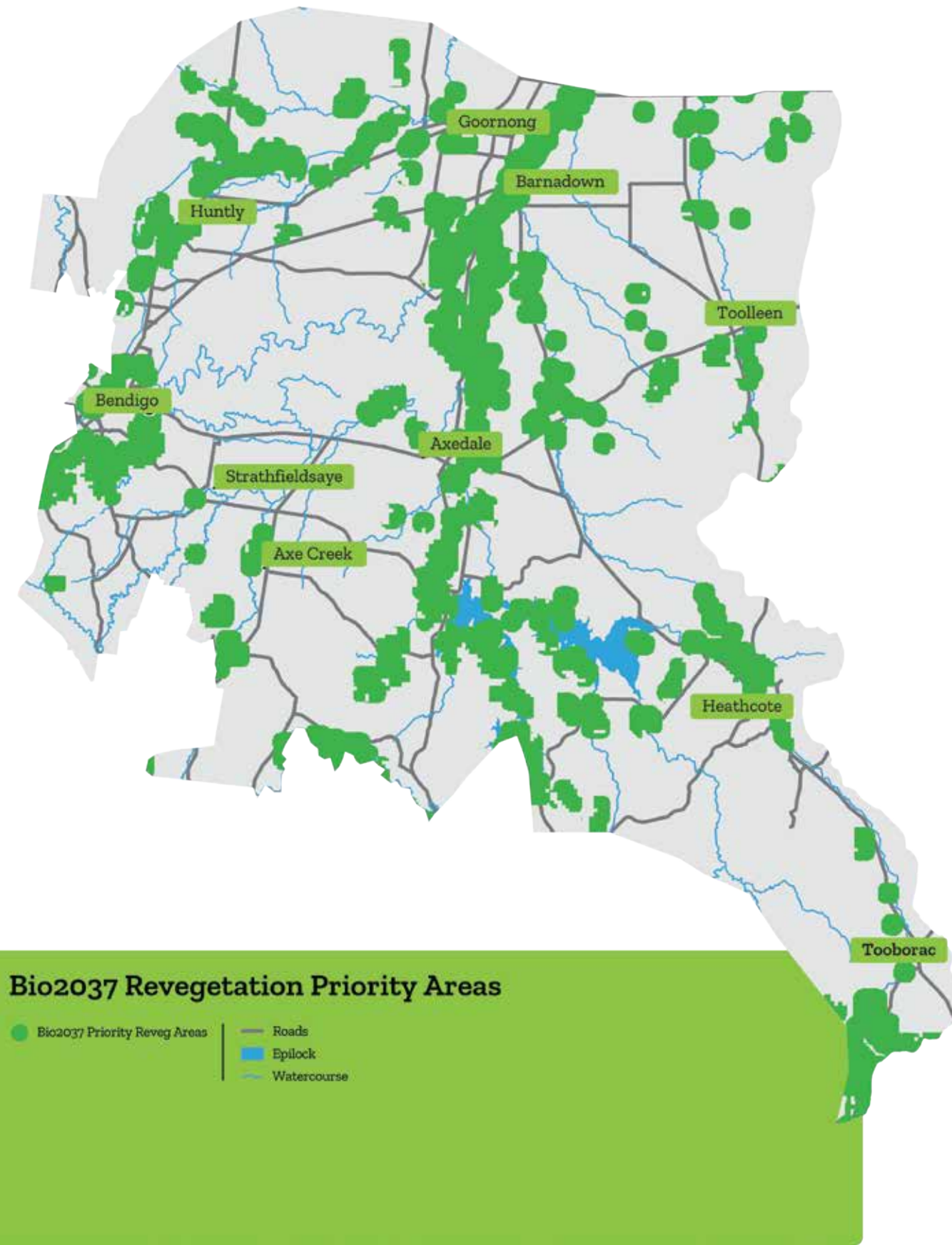
The Bio2037 Reveg Priority Areas Map (opposite) outlines the Victorian Government's priority areas for revegetation. These areas cover the top 10% of locations across Victoria where management actions maximise benefits to threatened (and other) species.

For groups and organisations to be eligible for grant opportunities through the Victorian Government, project plans must align with the strategy. Where this involves revegetation, it must contribute to their priority areas; mainly focusing on linking landscapes along waterways.

- Additional strategies that direct investment in natural resource management projects include:
- North Central Regional Catchment Strategy 2022-2027¹⁵⁴
 - City of Greater Bendigo's Climate Change and Environment Strategy 2021-2026
 - City of Greater Bendigo Biodiversity Strategy 2023
 - DJAARA's Dhelkunya Dja Country Plan 2014-2034
 - DJAARA's Forest Gardening Strategy Galk-galk Dhelkunya 2022
 - Taunguruang Land and Waters Council Country Plan 2016
 - Threatened Species Action Plan: Towards Zero Extinctions 2022-2032



Photo credit: Adrian Martins



Potential projects

There are three main opportunities for network-scale projects that could be undertaken as one large project or individual projects. They are based on feedback from groups and partners who are focused on landscape connectivity through a combination of on-ground works and community capacity building/engagement.

Landscape connectivity

An opportunity exists to strengthen the connection between key biolinks and waterway corridors in the Nature Network area. This could potentially involve a range of projects or sub projects that contribute to the long-term goal of connectivity across the landscape:

- Emu Creek, Sheepwash Creek, Splitters Creek and Axe Creek Corridor to the Campaspe River - continue to revegetate the Axe Creek corridor to the Campaspe River, particularly where private property adjoins the frontage, and link with the FOSSALS Strathfieldsaye section of the *Axe Creek Protection Project* and JCAG's *Splitters Creek project*.
- Link Wellsford Forest to Whipstick National Park Forest - establish a corridor from Wellsford Forest to the Lions Park Reserve at Bendigo Creek via Back Creek at Ascot. This would be a large multi-landholder and -organisational achievement. Smaller projects initiated over time, could focus on revegetation and weed control in parts of this corridor to contribute to the long-term vision of connection.
- Bendigo Creek and associated tributaries - link the southern end of Bendigo Creek catchment (Big Hill) to northern section in Greater Bendigo (Huntly). Establish a network of corridors that combine both rural and urban groups. Work may be undertaken in association with the City of Greater Bendigo's Reimagining Bendigo Creek project.

Potential projects require significant community, landholder and agency engagement and support to enable revegetation and connectivity activities across the landscape. In addition to private landholders, potential partners for biolink projects or sub-projects could include Biolinks Alliance; DEECA, Parks Victoria; North Central CMA; City of Greater Bendigo; Coliban Water, Dja Dja Wurrung and Taungurung.



Potential programs

Existing Member Group activities aimed at driving community engagement, education and social benefits, can be extended and coordinated at the Network scale. This approach will assist to reduce administrative and project management volunteer burden; increase event frequency, quality, distribution, and economies of scale; and build Member Group profiles.

Assistance could include facilitation of funding bids, equipment, registrations, partnerships, and pre- and post-promotion. Potential programs include:

- **Litter Removal Programs**
Support groups to promote and engage with Clean Up Australia Day (CUPD), Keep Australia Beautiful (KAB), and Adopt a Roadside.
- **National Tree Day**
Support groups to promote and engage with National Tree Day, with potential to become a lead agency. Opportunity exists to undertake the facilitation of the annual National Tree Day at a specific site (or sites) in the Nature Network area, noting that the City of Greater Bendigo has downsized its commitment to this event. Funding support is available through the Planet Ark Environment Foundation.
- **Environment Days/Events**
National and internationally recognised environmental days and weeks provide opportunities to promote education and engagement activities. Examples include World Wetland Day, World Wildlife Day, Endangered Species Day, National Water Week, Parks Week, Earth Day International Day for Biological Diversity, World Environment Day, Plastic Free July, Landcare Week, National Wattle Day, Frog ID Week, National Biodiversity Month World Habitat Day, Pollinator Week, National Recycling Week, and World Soil Day.

• Citizen Science

Citizen Science is a global movement that involves people from all walks of life in real science that matters to them. The Australian Citizen Science Association (ACSA) and the National Landcare Network (NLN) have a partnership celebrating people-powered science. The partnership puts community-led science in the spotlight, bridging knowledge gaps for effective land management and biodiversity conservation.

The Nature Network can support its Member Groups to participate in national monitoring activities such as the Aussie Backyard Bird Count, Australia's biggest frog count (Frog ID Week) and the Spring Wild Pollinator Count.

This may extend to facilitation of Waterwatch and River Detectives programs through the North Central CMA. The City of Greater Bendigo, through its Biodiversity Strategy, are also hoping to expand opportunities in the Citizen Science space.

- **Practical Regenerative Agricultural Communities**
Support the City of Greater Bendigo in promoting and engaging with the Practical Regenerative Agricultural Communities Program to promote ecological and biodiversity-focused initiatives to primary and small-scale producers.



Training

Training opportunities to build Member Group skills and capacity have been identified, they include:

- Strategic planning.
- Flora and fauna identification.
- Website development and maintenance.
- Database development and maintenance.
- Social media and online platforms.
- Marketing and communications.
- Recruitment.
- Citizen Science and Apps.
- Site management plans.
- Mapping and data collection / recording.
- Grant writing and budgeting.
- Chemical users and baiting accreditations.

Landcare Victoria Inc (LVI) are acting on similar feedback across the state and have developed webinars to support skills acquisition.

Resource sharing

Nature Network Member Groups recognise that sharing of resources is an important function of the new network. Resources are considered equipment, information, and technical support.

• Equipment

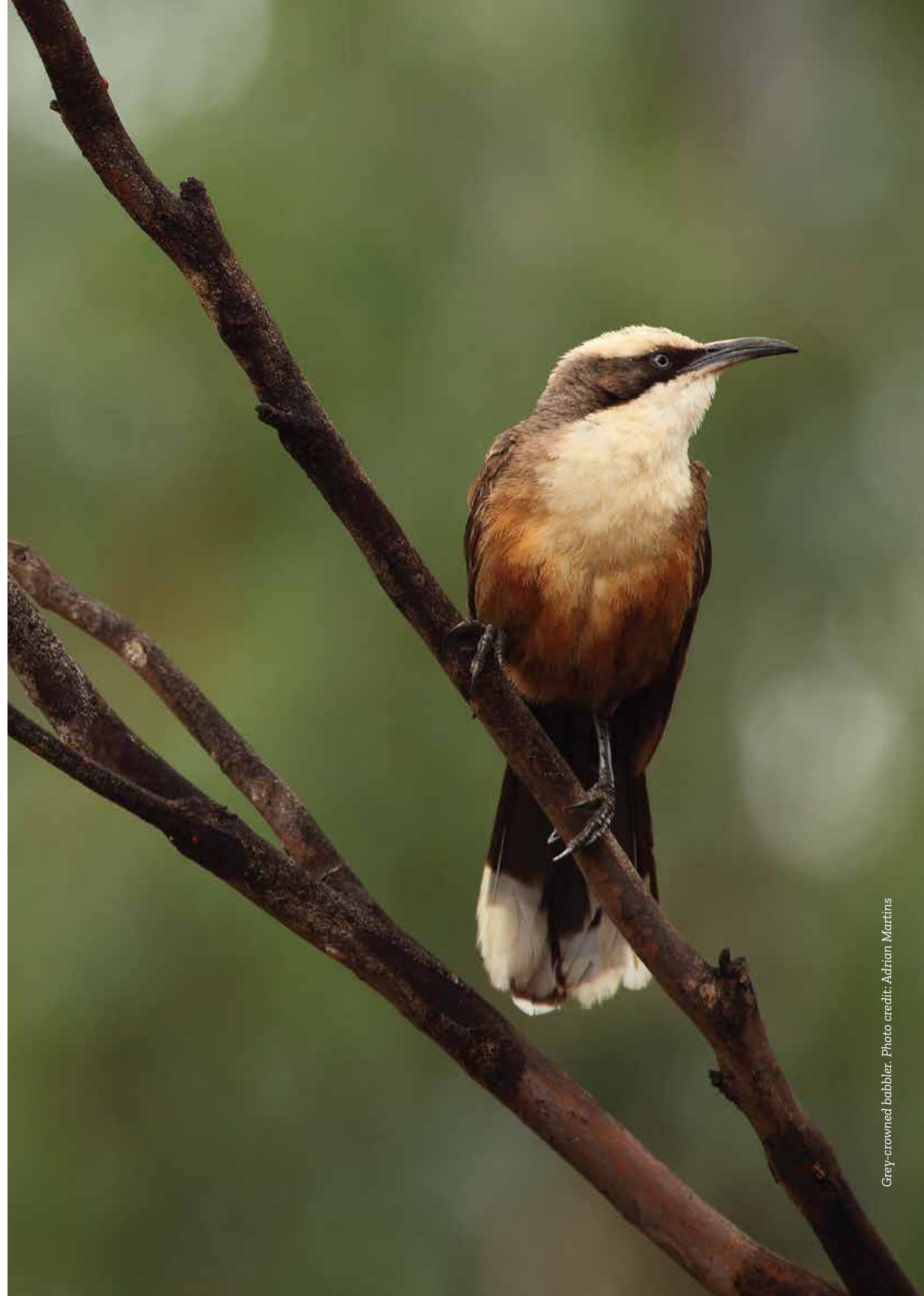
Establish a resources pool and/or an equipment register. Some Landcare groups (e.g., Longlea) have access to a wide range of equipment such as sprayers and water tankers. All groups are open to sharing their resources where possible. To facilitate sharing between groups, collate a list of resources and a loan system e.g., an online loan portal.

• Information resources

Collate and share information resources between groups. This could use a platform such as Microsoft Teams Viva Engage where groups could share online resources, projects, images, training opportunities, and events. It may also include professional development and team building activities.

• Technical support

The Nature Network could facilitate access to technical specialists for Landcare Groups for network-scale projects e.g., consultants where there is funding available or in-kind support from partner agencies. This could include recruitment of skilled labour or volunteers for landscape-scale projects.



Grey-crowned babbler. Photo credit: Adrian Martins

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