

The future of farming and biodiversity in agricultural landscapes: the Muttama Creek Catchment area



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In the spirit of reconciliation, the authors of this booklet acknowledge Aboriginal people as the First Nations people of New South Wales. We would like to acknowledge the Wiradjuri peoples as the Traditional Owners of the lands upon which the research for this booklet in the Muttama Valley took place. We also take this opportunity to acknowledge the resilience of Traditional Owners, who have for millennia lived and thrived through change on these lands. We continue to learn from them about what it takes to be resilient on this Country, and pay our respect to their elders, past present and emerging, and extend that respect to all Aboriginal and Torres Strait Islander peoples.





Soil
AVZ
DH
G/L
Soil Salinity
pH

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Foreword

This booklet summarises the collaborative work done in the research project 'The Future of Farming and Biodiversity: the Muttama Creek Catchment area'. This project is a collaboration between German and Australian researchers and the Muttama Creek Landcare Group and community. German landscape ecologist Jan Hanspach, who had worked at The Australian National University (ANU) in 2010, wrote a project proposal with ANU ecologists David Lindenmayer and Ben Scheele to combine their ecological expertise with his systems perspective on pathways to the future. When the project was funded, PhD student Tamara Schaal joined the team and travelled to Australia to undertake the project. The team partnered with the Sustainable Farms initiative at ANU which builds on decades of ecological research in south-eastern Australia and is well connected across the region. Sustainable Farms put the team in touch with Annie Jacobs who is a member of the then recently formed Muttama Creek Landcare Group and a local of the area. During a short visit to the area in late 2019, Tamara presented and discussed the project with land managers and other people involved in farming and biodiversity conservation in the area. The Landcare Group was keen to be involved and the decision was made to collaborate on this project.

In brief, this is the beginning of the story of how this research project came about and how the people who wrote this booklet are connected. We see this booklet as a source of information for people interested in environmental issues, those working on biodiversity in farming, and particularly land managers/holders in the Muttama area. We also hope that it will be a source of inspiration to think about what you can do individually and collectively to navigate toward the futures you and your community would prefer to see.

1

Introduction



We want to invite you to go on a journey with us. Think about a farm in south-eastern Australia and imagine how it has changed over the past ten, thirty, or three hundred years. What you see around you right now in this place – the eucalypts, paddocks with flocks of sheep or cattle, canola fields, perhaps moist soil and lush grasses – will likely have looked quite different in the past. There have been major developments in technology, weed management, and agricultural science in general, leading to huge increases in productivity and output. However, major challenges for landscape health have also emerged such as soil salinity and acidity, loss of tree cover, and soil loss.

Considering how much can change over a decade or even just one drought period, it is hard to foresee what the future will look like. Will farming families have vanished and been replaced by corporate farms in the hands of international investors? Will production for the global market have been superseded by small-scale, diversified production systems? Will your



Canola and grains are grown widely across the Muttama Creek Catchment.

community work together or will you find yourself isolated on the farm? Will there be any old, hollow-bearing trees left in the landscape, or will there only be rows of tree saplings on the rocky outcrops?

These are just some of the questions that might come to mind when we talk about the elusive term 'future'. Whilst some changes are slow and happen over generations, the Covid-19 pandemic has taught us all a lesson when it comes to how rapidly changes can happen, resulting in global supply chain issues and social isolation.

Change happens all the time, sometimes so subtle that we hardly notice it and sometimes so fundamental that the world around us seems upside down. Though it is challenging to imagine what life will look like one, two, five, or even ten years into the future, we should not shy away from thinking about it. Imagining what the future might look like can help us to anticipate changes and adapt our actions in the present. Another reason why this awareness of future changes is important is that we are not chess pieces being moved around on a chess board by global

forces. Though it may not always seem like it, we as individuals and even more so as communities have the power to bring about and influence change. We can implement changes in our immediate surroundings and we can collectively influence local decision-making and change the landscapes in which we work and live.



A gully several meters deep is an example for the challenge of further soil erosion especially after heavy rains.

The future will of course be made up of many different elements that are part of our lives. In this project, we focused on biodiversity in agricultural landscapes. The loss of biological diversity is one of the key challenges that we and future generations face. Biodiversity encompasses the huge variety and diversity of different species and ecosystems that can be found in Australia. Land-use changes and in particular intensifying and expanding agriculture are among the key drivers of biodiversity loss globally. As our knowledge about changes to ecosystems and their impacts increases, so does awareness about biodiversity loss in the broader society. Farmers are close observers of the land and are increasingly asked, for example by consumers or financiers, to demonstrate how they protect biodiversity and the natural environment on their farms. Biodiversity is therefore relevant for farmers now but it will become even more important in the future.

In the academic literature, there is a huge debate about the best approach to protect biodiversity in agricultural landscapes. However, this is a very complex issue, touching on economic, social and environmental topics and there is no one-size-fits-all. Therefore, in this project we wanted to understand different local viewpoints about how farming and biodiversity can be integrated, and jointly with the farming community in the Muttama Creek Catchment area, consider this topic more holistically by exploring different futures for farming and biodiversity. The overarching aim of the project was to understand different farming land-use priorities and explore options to integrate profitable farming and successful biodiversity conservation in the Muttama Creek Catchment area.

The remainder of this booklet is organised as follows. **Chapter 2** provides an overview of key natural assets on farms in south-eastern Australia. This chapter builds on insights from decades of ecological research by the Sustainable Farms initiative. The Muttama Creek Catchment is on Wiradjuri Country and **Chapter 3** is a guest chapter that provides a brief introduction to Indigenous knowledge and land management. **Chapter 4** explains why the Muttama Creek area was so interesting for this project and how it is in many ways a typical farming landscape of south-eastern Australia. **Chapter 5** covers the first research component of the project. It describes four different viewpoints on integrating farming and biodiversity, based on 94 interviews with people in the area. The second research component of this project, which is based on two workshops about preferred futures, is summarised in **Chapter 6**. We describe six project storylines that lead away from key issues in the present toward positive futures. **Chapter 7** of this booklet synthesises the key project findings, summarises the main implications, and gives policy recommendations for how to integrate farming and biodiversity in the future. Finally, **Chapter 8** provides background on the artworks that were created by a local artist who participated in the workshops and visually captured the spirit of the discussions.

Executive Summary

The Muttama Creek Catchment, located in the sheep-wheat belt of south-eastern Australia, is facing major changes, including climatic, demographic and market volatility. The project presented in this booklet sought to answer the question of how farming and biodiversity can be better integrated and how people in the catchment area can shape the future they would like to see. In this booklet, we highlight the multiple ways in which people relate to biodiversity in farming and what they believe can be done to protect it. We point to the different understandings of the relationship between farming and biodiversity and perceptions of what the farmer's role is. This booklet also shows what people from the area believe are the current key issues, how they can be overcome and what a good future looks like. We showcase the resultant six pathways, each of which presents a unique storyline of change in the area. We end this booklet with practical recommendations for what individuals and the broader community can do to work towards their ideal future and some implications for future policy development.

2 Natural assets on farms in south-eastern Australia

Written by Suzannah Macbeth



Farms in south-eastern Australia's sheep-wheat belt are located in a unique bioregion with natural features and environmental processes that strongly influence the occurrence of plants, animals and other organisms. Prior to conversion to farmland, these areas supported box-gum grassy woodlands, but in some regions only 3% of the original native vegetation remainsⁱ. Many woodland plants and animals are threatened, largely as a result of habitat loss.

When people think about biodiversity conservation, they often associate it with protected areas such as national parks. In Australia, the establishment of protected areas began first with small areas designed for recreation, followed by iconic areas and those with unique biodiversity.ⁱⁱ Protected areas are often in landscapes that are too rugged and remote to be used for agriculture or other industries, or are visually unique or dramatic. However, formal protection remains low in regions that have high agricultural productivityⁱⁱ, and the south-eastern sheep-wheat belt is no exception.

Given that this belt of productive land coincides with highly biodiverse box-gum grassy woodlands, farmland can contribute considerably to the protection of biodiversity. Enhancing and protecting natural assets on farms is one of the ways that farmers can help protect native plants and animals, thus supporting biodiversity and associated ecosystem services such as carbon sequestration.



Flame robins are small woodland birds often found in shelterbelts in south-eastern Australia.

Natural assets on farms

Farms rely on four key areas of natural capital – water, land (including soil), carbon and biodiversity – all of which influence agricultural production and are key to environmental sustainability. The first three of these are already well-understood by farmers and the agricultural industry, but the role of biodiversity is often not as broadly recognised. Biodiversity refers to the variety and variability of life, at a range of levels including species and ecosystems, and it is essential to the ongoing function of the ecosystems that underpin agricultural production.

The relationship of natural assets to biodiversity, and the role of biodiversity in supporting agriculture, can best be demonstrated through reference to a particular natural asset that is well-known and well understood: shelterbelts.

Shelterbelts have been planted for decades in many forms. Exotic shelterbelts such as conifer hedges were commonly planted to provide windbreaks. Lines of single-species Australian (not necessarily local) native trees are also a common sight. In recent decades, however, it has been recognised that mixed-species native shelterbelts of a suitable width and density provide significant value for stock productivity and for biodiversity. There are many examples of the benefits

of native shelterbelts, including protection from wind and sun for livestock, reduced desiccation of crops in hot dry conditions, increased pasture growth, reduced erosion, better water infiltration into the soil profile, greater diversity of bird and reptile species, and an increase in the diversity and number of native and non-native pollinating insects. ⁱⁱⁱ

Shelterbelts are just one example of a natural asset that plays a supporting role for both biodiversity and productivity. Based on decades of ecological work, the Sustainable Farms project (Box 1) developed the Natural Asset Farming framework which focuses on seven different natural assets – shelterbelts, remnant woodlands, paddock trees, rocky outcrops, riparian areas, farm dams and native grasses. The framework highlights how managing and enhancing any one of these assets can provide benefits for biodiversity and for productivity.

There are many, sometimes competing, ideas about how to farm sustainably and how to effectively integrate biodiversity into farming systems. However, natural asset enhancement projects are often relatively straightforward and can have minimal impact on the production system, fitting into most agricultural frameworks without necessarily requiring a wholesale change of approach (such as might be required with a shift to organic or regenerative farming). As farmland is private land, farmers are key actors for any on-farm changes.

Farmers as environmental stewards

As agricultural land stewards, farmers are also managing the ecosystems which underpin landscape function. Many farmers feel a strong connection to the native plants and animals on their land. In imagining a future for farming and biodiversity in agricultural landscapes, few would wish to envision the extinction of iconic native species such as Superb Parrots, Sugar Gliders or Little Eagles. As land managers grapple with changing climates and with such extinctions a real threat, farming communities are re-considering the implications of current practices and in many cases are planning for the future they want to see.

For many farmers, investing in natural assets leads to an increased awareness of the role these natural assets play in the landscape and in their farming systems. Farmers are already close observers of landscapes, plants and animals – driven by years of keeping an eye on pasture availability, watching out for stock in trouble during lambing or calving, or playing the delicate dance around weather for sowing and harvest. Engaging in natural asset management practices can thus help build increased ecological literacy, and a greater appreciation of the role of ecosystem services.

As farmers and rural communities consider how they might best influence the integration of biodiversity and farming, protecting and enhancing natural assets on farms provides many opportunities to achieve this integration.

Box 1: Sustainable Farms at The Australian National University

Researchers and field officers in the Sustainable Farms project, an initiative of The Australian National University, have been monitoring the responses of biodiversity to natural asset management changes for more than two decades. The ecologists who undertake the monitoring live in the regional communities where they work, and run on-farm field days to exchange knowledge and ideas, as well as to provide an opportunity for farmers to learn from each



other. The ecologists, with the help of Sustainable Farms engagement and communications staff, are thus able to support increased ecological literacy in their communities. They are also able to hear directly from farmers, so that farmer experiences and concerns can be integrated into an understanding of the role of natural assets and can inform future research questions.

Through hundreds of conversations with people on the land it has become clear that for many farmers, an initial investment in natural asset enhancements pays dividends in multiple ways – through increased production outcomes, connection to landscape, enjoyment, wellbeing, productivity and appreciation of wildlife and the natural environment.

Find out more about the benefits of natural assets and how farmers can manage them on the website: SustainableFarms.org.au

ⁱ Benson, J., *New South Wales vegetation classification and assessment*. Part 2: Plant communities of the NSW Southwestern Slopes Bioregion and update of NSW Western Plains plant communities, Version 2 of the NSWVCA database. *Cunninghamia* 10 (4):599–673 2008.

ⁱⁱ Craigie, I.D., Grech, A., Pressey, R.L., Adams, V.M., Hockings, M., Taylor, M. and Barnes, M. 'Terrestrial protected areas of Australia', in Stow, A., Maclean, N., & Holwell, G. (Eds.). (2014). *Austral Ark: The State of Wildlife in Australia and New Zealand*. Cambridge: Cambridge University Press. doi:10.1017/CBO9781139519960

ⁱⁱⁱ Further reading:

- Sustainable Farms (2022) *Managing Natural Assets on Farms: Shelterbelts*, available at: SustainableFarms.org.au/info/shelterbelts/
- Basalt to Bay Landcare Network (2015) *The economic benefits of native shelter belts report*, available at: basalttobay.org.au/ebons/

3

Caring for Country = Ngadhurinyagu Ngurambanggu

Written by Peter Beath



What was lost

The Muttama valley and the Cootamundra area were first settled in the 1830s. Since then, there have been close to 200 years of dispossession, forced and coerced relocation and breakdown of traditional life and culture for the original custodians of the land. The late 1800s to 1970s saw a period of assimilation and forced removal of Aboriginal children, further breaking the ties of traditional culture and drastically affecting the way of life for Aboriginal communities.

Cootamundra became the site of the Aboriginal Girls Training Home (also known as Cootamundra Girls Home). This not only affected the families where children were removed but also served as an ultimatum to all remaining Aboriginal families. They had to assimilate and leave traditional practices behind or risk losing their children.

This period led to much of the knowledge, customs and ceremony involved with Traditional Land management being lost. It also saw the introduction of new European-style land use/management with the introduction of sheep/cattle and new plant and crop varieties replacing native grasses. Traditional fire management of the land was halted and many drastic impacts on soils and ecosystems completely changed the landscape.

However, there remain signs of traditional land use and the complex system of land management still to be seen on properties today if you know what to look for.



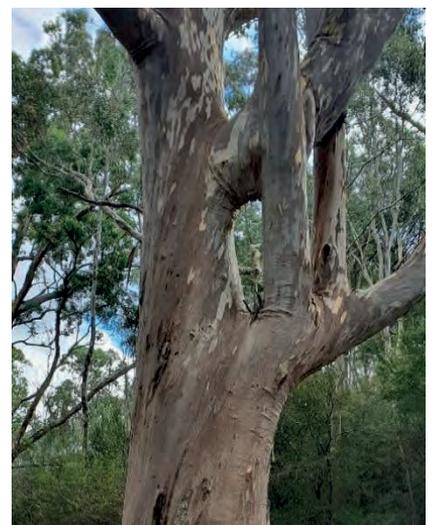
Scar Tree

What is still here

Cultural indicators - Current landholders can often find indicators of pre-colonial occupation on their properties.

Scar trees - Scarred trees are still commonly made by Wiradjuri people. Species of eucalypt, particularly red gum, yellow and grey box are carved and, when their bark is soft, removed to make coolamons (wood or bark carrying containers) and canoes.

Ring trees - These significant trees would have had their young, supple branches fused together using string woven from cumbungi reeds. The binding process trained the branches to grow in the form of a



Ring Tree



Pig Face

ring shape over time. Ring trees demarcate boundaries and mark special areas on Country. The trees mark significant cultural locations in the landscape and have been found at water junctions and inlets, campsites and burial grounds.

Native plants & grasses - Many of the traditional plants & grasses used by the Wiradjuri people of the Muttama Catchment area can still be found on farmland today in smaller quantities. If you see these plants they are not weeds and have many uses.

Pig Face: *Sarcocolla praecox*



Old Man Weed

Biradur is often found growing underneath saltbush. It has fleshy, succulent leaves and bright purplish-pink flowers in late winter and spring. Aboriginal people apply juice from the leaves to burns and blisters, in a similar way to Aloe Vera. The flowers and sweet white flesh of the fruit are often mixed with other plants, like a salad, and eaten raw.

Old Man Weed/Common Sneezeweed: *Centipeda cunninghamii*



Cumbungie

Budhaanybudhaany, commonly known as Old Man Weed, is one of the most important medicine plants known to have been used. It usually grows 20 centimetres high and has long, bright green leaves. Almost all parts of the plant are used including stems, leaves and seeds, each of which have multiple uses. Old Man Weed can be found in areas that are occasionally flooded in many parts of the Murrumbidgee catchment. Old Man Weed is still used today to treat a wide range of health issues.

Cumbungie/Bullrush: *Typha domingensis* and *Typha orientalis*

Baaliyan grows in wet areas, like creek beds and ponds that experience long periods of waterlogged conditions. It can reach more than 2 metres tall and form dense thickets that provide habitat for wetland animals. These conditions create a great place to hunt. Baaliyan roots are peeled and dried in front of a fire, then twisted to loosen the flour-like substance from the roots. This 'flour' is used to make a type of bread. Also, the long leaves are perfect for weaving and rope/string making. The long stems can also be used for light-weight spears that are good for hunting fish and birds.



Kangaroo Grass

Kangaroo Grass: *Themeda australis*

Gaymaan grows best in soils with low nitrogen levels and grows quickly during the early spring. It can be found in a wide range of soils including sandy, heavy clay, red and dark forest soils. Gaymaan seed is harvested and grinding stones were used to

make flour. This flour was mixed with water and cooked to make damper. Gaymaan is also edible for livestock before it begins to flower.

Native Millett - *Panicum decompositum*

Gulu is a thickly tufted, warm-season perennial grass. It can grow up to 145cm tall. Gulu leaves are blue-green colour. Gulu flowers in summer and autumn. After a period of good summer rains, Gulu can produce large amounts of seed. Gulu seeds are harvested and grinding stones were used to turn it into flour used to make bread.



Native Millet

Remembering the old ways

Some people still remembered the old ways and many early explorers and anthropologists kept records of their early observations of how people looked after and managed the land. Knowledge was passed down through oral tradition and the written history.

In *The Biggest Estate on Earth: How Aborigines made Australia*, Bill Gammage demonstrates that Aboriginal people actively worked the land to make sure that plants and animals were plentiful and dependable. This required a systematic approach to managing the land through the use of fire and strategic planting of edible seed grasses and useful plants.

Bruce Pascoe's *Dark Emu* argues that we need to reassess the 'hunter-gatherer' myth that pre-colonial Aboriginal Australians have been labelled with through school curriculums and media depictions for decades. *Dark Emu* looks at colonial myths and poses different interpretations using modern academic findings to come to a different conclusion, namely that Aboriginal people used complex systems of food production and land management for thousands of years.

In 2022 we are finally witnessing Indigenous knowledge and agricultural science coming together to look at new ways to incorporate old ways into modern agricultural practices. There is also a growing body of evidence that our native vegetation controls erosion by protecting soils and the banks of waterways, reduces land degradation and prevents salinity, improves the water quality and availability, provides habitat for native birds, mammals, insects and reptiles and encourages increased biodiversity on farms.

Many studies over the past decade continually show that an increase in biodiversity through restoration, protection and rehabilitation of native vegetation on properties leads to increased crop yields and improved pasture growth.

There is also a growing movement within both Aboriginal Communities and the agriculture sector to look at native plants and grasses as opportunities for alternative income streams. By embracing biodiversity and our native plants on farms we can see improved economic outcomes for landowners while also caring for country.

4

The Muttama Creek Catchment



The Muttama Creek Catchment area is in many respects a typical farming landscape of south-eastern Australia and it was therefore interesting for us to explore the big question of how farming and biodiversity can be integrated in the future. The catchment derives its name from the approx. 100 km long Muttama Creek, a tributary of the Murrumbidgee River. As part of the South West Slopes, undulating hills and rocky outcrops mostly on hilltops or on top of ridges characterise the area around the Muttama Valley. The catchment is part of the Cootamundra-Gundagai Regional Council, whose **two main towns of Cootamundra in the North and Gundagai in the South** account for most of the population of 11,000 in the local government area.



Location of the Muttama Creek Catchment in eastern New South Wales.

The area is part of the so-called sheep-wheat belt, a large area across south-eastern Australia known for agricultural production through both cropping and livestock farming. The temperate climate, relatively stable weather, and fertile soils have played a major role in making agriculture an important aspect of the regional economy and in sustaining family farming in the area.

Before European colonization, the catchment area used to be Box Gum Grassy Woodlands, a mix of eucalypt trees, native grasses, and shrubs. Since the beginning of industrialised agriculture, these ecosystems have been heavily modified and today only remnant areas of natural vegetation remain. Particularly the loss of many old, hollow-bearing trees has resulted in the decline of bird species such as the threatened Swift Parrot. Despite funding to restore Box Gum Grassy Woodlands, no substantial improvements in threatened species have been observed in the area.



Junction of the Muttama Road leading towards the two major towns in the area: Gundagai in the South and Cootamundra in the North.

These are some of the examples that highlight that the area has been on a long road of change. However, the future trajectories are far from certain, and increasing volatility and unforeseeable pressures create challenges for the rural

community in the area. For example, fluctuations in commodity prices on the world market have major implications for the profitability of farming businesses, and demographic changes, particularly due to an ageing population, alter the community fabric. Additionally, south-eastern Australia has experienced and will continue to experience declines in rainfall, increasing temperatures, and more extreme weather events such as droughts, fires, and floods. This will not only present a major challenge for farming in the area but will also increase pressures on biodiversity, in particular native wildlife and vegetation.

To discuss how the catchment area might develop in the future there is an urgent need to incorporate future uncertainties into current discussions within the community and consider ways to take actions now to shape the future.



The Muttama Creek Landcare Group

Written by Vivien Thomson

The community surrounding Muttama Creek is quite diverse yet shares a deep concern about their farming landscape and members of the local farming community started the Muttama Creek Landcare Group in late 2018.

The Landcare Group aims to protect and rehabilitate the natural vegetation of the Muttama Creek and surrounds, to reduce adverse impacts of climate volatility in the area and increase biodiversity. Extreme weather events are happening more frequently, and our Landcare group plays a role in supporting farmers to help prevent and manage major impacts as well as support in the recovery when damage occurs.

As a grassroots movement, Landcare is all about community and creating positive changes for the long term. The Muttama Creek Landcare Group is driven by a group of volunteers who share a love of the land, a connection to the land and want to ensure we look after the land. The group cares about the ecological future of their farming landscape and are keen to work together for a sustainable future.

Members of the Landcare Group make a difference to natural and sustainable resource management through a wide range of impactful “hand-on” activities, workshops, community events and education. In the



A ‘Breakfast with the Birds’ activity organised by the Landcare Group.

past, this included for example Bird Walks to identify different bird species on a property and learn about their habitat requirements. The Landcare Group also came together to exchange experiences and learn about planning the farm landscape more holistically, and met to discuss soil testing and improving soil health. The Landcare Group meets on a regular basis to exchange ideas, discuss project applications and plan community activities.

You can find information on the Landcare Group’s activities and connect with them here: <https://www.facebook.com/muttamacreeklandcare/>

5

Different viewpoints on farming and biodiversity



What does a biodiverse farm look like and how can biodiversity be managed in the farming business? **Chapter 2** provided a broad overview of the elements that can help create and maintain habitats and biodiversity on the farm. However, we know from our experience and the academic literature that farmers' ideas about what biodiversity is and how it can be managed can be quite different from scientific definitions of the term.

Therefore, for this first research component, we wanted to understand the main viewpoints on biodiversity in farming that are prevalent and shared among people in the Muttama Creek Catchment area. We were interested in the experiences and opinions of people in the farming community about how to manage biodiversity in the farming business. To understand these different viewpoints on the relationship between farming and biodiversity, we conducted interviews with 94 people between March and June 2020 using the Q-methodology (see Box 2). We interviewed local land managers and land holders, agricultural consultants, staff working for key governmental organisations and relevant individuals working on the topic that were suggested to us.



A shelterbelt planted on a farm provides multiple benefits such as habitat for wildlife and wind protection for stock.

Interview process

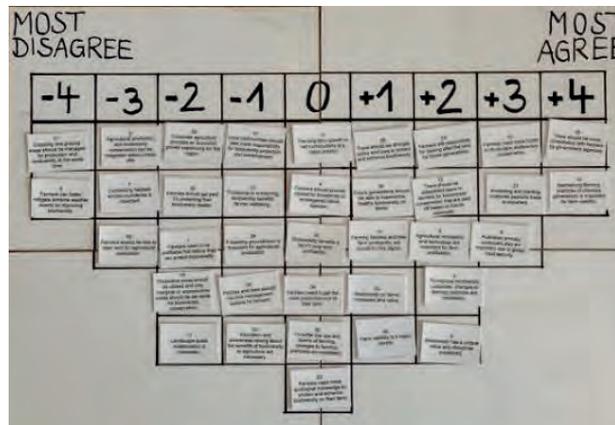
Before starting the interviews, we developed a list of statements that we expected to reflect a range of different perspectives on the interview topic (see Appendix A1). The statements were selected to represent different elements of the debate around integrating farming and biodiversity, including the importance and benefits of biodiversity, the importance of agricultural production, different farming types, the role of policy and government, financial resources, education, the farmer's role and responsibility, the role of collaboration and changes in farming practices.

The interviews all followed the same process: All interviewees were asked to rank the same 36 statements (Appendix A1) based on the question: **What should we consider to integrate farming and biodiversity in agricultural landscapes in the future?** Each interviewee was provided with a grid (see Box 2) to sort all the

statements from what they most agreed with to what they most disagreed with. We followed that up with questions to understand the reasons for the sorting and a short questionnaire to obtain demographic information, to identify which stakeholder group interviewees belonged to and to understand how they would assess the current condition of biodiversity in the catchment area.

Box 2: Q-methodology

Q-methodology is a structured approach to studying peoples' subjectivity, i.e. their perspectives on a certain topic. Based on the topic of interest, a range of statements or photos is selected that represents the breadth of viewpoints on a certain issue or area of interest. Then, interviewees are selected who are expected to hold different viewpoints about this topic. All interviewees are asked to rank the same statements based on what they most agree and disagree with or what they think is most positive and most negative (see photo below). Based on the ranking of these statements and the information provided during the interview, researchers search for patterns. This means that they look for similarities and differences between where the statements were placed and what topics were brought up during the interview. The result is different viewpoints which are each unique and different from the others.



The grid that interviewees used to sort the 36 statements relative to each other, from what they most agreed with to what they most disagreed with.

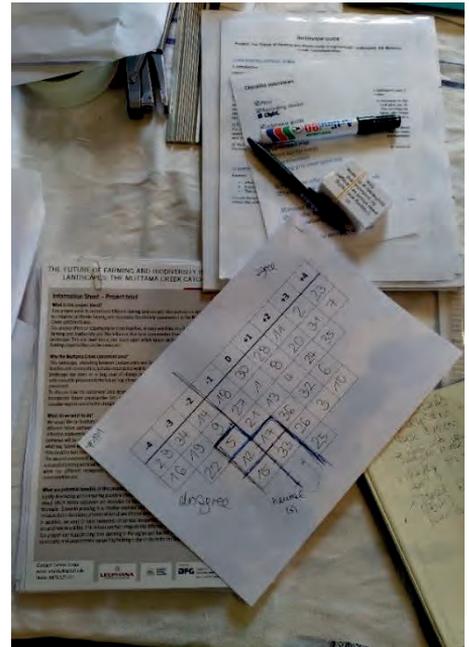
For biodiversity, we decided to focus on **native vegetation and wildlife** during the interviews. We acknowledge that this definition of biodiversity does not include some elements of interest to farmers, such as non-native species, below-ground diversity and animal genetic diversity.

Analysis of the data

After finishing all the interviews, the rankings were digitalized, the interviews transcribed and, finally, the data was analysed. The sortings of the statements were analysed statistically to find patterns across all the interviewees in how the statements were placed relative to one another. For example, some interviewees prioritised statements that emphasised the importance of production and productivity compared to others who instead agreed more with statements about the importance of biodiversity protection. Though each of the sortings is as unique as a fingerprint, certain statements stood out because they were ranked either considerably lower or higher among the different interviewees.

From the interview transcripts, we identified different interpretations and meanings of topics that emerged repeatedly in one or several interviews. Two examples were descriptions of farmers as temporary custodians of the land and that biodiversity has no or limited benefits to production. Through a combination of the statistical and interview analysis, we identified four different viewpoints.

In the following, we describe the four viewpoints that emerged out of the research in more detail. They represent **archetypal ways of viewing the relationship between biodiversity and farming**. Their names are variations of the old farming adage ‘you can’t be green if you’re in the red’, which several participants mentioned during the interviews. We also added illustrative quotes from the interviews that reflect the sentiment of each of the viewpoints.



The materials we used for the in-person interviews.



SEB
KEMPKE
20
22

Benefit viewpoint: You'll be in the red if you wreck your green.

Protecting biodiversity in agricultural landscapes is very important, especially given ongoing threats to biodiversity. Some farmers behave as “eco-vandals” (Interviewee 39) and many farmers lack environmental understanding. Biodiversity is part of ecosystems and things need to be considered on broader scales such as the catchment or the landscape.

“Because we've already got limited land available for biodiversity left and allowing farmers to clear, there will always be someone prepared to clear everything and so I don't think that there should be free rein [...]” Interviewee 38

To bring about change, there are two important levers of change. First, farming practices need to evolve from those of previous generations. Second, farmers' biodiversity knowledge and ecological literacy need to improve.

“[...] active knowledge is power so you're really empowering people to make better decisions around the balancing act between the two when they have some understanding of [...] how farming and biodiversity can work together.” Interviewee 67

Biodiversity and farming are intertwined and need to be considered in a balanced way. For example, conservation should not just focus on areas unsuitable for production. Protecting biodiversity is important because it benefits farming in the long run. Though profitability is also important, maximum production shouldn't be the main goal and production objectives shouldn't outweigh biodiversity objectives. Biodiversity is like a litmus test for the business.

“[...] I think that farmers will get paid for protecting their biodiversity assets within their own business, the profitability of their businesses will improve so there will be a payoff there [...]” Interviewee 29

Farmers today have an obligation toward future generations and they act as (temporary) custodians of the land. They are therefore also responsible for protecting the environment.

“I think that as a landowner I feel responsible to take care of the land for the period of time that I have it in my care. And when I think about native wildlife or trees, I think it's really important that whatever I do or we do collectively as an area here, doesn't impact that opportunity for the future.” Interviewee 83

However, this responsibility should be shared between farmers and the wider community. Despite this shared responsibility, the government or the broader community should not get too involved in on-farm changes.



СЕР
КЕМПРЕ
20
22

Balance viewpoint: You can stay out of the red and keep some green.

Farmers are food producers and they, therefore, have to be productive, make money and maintain a viable agricultural business. The practices of previous generations no longer ensure viability and changes are needed to deal with volatility of markets and to preserve biodiversity. In that regard, technology plays an important role in improving practices, increasing profits and it can also benefit biodiversity.

“I think the good farmers, probably the same farmers that are using precision agriculture and innovation etc. etc. will see the value in protecting their biodiversity assets [...]” Interviewee 79

For that reason, paying farmers for biodiversity or more funds in general are not the best approach for protecting biodiversity. Those who have a desire to protect it, will make space for biodiversity irrespective of funding. Additionally, increasing ecological knowledge and awareness about benefits of biodiversity to farming are important, particularly considering the extinction of species.

Farmers are caretakers, responsible for managing the land well and considering future generations. Australian farmers produce “clean and green products” (Interviewee 79), referring to products that benefit both human health and the environment.

“We should be doing it because we’re custodians of the land and we want to see the land in a better state if we keep improving it.” Interviewee 93

A balance between biodiversity and production can be achieved. For example, getting the most production out of the land and protecting and planting paddock trees are both important. Trees provide many benefits, e.g. in terms of salinity or stock protection from wind. They should therefore be planted to reverse the trend of loss of trees from the landscape. In cropping and grazing, both production and biodiversity should be protected as there exists a synergistic relationship.

“To keep doing it is to keep improving the productivity as well as the healthiness of the environment and the soil I think we can do it in a balanced approach.” Interviewee 10

Farmers should not have the liberty to just clear land to improve agricultural production. However, too much control by the government is also not the solution. This relates to the disconnect between rural/farming on the one hand and urban/city communities on the other hand which is why there shouldn't be too many measures imposed on farmers.

“[...] I think there has been a relaxation in the last few years but certainly I think there was a pushback of some in the farming community against draconian issues.” Interviewee 69



SEB
KEMPKER
20
22

Trade-off viewpoint: You have to be viable or you can't spare any green.

Profitability and viability are essential for maintaining the farming enterprise into the future. They are also key to having money available to protect on-farm biodiversity. Farmers are food producers, contributing to global food security. If you have “the wolf at the door” (Interviewee 82) and have to make a living in the competitive agricultural sector, biodiversity will be your last priority.

“[...] unless farming is viable and unless farmers are profitable, we are not going to be here [...] we won't be protecting any biodiversity anyway because we won't be able to maintain the operation, we'll be leaving farming.”

Interviewee 92

Innovation and technology instead of practices of previous generations are necessary to develop the farming business. Family farming instead of corporate farming is important in the area as it benefits the community economically and improves the community fabric. Farmers are responsible to look after the land and make sure that future generations do not find it in a degraded state. However, farmers are not the only ones responsible for preserving biodiversity and providing on-farm habitats for wildlife and they need to be able to afford it.

“[...] I think 'should' is the wrong word, I think farmers would provide habitat for threatened and endangered species as long as they can afford to”

Interviewee 32

Although there is a “feel good” factor to biodiversity, it is unclear or unproven whether biodiversity benefits farm profitability, and biodiversity can also negatively impact production. For example, trees on the farm can take nutrients and water from close-by fields and are an issue for modern farming equipment. There are “no free lunches” (Interviewee 18), i.e. biodiversity results in costs to the farmer.

“[...] if you start to tie up more land in biodiversity you cut productive land out of production so there should be a bit of a trade-off there. Production for biodiversity.” Interviewee 56

The relationship between biodiversity and production is a trade-off, i.e. they are on opposite sides of a seesaw. If you increase biodiversity, this will result in production losses. If farmers believe that biodiversity provides benefits for their business, however, they will protect it.

“If it can be proved that putting larger areas of biodiversity aside can reduce our costs and make us more profitable, problem solved.” Interviewee 40

For biodiversity protection, money is an issue and farmers should get paid to protect biodiversity. Though farmers should not have the freedom to clear land, the government should not get too involved or control what farmers do on their land. Nevertheless, collaborative approaches such as Landcare have had positive environmental impacts in the region.



NO
RED TAPE

SEB
KEMPRE
20
22

Payment viewpoint: You have to stay out of the red and get paid for the green.

It is vital for the farm business that farm productivity is maintained or increased. The scarcity of money is a key issue for protecting biodiversity. Additionally, there is a trade-off between production and biodiversity conservation. As a result, farmers either need more money or need to be paid for biodiversity protection. Having money available means that farmers can protect biodiversity. An option could be revenue-contingent loans.

“So we should get paid to keep our natural bush.” Interviewee 75

Farming is based on learning from past experiences and there are differences between farming. Practices of previous generations are therefore not important for viability but instead technology or innovation are.

*“My grandfather he would have been the one that was clearing the land and my father would have been helping him as a child and then as he aged he identified that the gullies [...] have been created from poor land conservation. [...] I'm the third generation now that I've seen this come through.”
Interviewee 15*

The generational thinking also includes future generations, i.e. that they should be able to experience healthy on-farm biodiversity. Farmers are responsible for looking after the land for them. Biodiversity can increase land values but protecting it just for its own sake is not hugely important. Farmers should not be forced to provide habitat or to plant scattered paddock trees. Production and biodiversity are separated and farmers should not have to manage the land for both. Money is a limiting factor and there is a competition between spending money on biodiversity versus other farm expenses.

[...] if your farm is not profitable then you're not going to outlay money on something [...] instead of like feed for your livestock, you outlay money on that sort of stuff before your biodiversity.” Interviewee 08

It is very important that farmers are free to make their own decisions, especially without too many governmental restrictions or “big brother” (Interviewee 19). For that reason, local communities should not necessarily take on more responsibility for biodiversity and farmers should not be obliged to collaborate across the landscape. In general, farmers need more ecological knowledge and education, and awareness about how biodiversity benefits farming is important. However, farmers are the ones who decide what information to take on and implement.

“[...] and I suppose it comes down to sometimes the person who is actually on the place [farm] or who knows the land actually has the knowledge of how this should be done.” Interviewee 15

Summary and comparison of the viewpoints

Through interviews with 94 people who are involved in farming and biodiversity in the Muttama Creek Catchment area, we identified four different viewpoints. This approach allowed us to characterise key perceptions and attitudes toward biodiversity. The perspectives are archetypal ways of viewing the farming-biodiversity intersection. This is not to say that one individual has to hold one viewpoint or that the perspective of one person cannot change. They are instead a snapshot of the main and shared viewpoints that people have about this topic. We interviewed different groups of people, most importantly farmers but also staff from governmental organisations and agricultural consultants. However, we found that the four viewpoints were not strongly linked to a particular group. This suggests that these perspectives are likely common among people in the farming community and those working for organisations in that area.

There are some key differences between the four viewpoints (Table 1). First, this includes the **relationship between farming and biodiversity**. Does farming depend on healthy biodiversity or, on the contrary, is there uncertainty about if and how biodiversity benefits farming? Second, they differ regarding the **roles and responsibilities of farmers**. Are farmers primarily food producers or are they rather temporary custodians with an obligation to protect the environment? Third, the viewpoints favour different **approaches to the protection of biodiversity**. Is more environmental education key to improving farming practices or is more money crucial to improving biodiversity outcomes? The *Benefit* and the *Balance viewpoints* represent a more pro-environmental stance with positive attitudes towards biodiversity. The other two perspectives prioritise and focus more on profitability and production, meaning that biodiversity plays a less important role in the farming enterprise. In the *Trade-off* and the *Payment viewpoints*, biodiversity is seen as something additional to the production system and not a key aspect of it.

Table 1. Three key aspects that differ between viewpoints.

	Relation between farming and biodiversity	Farmers' role and responsibility	Key solution to improve biodiversity outcomes
Benefit viewpoint	Intertwined; farming depends on ecosystem health long-term	Farmers as custodians; societal/community responsibility for biodiversity	Increasing farmers' knowledge; changing farming practices
Balance viewpoint	Balanced; biodiversity benefits landscape health	Farmers as food producers & caretakers	Technology; farmers awareness of biodiversity benefits
Trade-off viewpoint	Trade-off; no evidence of biodiversity benefits to agriculture or no benefits known	Farmers as food producers; profitable business; biodiversity not sole responsibility of farmers	Profitable businesses have extra money available for biodiversity conservation; paying farmers for biodiversity conservation
Payment viewpoint	Separated; no biodiversity benefits to agriculture	Productivity; farmers' choice; responsibility to look after the land	Paying farmers for biodiversity conservation

Regardless of the viewpoint, the people we interviewed generally agreed strongly that protecting groundcover is important. This might be explained by the timing of the interviews. We conducted interviews between early March and mid-June 2020, towards the end of the most recent drought period. The loss of top soil and the lack of vegetation on paddocks were at the time particularly important issues. Another statement that had strong agreement across the four viewpoints was that farming practices of previous generations should not be maintained. Interviewees explained that this was due to their limited benefits for farm viability or negative impacts on the environment or landscape. Such previous practices included, for example, ploughing the fields or the excessive use of superphosphates.

We also asked all 94 interviewees how they would assess the condition of biodiversity in the catchment area today. 40% of the people we interviewed felt that the condition was either *poor* or *very poor*. Another 40% felt that it was *fair* and only 13% felt that the biodiversity in the catchment area was in a *good* condition. Of all the people we interviewed, no one felt that the condition of biodiversity in the catchment area was *very good*.

6

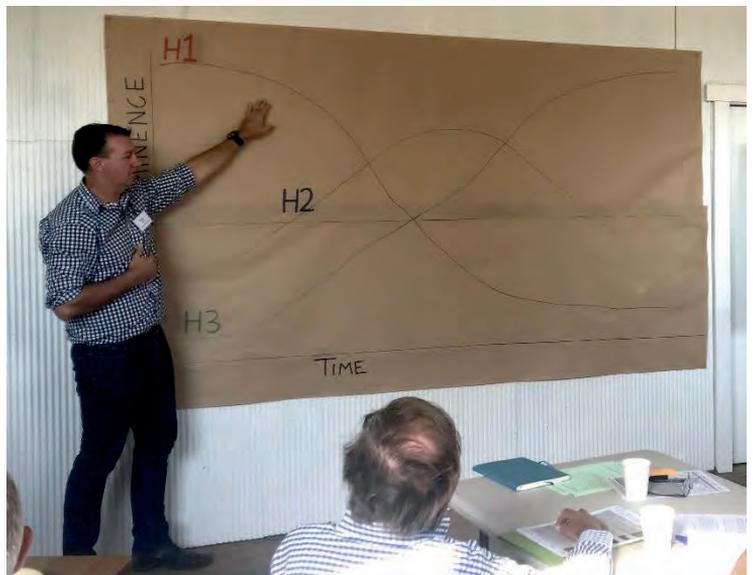
Positive futures and pathways of change



We all probably have some idea about what the future might unfold one year from now or maybe even two years into the future. But what about five years from now or even ten or fifty years? Whilst we might be able to predict rainfall patterns for the coming season, other things that have a huge impact can be completely unexpected, an example being the global spread of Covid-19. If you had anticipated that we would live through a global pandemic, the 2019/20 UNCERTAINTY 2020 bushfires or the 2022 floods, would you have done anything differently? “The future” is not just an abstract term and a distant time horizon, but what we expect of the future and how we imagine it influences how we act right now, in the present day. To practice future thinking and consider how we can play an active role in shaping a ‘good’ future, the second component of the project focused on exploring different futures.

How will we create a future where our landscape sustains viable communities, profitable farming and a rich biodiversity?

This was the guiding question for two community workshops which took place in April and May 2021. The research team and the Muttama Creek Landcare Group jointly organised these workshops to bring together people from the local communities to explore the future of farming and biodiversity in the Muttama Creek Catchment area. The workshops aimed to discuss preferred futures and which actions can be taken individually and collaboratively to move toward the desired futures. We deliberately spoke of multiple futures to acknowledge that there are different ideas about what a positive future would look like.



The workshop facilitator Paul Ryan explaining the Three Horizons framework at the first workshop.

In the workshops, we used the Three Horizons framework (Box 3) which directs attention to three aspects: 1) issues in the present, 2) positive futures, and 3) innovations that help move from the current situation to the desired future.

Box 3: The Three Horizons Framework

Three Horizons is a tool that uses the idea of three overlapping time horizons to structure and guide discussion about pathways toward positive futures.

The Three Horizons are:

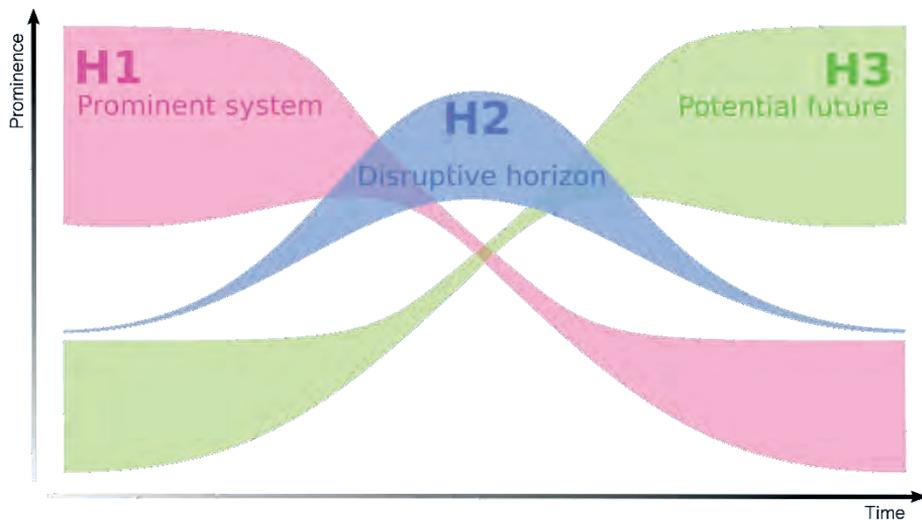
Horizon 1 (H1) is the visible world we live in now. This means the things around us, the landscape, rules, production systems, structure in our community, government etc. This system dominates everything else. However, this will change in the long run and the current system will decline for many different reasons.

Horizon 2 (H2) is the disruptive time horizon. Big ideas, major policy changes, new ways of thinking or technological innovations disrupt the current time horizon and lead to the Third Horizon.

Horizon 3 (H3) is the potential future. It includes innovations and ideas that could become prominent. Many of these ideas and things that we want for a better future exist in the current system but they are not prominent. At some point, there is a cross-over where those ideas become prominent and this time horizon emerges.

The energy system as an example:

The current fossil-fuel based industry (**H1**) is increasingly disrupted by innovations such as solar panels (**H2**), potentially leading to a renewable-dominated energy system (**H3**).



Workshop 1: What could our future look like?

The focus of the first workshop was to consider current issues and think about aspects that would make up a positive future. Workshop participants discussed why the way things are currently going is not sustainable in the long term (Questions 1 and 2), what elements of today's system should be retained (Question 3), what a positive future would look like (Question 4) and what elements of such positive futures can be found today (Question 5, Figure 1).

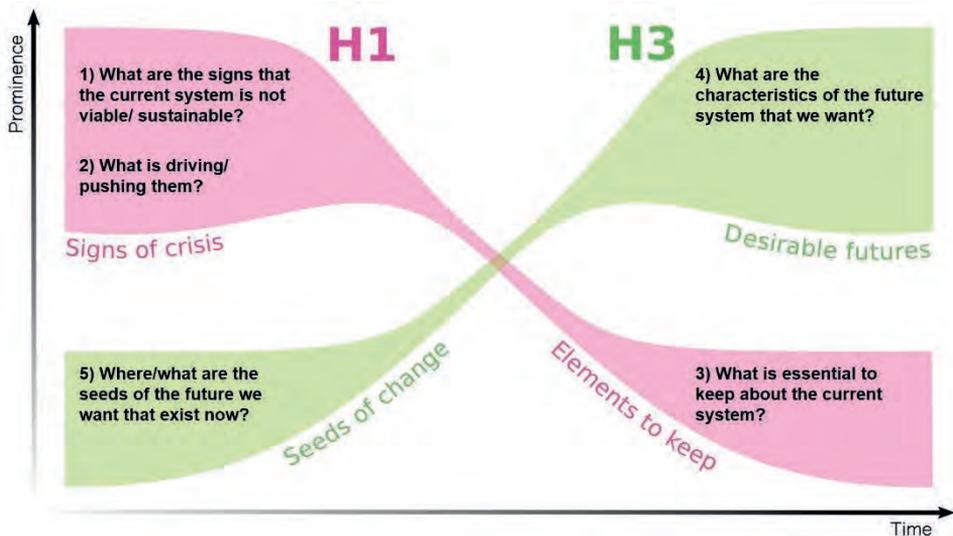


Figure 1. Guiding questions for the first workshop.

What are the signs that the current system is not viable/ sustainable?

The workshop participants identified a range of key issues, i.e. signs that business-as-usual is not viable in the long run (first guiding question):

- **External pressures**, e.g. changing climate, consumer awareness.
- **Unsuitable “traditional” farming approaches**, e.g. over-reliance on chemical inputs, working the land too hard, lack of agility.
- **Decreasing community health and capacity**, e.g. ageing population, burnout.
- **Broken water cycle**, e.g. poor water quality, excessive runoff with heavy rain.
- **Declining health of the farming system**, e.g. soil health decline, erosion, more (invasive) weeds.
- **Biodiversity loss**, e.g. old trees disappear from the landscape, decline in tree cover, fewer birds, echidnas, platypuses, etc.



Artwork depicting Horizon 1: The Treadmill (Artist: Julia Roche)

Notes by the artist: This image represents a contained, controlled approach to agriculture, where separateness is favoured over connectedness.

- Murky brown is symbolic of much needed change by reducing inputs of synthetic materials. The need to manage and reduce agricultural carbon footprint.
- Blue sky peeking in from dirty marks symbolic of the pollution.
- Yellow mark-making representing a monoculture crop (canola). No trees.
- Line-work/fence lines symbolic of control. Manmade water source; dam.
- Lifelessness. Boring. But sense of chaos and dirtiness in the air.
- Charcoal to represent climate change – danger of fire increased.

For the second guiding question, participants decided to focus on traditional farming approaches and a broken water cycle and identified a broad range of aspects, including social and biophysical, that lead to these issues (see Appendix A2).

What is essential to keep about the current system?

To answer the third guiding question, workshop participants discussed which aspects of today they would like to still see in the future:

- Different **skills and technologies**, e.g. the adoption of new technology, skills to use farm bots.
- **Environmental stewardship and cultural heritage**, e.g. reward for good, sustainable practices; maintaining and enhancing remnant vegetation.
- **Food production**, e.g. locally produced food, the right and ability to produce food and fibre.
- **Family farming**, e.g. a high percentage of family farms, family farms are committed to the community and are stewards of the land.
- **Vibrant communities**, e.g. a sense of community, regional population retention.
- **Government support**, e.g. good biosecurity legislation, government funding for local outcomes.
- **Independence and freedom**, e.g. democracy, the freedom to choose the way of farming.



Workshop participants discussing what the future could look like at the first workshop.

What are the characteristics of the future system that we want?

To answer the fourth guiding question, participants thought about what they would like to see in an ideal world in the future:

- **Connecting science and technology**, e.g. using technology to improve the farm, agriculture driven by renewable energies.
- **Fostering capacities and knowledge**, e.g. capacity to plan for change, anticipatory behaviour.
- **Ethical and responsible farming**, e.g. traceability, ethically produced food and fibre.
- **Healthy and biodiverse ecosystems**, e.g. healthy aquatic ecosystems, increased biodiversity.
- **Balanced farming systems**, e.g. better utilisation of farmland footprint, balanced land use between production and the environment.
- **Resilient and diverse systems**, e.g. diversity of people, ecosystems etc., increased robustness and resilience.
- **Maintaining community wellbeing**, e.g. better living standard for all in the local communities.
- **Providing economic opportunities and viability**, e.g. ecotourism, biodiversity has an economic value, financially viable farming systems.

Where/ what are the seeds of the future we want that exist now?

For the fifth and final guiding question, workshop participants considered ideas, practices or technologies that are not dominant yet but which could be the seed from which change emerges in the future:

- **Technological innovations**, e.g. electric fences, drones, virtual animal tags, glass houses, aquaponics.
- **Education, knowledge and science**, e.g. more access to agriculture in the education system, education on regenerative farming, evidence-based science in agriculture.
- **Ethically responsible farming**, e.g. paddock-to-plate traceability, animal welfare and humane practices, honesty in labelling.
- **Environmental stewardship**, e.g. protection of species, getting rewarded for good environmental stewardship.
- **Non-traditional farm management**, e.g. cell or rotational grazing, cover crops, carbon and solar farming.



Artwork depicting Horizon 3: Life of the Sunflower (Artist: Julia Roche)

Notes by the artist: This image represents a healthy respect for the life-giving forces and symbiotic relationships which sustain life.

- Soft transparent marks representing gentle energy. Organic spots and mark-making in sky to represent rain.
- Layering to represent interdependence and honouring of supporting systems.
- Clean blue to symbolise healthy functioning water system.
- Sunflowers plus abundance of plants/flowers/crops - biodiversity.

Workshop 2: How do we achieve our preferred future?

The second workshop focused on connecting the elements that were discussed by participants at the first workshop. The aim was to develop **pathways of change** that would lead away from the issues in the current system toward futures seen as positive and desirable. The guiding question stimulated discussions about ways to bring about change (Figure 2).

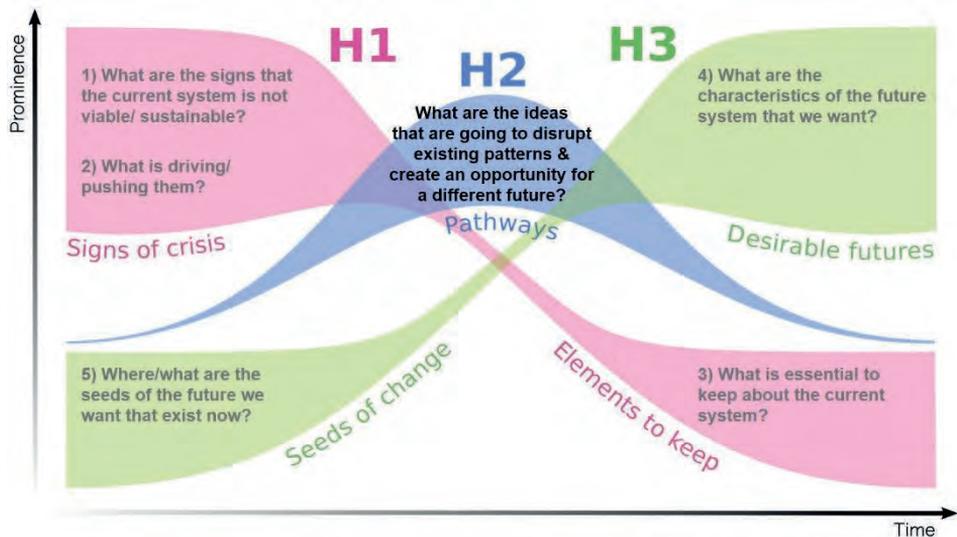


Figure 2. Guiding question for the second workshop.

Participants worked in six groups during the workshop. Each group identified key issues in the present that they would like to address (**Horizon 1**) and characteristics of positive futures (**Horizon 3**) that they would like to move toward. Also, each group came up with a project idea that would connect these two horizons (**Horizon 2**).

Developing storyboards

To help the groups structure their ideas and connect them into a coherent storyline, we used storyboards (Figure 3). Each storyboard contained; 1) the starting point of the story, i.e. the main issues, 2) which enablers the project could draw on to bring about change, 3) how key barriers that the project might face could be overcome, and 4) the outcome, i.e. what the preferred future would look like.

On the next pages, you will find the six storyboards and the stories that were told by participants at the workshop (see also Appendix A3 for an overview).

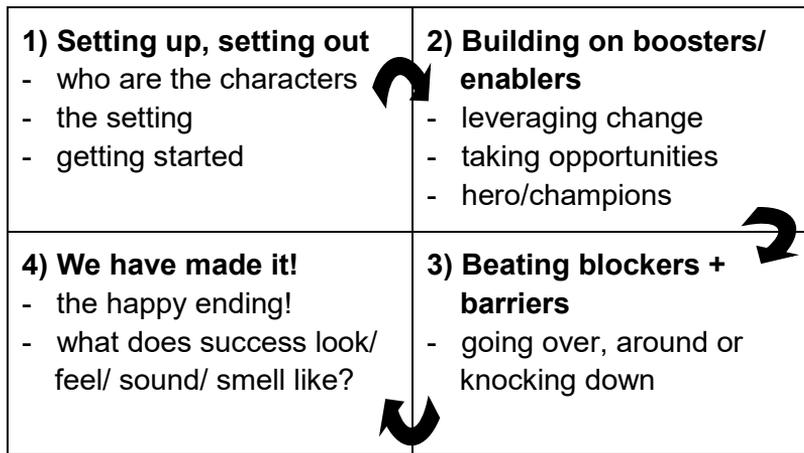


Figure 3. Storyboards used to develop the storylines by each group.



Workshop participants developing storylines in groups of 3-6 people. Sticky notes of different colours were used to organise ideas and link them to the Three Horizons.



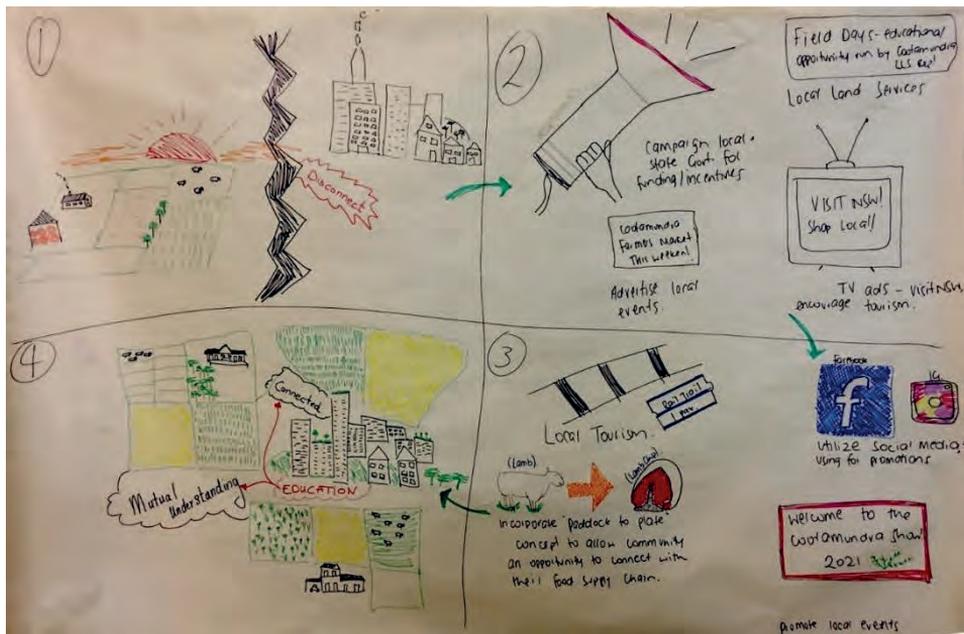
Artwork depicting Horizon 2: Paradigm Shift (Artist: Julia Roche)

Notes by the artist: This image represents flux and change as traditional methods break down and new pathways are sought.

- Fungus/mycelium represented with greeny/blue swipes.
- Hint of rainbow to symbolise hope for change.
- Fluid application of paints to symbolise change and possibility.
- Fragments of light. Hint of fluro.
- Representation of all elements (air, water, fire and earth) in a whirlwind/flurry.
- Charcoal strikes symbolic of chaos and tension.
- Lines symbolising networks forming // cycles of energy being created // concepts being captured and commercialised.
- Movement to symbolize bringing Horizon 3 to light quicker.

1) A Utopia of Increased Connections at Multiple Scales

The key issue that this pathway addresses is the disconnect between rural and urban areas. This disconnect can be found at different levels: there is a disconnect locally, within the catchment, and to the cities. The agricultural education in the current education system is insufficient. Further, family farms are increasingly being replaced by bigger farms or corporate ownership and there are fewer people in rural communities. Added together, this has led to less diversity in farming practices and a lack of skilled labour.



Storyboard 1: A Utopia of Increased Connections at Multiple Scales

However, there are opportunities for change because people in cities are interested in being in touch with where their food is grown. One example is paddock-to-plate marketing and learning from successes of other communities. The underlying understanding is that everyone is a player in agriculture because we all consume food. The internet and technology can make agriculture more accessible and social media platforms provide possible tools for connecting people with agricultural landscapes and to increase the public's interest in farming. Tourism is another enabler for overcoming the urban-rural divide because people from major cities e.g. Canberra or Sydney come to see canola during the spring, ride rail trails or enjoy local food. Another lever for change can be increased connections with Indigenous heritage, land use and management of the area.

“Welcome to the Cootamundra Show ... trying to interest people in agriculture and generally make agriculture ... more people-friendly.”

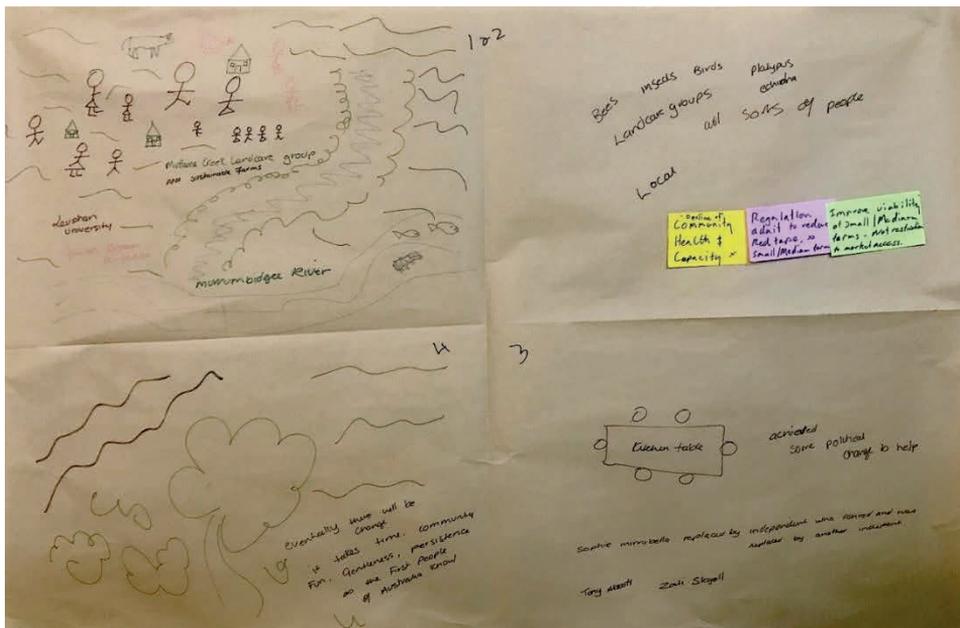
While there are challenges with selling directly to consumers – e.g. a small-scale butchery or supplying a butchery directly versus selling at the sale yards – a range of pros and cons can be identified for all these opportunities.

This ‘utopia’ is about increasing connections at different levels and bringing more people into rural landscapes. This allows people to see, experience and understand our agricultural landscapes better.

“... a nice, happy, friendly world that’s a bit of a utopia but the idea is more broadly that people are more connected and understand.”

2) The Power of Grassroots Activities for Change

The key issue that this pathway tackles is the decline in community wellbeing and capacity. Current state and council regulations impact on changes to rural areas including a transition to low impact farming, market access for small and medium farms and bringing additional family members onto the farm.



Storyboard 2: The Power of Grassroots Activities for Change

However, through a shared concern about the declining wellbeing and capacity in the local communities, the Muttaka Creek Landcare Group is a possible booster for change. Grassroots initiatives such as ‘kitchen table conversations’, have

potential to influence at the local community level, e.g. by lobbying local politicians or councillors. Other enablers are mixed farms bringing back family members, including the next generation, or other interested parties such as free-range egg farmers, pig farmers or those seeking to establish a market garden. There are also existing farmers' market associations which increase connections and sell local products.

"[At] Muttama Creek Landcare Group ... we're concerned about our health and capacity declining."

In the 'happy place', soil health has improved, the rural population has remained stable, the viability of small and medium enterprises has increased and there is improved capacity for ethical semi-intensive agriculture. Over time, the Muttama Creek becomes strong and healthy and many trees can be found in the landscape. Additionally, people are engaging more with the landscape.

"... it takes time, the community, fun, gentleness and persistence ..."

3) A Vision for a Better Future of the Community and the Environment

This pathway addresses two key issues: First, rural communities are declining and there is a lack of diversity of people in the community. Second, the landscape is showing signs of depletion and exhaustion due to inappropriate cultivation and topsoil loss. There is a large amount of tree loss including remnant dead trees in the landscape due to clearing, lack of regeneration of trees and ringbarking in the past.

"... commodity prices are really good now but it's pretty clear that in the past they haven't been good enough to sustain the landscape, as well as the community, and everything within it."

Current policies and legislation create a lot of red tape which blocks implementation of many of the good ideas that people have. Additionally, the focus on 'big dollars' in agriculture, especially among increasingly bigger and more "corporate" farms, whose focus is solely on production. This can lead to a more pronounced boom-bust cycle. There are more people who are trying to do things differently but they are not very well connected to either markets or others with similar interests. Other barriers for change include the lack of industry support for micro projects, the largely individualistic approach to farming, and farmers' fear of being exposed to scrutiny. To bring about change, greater self-confidence, improved knowledge, and government support to 'cross the river' and do things differently are needed. Even though large parts of the agricultural landscape are in a poor state, old growth trees with hollows can still be found. There is also an increasing number of people in the cities who want to support landholders. This provides opportunities for increasing connections to farmers and farming

landscapes. Farm diversification is another possible strategy for the future, for example growing asparagus or farming on a smaller scale. Networking and support for micro projects are also enablers for change. Local initiatives such as the Jugiong hub are starting to grow and create spaces with a 'city vibe' that people want to stay in.



Storyboard 3: A Vision for a Better Future of the Community and the Environment

As people are starting to do things differently, the landscape is becoming greener with passive solar houses and native gardens emerging. Farmers are selling their products directly to the public and they build partnerships with consumers who value their products and the new production systems they use. Aside from making money through direct sales, farmers earn green dollars e.g. from carbon credits. Farmers are getting paid for sustainable practices and nature conservation. The 'happy place' is also characterised by net zero carbon emissions.

"... the dollars are going to this farmer for sustainable practices and conservation."

In this vision, the rural communities are more bespoke, younger and energised. Connections are vital, for example through the internet. Energy and joyousness characterise this ideal future in which people live in vibrant rural communities and not in isolation. Everyone lives in harmony with the land and is more observant and in touch with their land.

4) A Multi-Generational Farming Story about Tree Planting

This pathway addresses the key issue of sparse native timber and vulnerable old trees in the landscape. There are several reasons for farmers' unwillingness to plant more including the short-term loss of return, the lack of time and inflexible funding requirements.

This farming family story starts with a poor old farmer who has sparse vegetation on the hills and nothing along the creek and who can only afford a limited number of children. He also only has one skinny little cow.



Storyboard 4: A Multi-Generational Farming Story about Tree Planting

The farmer then gets an idea of how to improve his farm and starts implementing it. As a result, shrubbery is growing on his property, the cows are calving, there is water in the creek, as well as wildlife in the water and around the creek. The farmer's situation is improving and the family is growing. As things progress further, the farmer has the front of the hill planted out, there is understorey, many trees and generally more vegetation on the property.

The key idea behind this farming story is to establish vegetation blocks planted over several generations. This provides the opportunity to have the full range of vegetation which can be used for firewood or left to grow. In this story, the farmer is intrinsically motivated to improve his property but financial incentives also

provide an opportunity for change. There are also several examples for community level incentives which motivate farmers to start on-farm improvements. For example, Landcare has in the past initiated activities in the area. Another opportunity could be an organisation similar to BlazeAid which might assist farmers by sending staff to help plant trees and fence off areas.

They might also get involved in farmer education. More education about the value of planting trees and protecting remnant timber – e.g. through farm walks and increased awareness about the benefits of tree lots – also provide opportunities for creating a landscape that has a mix of trees and shrubs.

“... incorporating the city cousins. Come out and share a weekend with us and let's plant some trees and have a camp fire, cook some home-made sausage”

In the 'happy place', the farm has had a positive impact throughout the community. The farmer has decided to go with Angus cattle instead of Friesians because the land has become more productive. The farm is a family-oriented enterprise which involves all generations in tree plantings.

“... we're talking about a multi-generational theme happening and ... he was planting some trees and then his kids were planting trees and their kids were planting trees ...”

5) Building Connections to Create a Spider Web of Influence

The key issue that this pathway addresses is the disconnect between the federal and state systems, with specific reference to the federally funded soil carbon projects and projects funded by state government such as the Biodiversity Conservation Trust. In particular, when there are in-perpetuity agreements for land on a property set aside for biodiversity conservation, that property is excluded from soil carbon projects. As a result of this lack of coherence, legislation blocks synergies between projects and creates red tape. People's mindsets, especially a fear of change, stand in the way of creating better connections between biodiversity and soil carbon projects. For example, many landholders feel that moving away from traditional to more sustainable farming practices and embracing long-term projects, e.g. biodiversity conservation and soil carbon projects, is a huge and risky commitment.

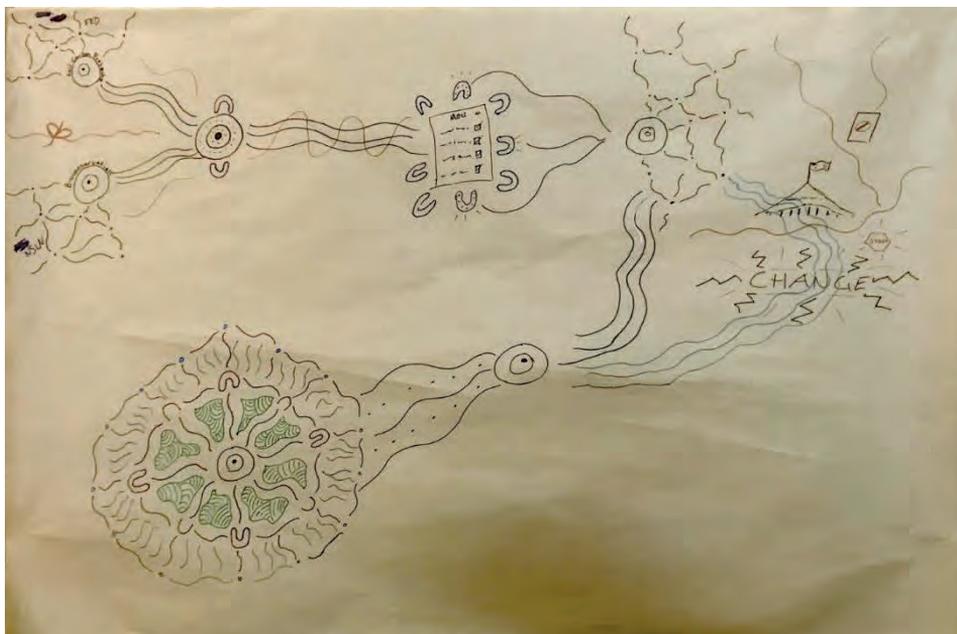
“... the fear of engaging and the fear of the unknown is a big thing to overcome.”

Synergies between the projects regarding biodiversity, food production and farmers' income exist. However, for these synergies to emerge, federal and state agencies need to collaborate and help create a spider web of influence. This in turn helps to improve connection with research and funding opportunities. Government agency representatives located in the community are important for influencing the direction of change. Farmers who are passionate about these

synergies and champion them can increase buy-in from the rest of the community by demonstrating that it is worthwhile to do these projects on their property. Soil carbon markets provide another opportunity for changes to farming practices.

“... we need to get everyone around the table trying to figure out a way that [the federal and state systems] can work together.”

Eventually these changes lead to a healthy and sustainable environment.



Storyboard 5: Building Connections to Create a Spider Web of Influence

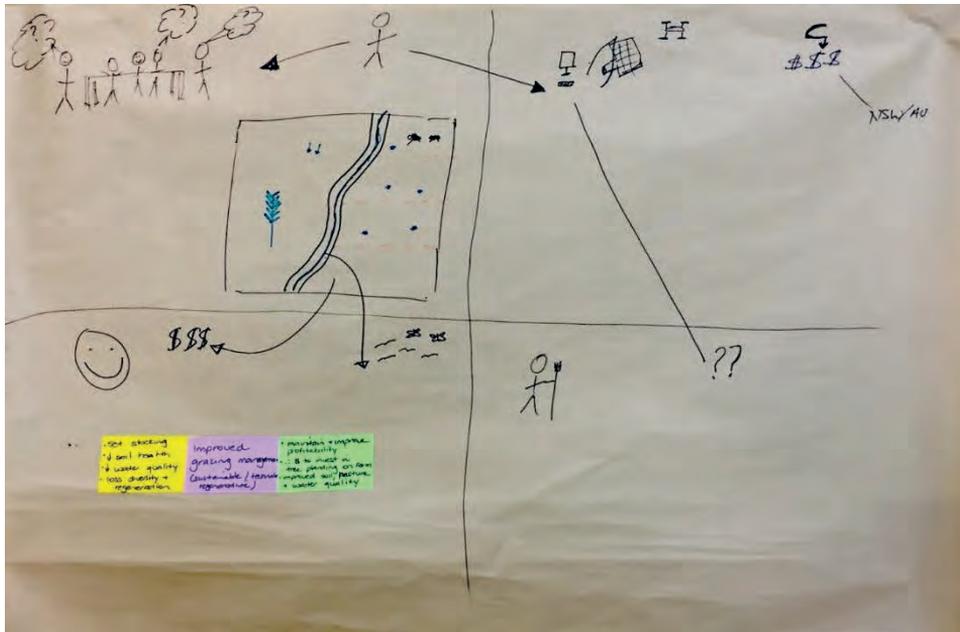
6) Best Practice Outcomes from Improved Grazing Management

This pathway addresses the interlinked issues of reduced soil health and water quality, loss of biodiversity and lack of regeneration due to set stocking. It builds on existing practices in the mixed farming sphere, in particular rotational grazing instead of set stocking. The key element of this pathway is to promote virtual fences in mixed farming.

One of the enablers of change will be advisors who help farmers with technology, e.g. to work out electronic tags for virtual fencing. Other technologies that this project builds on are solar panels and drones used for feed calculations, stock monitoring and ground cover assessment. In the future, carbon rebates by the NSW government may provide another opportunity to encourage changes to grazing management practices.

However, the technology is still not fully developed and available to everyone. Another barrier for changes to farm management and increased technology in farming are people's mindsets. Some farmers are set in their ways regarding farming practices and it is very hard to convince them to change.

"... the question mark over this technology for ear tags and things ... we're still waiting for that technology to come through when and if it will so that's our blocker at the moment."



Storyboard 6: Best Practice Outcomes from Improved Grazing Management

By establishing virtual fences, eventually profitability increases which gives landholders more opportunities to establish regeneration areas, fence off creeks and generally protect areas on their farms. These on-farm technology and management changes also lead to improved environmental outcomes, for example more birds or insects in the landscape.

"... the outcome of that is more ... profitability and a better environment, more birds, more bees, more butterflies, happy people."



Workshop participants developing the storylines at the second workshop.

Summary and comparison of the pathways of change

The six pathways of change showcase many of the issues that are concerning for the community but also the diverse aspirations for the future. Workshop participants developed innovative project ideas that help move toward positive futures. The current issues ranged from community health (e.g. skilled labour shortage), to biodiversity loss (e.g. fewer old trees in the landscape), farming system health (e.g. soil health), traditional farming practices and a broken water cycle (see also Appendix A3).

The pathways clearly show that there are many things that individuals or the community can do to bring about change. In the change processes described in the pathways, farmers played a particularly important role. They are especially important in the *Grassroots*, *Vision*, *Farming Story* and *Best Practice pathway*. Additionally, the community of which farmers are part, and community organisations are also vital for change either by bringing about or supporting change. This became particularly clear in the *Utopia*, *Grassroots* and *Farming Story pathways*. For example, not only can community organisations support individual farmers with tree plantings but people getting together around 'kitchen tables' can also influence political decision-making. The *Spider Webs pathway* but also the *Best Practice pathway* focused more on general policy or institutional changes. For example, synergies between biodiversity conservation and carbon sequestration could be improved if the policies were better integrated. In the *Best Practice pathway*, technological innovations such as drones or virtual fences combined with changes to practices resulted in major changes in profitability and biodiversity. In contrast, the *Farming Story* and *Utopia pathways* emphasised a different driver of change: education. Whilst the *Farming Story pathway* focused on farmers' environmental education, the *Utopia pathway* considered a better integration of agriculture into the educational system.

The groups also discussed which barriers would inhibit and which enablers would help realise their project ideas. The barriers and enablers are listed in Table 2.

Table 2. Barriers and enablers identified by the groups.

	Barriers (examples)	Enablers (examples)
Governance and policy	Regulation overburden, inflexible funding agreements, agencies not talking to each other	Changes to regulation, financial incentives, carbon rebates through the NSW government
Individual aspects	Farmers' fear of exposure to scrutiny, mindset, fear of change or transition	Long term vision for farm and community, groundswell revolution
Market and industry	Lack of stewardship, market access	Buy from the bush, ecotourism, soil carbon markets
Education and knowledge	Community awareness	Connecting with Indigenous heritage/land use/land management, community education, advisors helping with technology
Collaboration and connections	Broader community disconnect with agriculture and rural Australia, fewer people	Localised networks & community support, community help (similar to BlazeAid)
Farming systems	Less diversity in farming practices, fewer family farms, historical livestock management	Diverse species, i.e. a mix of trees and shrubs
Technology	Technology has not been developed yet, practicability of technology	Internet and technology making things more accessible, existing farm technology such as drones
Other	Bushfire risk, habitat for pests such as foxes	Jugiong hub, Gundagai Nimbo falls, rail trail

The future visions of the pathways have some overlap, but there are also differences (see also Appendix A3). They included ecological (e.g. healthier landscapes), economic (e.g. increased profitability), and social aspects (e.g. a younger community). The pathways are different in part because change happened at different scales. For example, in the *Farming Story pathway*, there were big changes on one individual farm which then impacted the whole community. The *Vision pathway* sought to establish alternative food systems through direct marketing to consumers or diversified food production. Though the pathways addressed different desirable aspects of the future, this does not mean that they are mutually exclusive or that there exists no overlap between the pathways. On the contrary, the pathways could be pursued simultaneously and share similarities. For example, better connections to consumers through direct sales, more networking and the importance of organisations or agencies based in the community were brought up by several groups.

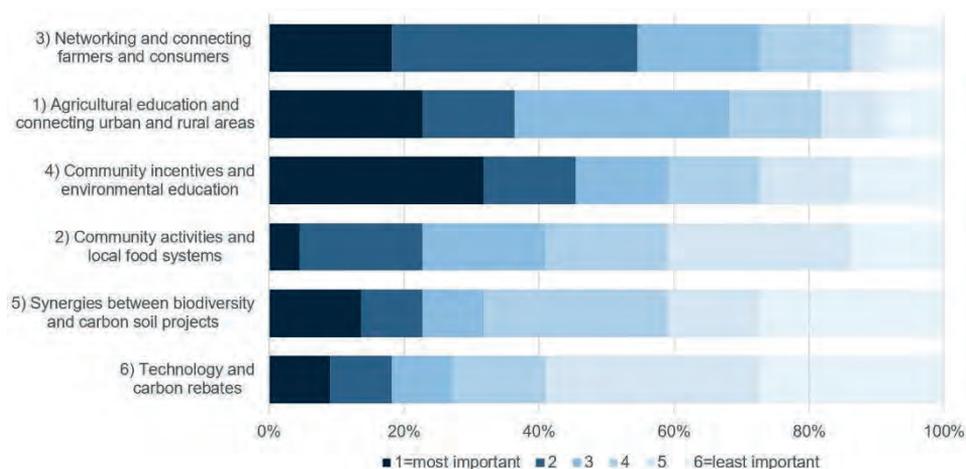


Summary artwork (Artist: Julia Roche)

Online poll to understand project storyline preferences

In May 2022, we sent out an online poll to all interviewees and workshop participants to understand what they believed people from the Muttama Creek Catchment region should prioritise to make a positive future.

We asked everyone to prioritise the six pathways from *most important* to *least important*. In total, 22 people participated in the online poll. In the figure below, the project storylines are sorted based on how often they were ranked in the best three categories.



The ranking highlights the importance of projects that increase connections between farmers and consumers as well as between urban and rural areas. Another key aspect mentioned by respondents are community-level activities or incentives.

Most respondents provided a short explanation for their ranking. Several respondents mentioned the role of farms in soil carbon storage and discussed how farmers can be supported in that endeavour. Another key topic that several respondents highlighted was the importance of environmental awareness and education as a way to better enhance and protect biodiversity on the farm. Some of the respondents also felt that practices need to change for better management of the environment.

You can find a detailed overview of the results of this online poll on our Facebook page: <https://www.facebook.com/FutureofFarmingandBiodiversity>

7 Synthesis and recommendations



Throughout this booklet, we have taken you on a journey to discover and understand different viewpoints on how farming and biodiversity can be integrated and six pathways of change toward what workshop participants perceived to be positive futures. Across these two project components and during the two and a half years of working with people from the Muttama Creek Catchment community, four key insights emerged:

1) Developing a localised understanding of biodiversity

The interviews in particular showed that people have different ideas about how, why and if biodiversity should be protected. Moreover, some interviewees questioned our definition of biodiversity during the interviews, arguing that biodiversity should also encompass factors such as crop diversity. Our findings suggest that there is no shared understanding among people in the area of what biodiversity on the farm is. **Chapter 2** provides some ideas about the different elements that help build or sustain biodiversity on the farm. However, this does not replace a localised understanding of what a biodiverse farm looks, smells, sounds and feels like in the catchment area. A definition of biodiversity, including which species are threatened and how they can be protected in the area, developed in a bottom-up process with local people could help identify what farmers individually and across the broader landscape could do to protect it.

2) Acknowledging and engaging with Indigenous knowledge and land management

Our findings also highlight that Indigenous knowledge and land management currently do not play a prominent role in people's thinking about the topic of farming and biodiversity. Nevertheless, it was one of the topics that was brought up by some of the interviewees and again during the workshops. As **Chapter 3** illustrates, if you pay attention and have the knowledge, you can still find signs of the thousands of years long Indigenous history on farms. Moreover, there is value in (re-)discovering the old ways of thinking about land management by the traditional custodians of the land. There is under-explored potential to engage with Wiradjuri heritage and connection to country in the catchment area.

3) Building on shared goals and visions of the future

The interviews highlighted divergent viewpoints on biodiversity and farming and the workshops showed that people in the Muttama Creek Catchment community have different ideas about what the future should look like and how change can be brought about. Despite these differences, bringing people together in the workshops highlighted that there exist shared values, such as intergenerational farm management, and community aspirations, such as a lively, healthy social fabric. The project ideas and storylines in which they are embedded can be used for strategic planning in the future and as design criteria for future community projects (see also Box 4). However, to move these project ideas forward and apply for funding requires leadership to prioritise activities and see community actions through. Ideally, these outcomes should be embedded in a longer-term project or change process.

4) (Re-)Building connections

Both during the interviews and workshops, people expressed a sense of disconnect in the system, e.g. between rural and urban areas or between farmers and consumers. The workshop outcomes highlighted opportunities to (re-)build connections. This included direct sales to connect farmers and consumers, social media to bridge the perceived distance between rural and urban areas and improved coherence of biodiversity and carbon policies (see Boxes 4 and 5). This idea of re-connecting, of building linkages across scales, between people or better access to information, can be used as guiding principle for future community activities or projects.



Box 4: Actions to bring about change

As an individual farmer, what can you do to “fix” big picture issues?

- **Networking:** Join an existing community initiative such as Landcare or talk to your neighbours, friends or acquaintances and create a (local) network with people who share similar interests.
- **Customer relationships:** Look into opportunities such as ‘Buy from the Bush’ to build a relationship and establish more direct contact with the consumers of your products. You can also sell your food more locally, for example at farmers’ markets.
- **Social media:** Use technology such as Facebook, Instagram etc. to share information about your farm (provenance!) and reach (potential) customers, e.g. as part of paddock-to-plate marketing.
- **Income diversification:** Agri- or ecotourism might be an opportunity to attract city people who want to ‘escape’ to rural areas.
- **Indigenous heritage:** Join community events about Indigenous heritage or land management in your local area to learn more about Wiradjuri history.

As a community organization or initiative, what can you do to support change or create opportunities for change?

- **Micro or pilot projects:** Explore opportunities to support micro projects. They can help test out new ideas or innovations, e.g. pilot projects to test out new technologies and their suitability for the area. Support can be financial but also through advice or networking.
- **Tourism:** Explore opportunities to support or establish your local area as a locus for agri- or ecotourism. You can help promote local food and explore opportunities such as using old rail trails.
- **Knowledge building & exchange:** Support opportunities for building knowledge, e.g. more knowledge about agriculture in the education system or activities to build ecological knowledge among farmers, e.g. about the value of planting trees.
- **Creating community incentives:** Create incentives that focus on impacts beyond the individual farm. For example, this can be through tree plantings or fencing off areas as joint or community activity.
- **Indigenous heritage:** Connect with Indigenous heritage, land use and land management. Help organise community walks or other joint activities to learn about Indigenous heritage and land management.

Box 5: Policy implications

A diverse set of policy instruments

People hold diverse and contrasting understandings of the connection between biodiversity and agricultural production and they have different underlying motivations for valuing biodiversity, ranging from intrinsic to extrinsic motivations. This also means that land managers will have different strategies to protect or improve biodiversity on the farm and that they will likely have different farming practices. There has been an increased emphasis on market-based policy instruments in Australia, but it is important to have a broad and balanced set of instruments. Too much focus on the economic value of biodiversity in policy measures might reinforce a view that biodiversity is separate from the farming business. To ensure that biodiversity is not just protected for money, financial incentives should be accompanied by other measures such as environmental education programs or community-based activities such as Landcare.

Place-based policy instruments

Understandings and definitions of what biodiversity is on the farm differed between people. These understandings are specific to the context in which people work, meaning a biodiverse farm in south-eastern Australia will likely be quite different from one in Queensland. Therefore, policies need to better engage with the experiences and knowledge that local people and communities have. When the policies fit well with these place-specific understandings, this can have a positive influence on policy uptake and acceptance by farmers. It can build on the motivations to protect biodiversity and support environmental stewardship among people who manage the land.

Synergies between biodiversity and carbon instruments

People in the farming community saw carbon credits and carbon rebates as enablers of change. Measures to protect biodiversity, e.g. by increasing vegetation on the farm, and those storing carbon in the soil should be designed in a way that farmers implementing them can combine them. This can help create synergistic outcomes which address both biodiversity loss and climate change. There is willingness among farmers to get involved in carbon farming and vegetation projects, e.g. tree plantings, but our research suggests that the potential has not been fully exploited.

Conclusions

This project set out to explore options to integrate profitable farming and successful biodiversity conservation in the future. We identified four archetypal ways of viewing biodiversity in farming, multiple perceptions of what a positive future would be and different ideas about how change will come about. The Muttama Creek Catchment area in the South West Slopes is in many ways representative of the broader farming region and the challenges, current and emerging, faced by rural communities. Though the research findings summarised in this booklet contain many elements specific to the Muttama Creek Catchment area, the four viewpoints on farming and biodiversity (**Chapter 5**), the six pathways of change (**Chapter 6**) and the four key insights summarised in this chapter are relevant for other farming communities.

The approach taken in this project illustrates ways to bridge different understandings of biodiversity in farming and develop shared future visions and trajectories of change. In particular, the guiding questions used during the workshops can serve as a template to think about different futures and design change processes in other areas. Our project was naturally limited by available funding and was set within a particular time frame. Whilst the project may end, this does not mean that engagement with the topic will end. Scientific knowledge about the loss of biodiversity is increasing and so is awareness about biodiversity among the general public. We firmly believe that it will be increasingly important to consider biodiversity in farming, often in conjunction with related topics such as soil health or carbon farming.

We wrote this booklet as source of information for people interested in environmental topics and as inspiration to consider what changes can be made to protect and restore biodiversity within viable farming businesses in the future. What the future will look like is unknown. Throughout this booklet, we often referred to the plural 'futures'. On the one hand, we wanted to acknowledge that different people have different assumptions about what the future will look like and visions of what they would prefer it to look like. On the other hand, we wanted to highlight that the future is not set in stone but that it is shaped by our actions – as individuals, communities, countries and humans on planet Earth. What decisions we take and how we act now will influence which system will become dominant and which future will emerge. This booklet provides examples of actions that can be taken now individually, by communities and policy-makers to change the trajectory of farming and biodiversity. It is up to us to steer and navigate toward the future we and our children and grand-children will live in.

8

About the artworks

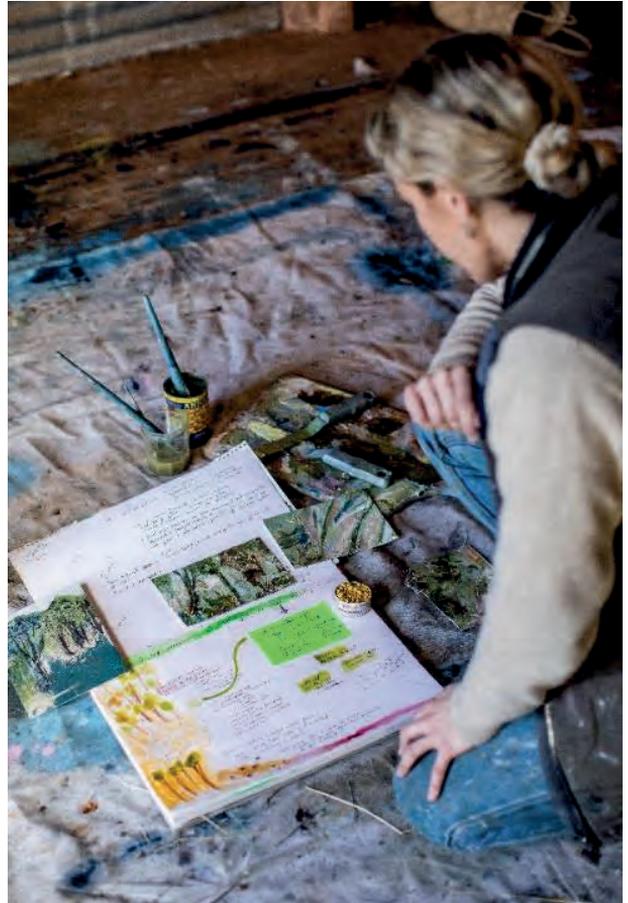


The artworks were created by **Julia Roche**, an interpretive and abstract artist who grew up on a family farm near Mangoplah in Southern NSW. Julia paints in response to the environment in an emotional and intuitive manner. She uses colour, shapes, mark making and layering effects to create ethereal landscapes. Julia's aim is for the audience to create a closer feeling between seeing and feeling.

Julia creates her artworks on Wiradjuri Country in a repurposed woolshed on the farm. Working plein air through the day and often through the night, her artworks are inspired by the natural world. At the final stages of her work, when the material is still wet, she often leaves the artworks out on country-exposed to the elements. Rain or mist thus play a part in the process and the interplay of oil and water creates visible effects.

Julia attended the two workshops and brought a notepad, watercolours, charcoals and other materials. She did sketches and took notes about how the discussions during the workshops could translate into colours, shapes and patterns. She also tried to capture the emotions that workshop participants showed as they were discussing the Three Horizons.

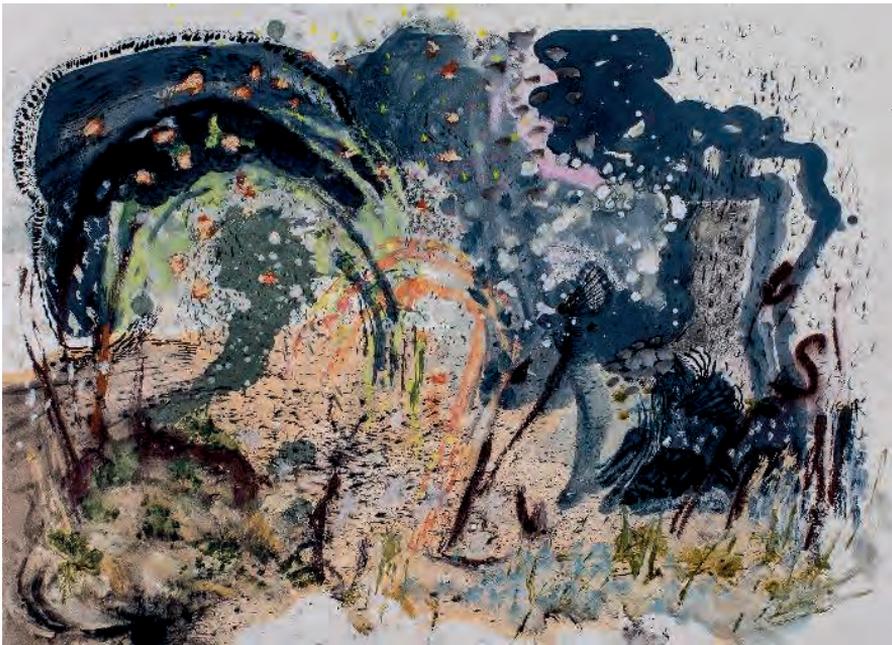
Inspired by the workshops, Julia created one artwork for each of the Three Horizons, a summary artwork and a palette that documents the progress of her work.



Horizon 1 – The Treadmill



Horizon 2 – Paradigm Shift



Horizon 3 – Life of the Sunflower



Summary artwork



Acknowledgements

We would like to thank the Muttama Creek Landcare Group and all of its members for the support, feedback and collaboration throughout the project. Information about their activities can be found on their Facebook page: <https://www.facebook.com/muttamacreeklandcare>

We would also like to express our gratitude to all interviewees and workshop participants for their time and willingness to talk about the topic of farming and biodiversity and discuss pathways to positive futures with us. Your contributions have been of great value to this project.

The workshops would have not been the same had it not been for Paul Ryan's skilled facilitation and Dr Michael Mitchell's expert input and support.

Visualising research outcomes can help make findings more accessible and can provide grounds for reflection. We thank Julia Roche for the Three Horizons artworks and Sebastian Kempke for the illustrations of the four viewpoints. We also thank Florian Schaal for his advice with the design of this booklet, Suzannah Macbeth for taking the time to proofread this booklet and Annika Drews-Shambroom for her support in formatting the booklet.

Lastly, we would also like to thank all individuals and organisations who have not been mentioned here by name but have enriched this project through conversations and discussions and thus contributed to shaping the research process and outcomes.

The research project was funded as project number 407710220 by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through a grant to Dr Jan Hanspach.

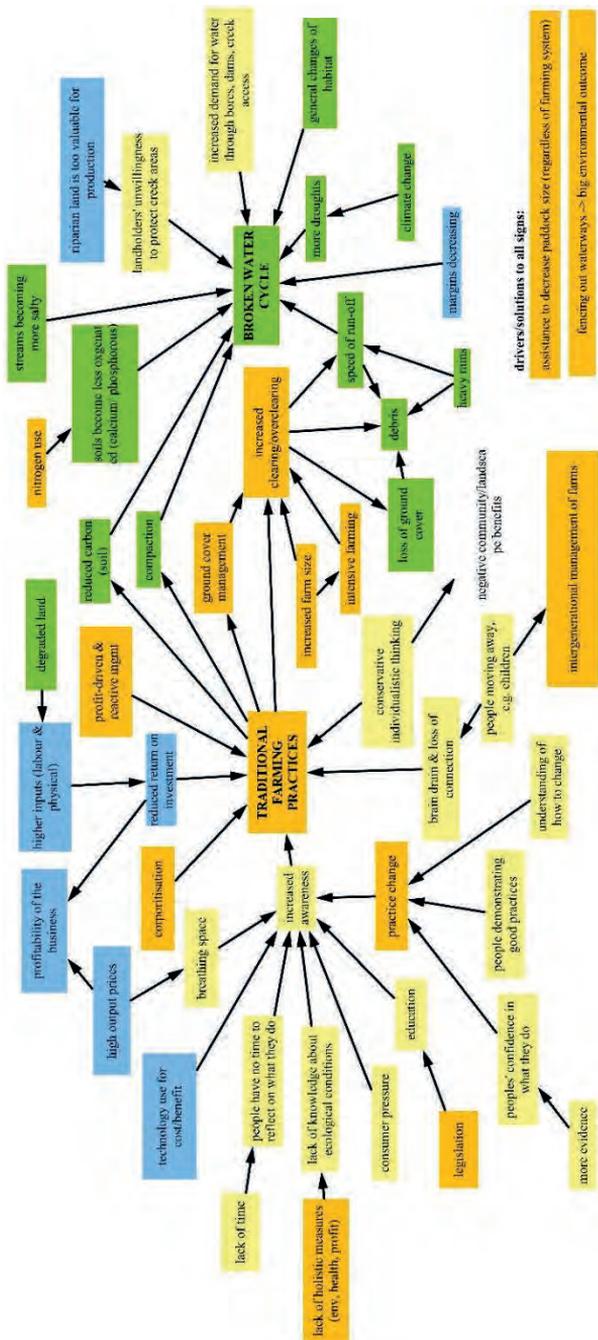


Palette Board (Artist: Julia Roche)

Appendix

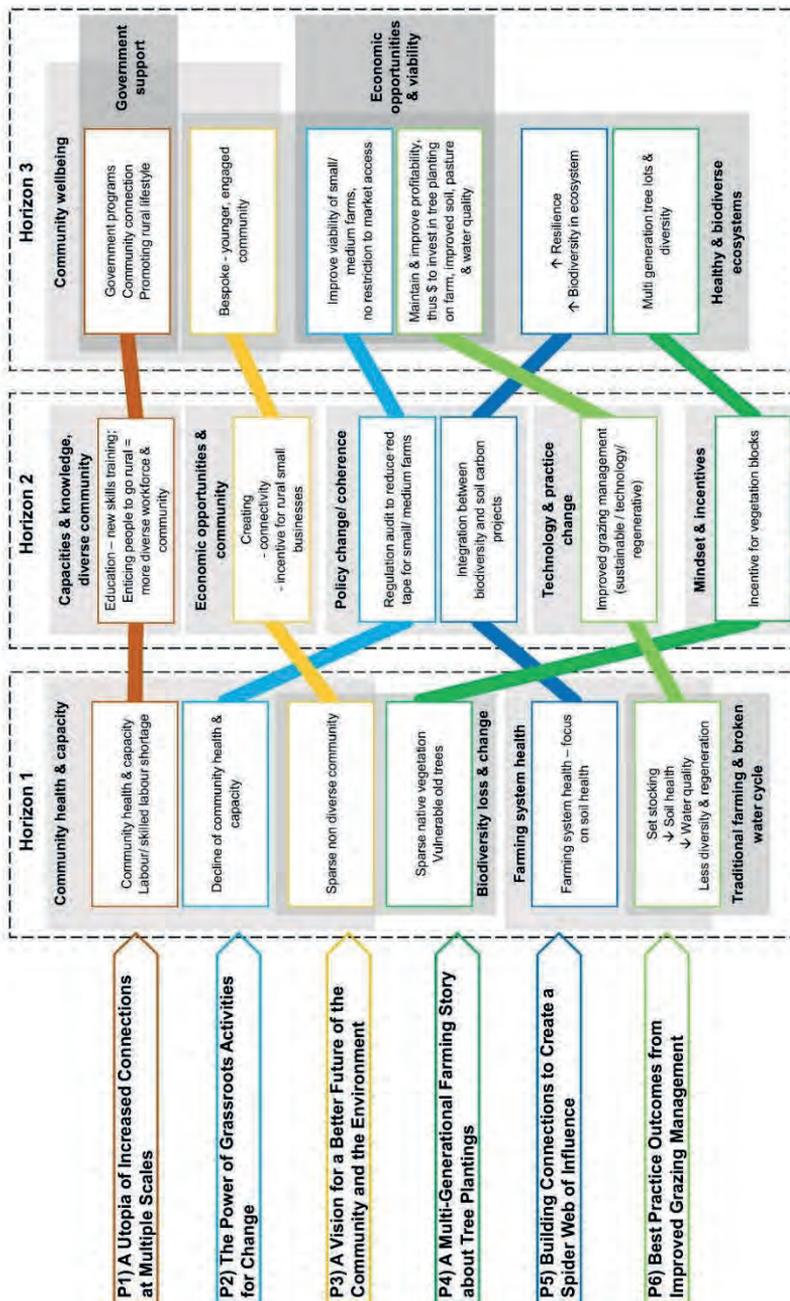
A1. Statements used for the sorting during the interviews.

- 1 Farmers need to be profitable first before they can protect biodiversity.
- 2 To improve biodiversity outcomes, changes to farming practices are necessary.
- 3 Agricultural innovation and technology are important for farm profitability.
- 4 Farmers should provide habitat for threatened or endangered native species.
- 5 Farmers can better mitigate extreme weather events by improving biodiversity.
- 6 Biodiversity has a unique value and should be preserved.
- 7 Connecting habitats across boundaries is important.
- 8 Australian primary producers play an important role in global food security.
- 9 Agricultural production and biodiversity conservation can be integrated without trade-offs.
- 10 Farmers need more funds to do on-farm biodiversity conservation.
- 11 Landscape-scale collaboration is necessary.
- 12 The long-term growth in farm productivity is a major priority.
- 13 Biodiversity on farms increases land value.
- 14 Productive areas should be utilised and only marginal or unproductive areas should be set aside for biodiversity conservation.
- 15 Farming families and their farm profitability are crucial for this region.
- 16 Farmers should be free to clear land for agricultural production.
- 17 Local communities should take more responsibility for biodiversity protection and enhancement.
- 18 There should be more consultation with farmers by government agencies.
- 19 Maintaining farming practices of previous generations is important for farm viability.
- 20 Education and awareness-raising about the benefits of biodiversity to agriculture are necessary.
- 21 Protecting or enhancing biodiversity benefits farmer wellbeing.
- 22 There should be subsidised loans to farmers for biodiversity conservation that are paid off based on future revenues.
- 23 Farmers need more ecological knowledge to protect and enhance biodiversity on their farm.
- 24 Protecting groundcover is important for agricultural production.
- 25 Farmers are responsible for looking after the land for future generations.
- 26 Future generations should be able to experience healthy biodiversity on farms.
- 27 Protecting and planting scattered paddock trees is important.
- 28 There should be stronger policy and laws to protect and enhance biodiversity.
- 29 Policies and laws should not limit management options by farmers.
- 30 Farmers should get paid for protecting their biodiversity assets.
- 31 Cropping and grazing areas should be managed for production and biodiversity at the same time.
- 32 To buffer the ups and downs of farming, changes to farming practices are necessary.
- 33 Corporate agriculture provides an economic growth opportunity for this region.
- 34 Farmers need to get the most production out of their land.
- 35 Biodiversity benefits a farm's long-term profitability.
- 36 Farm viability is a major priority.



A2. Influence diagram. The diagram shows how two key issues (traditional farming practices and a broken water cycle) are influenced by a broad range of different aspects.

- Social aspects/drivers
- Governance/management drivers
- Economic/technological drivers
- Biophysical aspects/drivers



A3. Pathways overview. The figure shows the six storylines which are based on innovations (Horizon 2) that lead away from current issues (Horizon 1) toward positive futures (Horizon 3). The coloured boxes are post-it notes from the workshops and were written down prior to developing the pathways. Therefore, there are small textual differences compared to the storylines. The grey boxes represent overarching themes.

Further readings

Chapter 2. Natural assets on farms in south-eastern Australia

- Sustainable Farms (2020). *Ten ways to improve the natural assets on a farm*. Fenner School of Environment & Society, Australian National University, Canberra, Australia. Available online via: sustainableFarms.org.au/ten_ways
- Lindenmayer, D.B., Macbeth, S.M., Smith, D.G. and Young, M.L. (2022). *Natural Asset Farming: Creating Productive and Biodiverse Farms*. CSIRO Publishing, Clayton South.

Chapter 3. Caring for Country = Ngadhurinyagu Ngurambanggu

- Gammage, B. (2013). *The Biggest Estate on Earth: How Aborigines made Australia*. Allen & Unwin.
- Pascoe, B. (2015). *Dark Emu: Black Seeds: Agriculture or Accident?* Magabala Books.

Chapter 5. Different viewpoints on farming and biodiversity

This chapter is based on the academic publication ‘*You can’t be green if you’re in the red*’: *Local discourses on the production-biodiversity intersection in a mixed farming area in south-eastern Australia* which is under review with the journal *Land Use Policy*.

Further information on the method we used for the interviews can be found here:

- <https://qmethod.org/>
- Watts, S., Stenner, P. 2012. *Doing Q methodological research: Theory, method and interpretation*. SAGE, London, 238 pp.

Chapter 6. Positive futures and pathways of change

This chapter is based on the academic publication *Using the Three Horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity* which is under review with the journal *Sustainability Science*.

Further information on the workshop tool we used can be found here:

- Sharpe B. 2013. *Three Horizons. The Patterning of Hope*. Triarchy Press, London.

The project information sheet, project updates and the workshop summary report for the two workshops can be downloaded via the following link:

<https://1drv.ms/u/s!AovaX0von8ymqukjGkDqwFwccr-KbQ?e=s117BI>

You can also find further information about the project on our Facebook page:

<https://www.facebook.com/FutureofFarmingandBiodiversity>





This booklet summarises the work undertaken in a project that sought to understand different land-use priorities and explore the future of farming and biodiversity in the Muttama Creek Catchment area. Located in the sheep-wheat belt of south-eastern Australia, this area sustains many farming families and communities and has been on a long road of change with increasing volatility and pressures.

What should we consider to integrate profitable farming and successful biodiversity conservation? Through 94 interviews, we identified four different viewpoints on the relationship between farming and biodiversity, the farmer's roles and responsibilities and approaches to protect biodiversity on farms.

How will we create a future where our landscape sustains viable communities, profitable farming and a rich biodiversity? In two community workshops, different ideas about what positive futures would look like and pathways towards those futures were discussed.

This booklet highlights that whilst the perspectives on biodiversity conservation in farming landscapes differ substantially, there are shared interests and community aspirations towards the future. These shared interests provide a fertile ground for collective action to create a positive future.