Mallee Dryland Sustainable Agriculture Strategy 2017–23

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Acknowledgements

The Mallee Dryland Sustainable Agriculture Strategy is a partnership document for the use of partner groups in the Mallee Catchment area that have a common goal to enhance and encourage sustainable dryland agriculture in the region.

These include, but are not exclusive to, Mallee Sustainable Farming (MSF), Birchip Cropping Group (BCG), Mallee Catchment Management Authority (CMA) and Agriculture Victoria (DEDJTR).

This document is auspiced by the Mallee CMA and is a reference point and planning resource to enable effective leverage of external and internal resources and collaboration among regional partners to ensure the sustainability of dryland agriculture in the Mallee.

The Mallee Catchment Management Authority (CMA) acknowledges and respects Traditional Owners, Aboriginal communities and organisations. We recognise the diversity of their cultures and the deep connections they have with Victoria's land and waters. We value partnerships with them for the health of people and country. The Mallee CMA Board, management and staff pay their respects to Elders past and present, and recognise the primacy of Traditional Owners' obligations, rights and responsibilities to use and care for their traditional lands and waters.

A Steering Committee involving key regional partners was established to oversee the development of this Mallee Dryland Sustainable Strategy. The committee was chaired by the Mallee CMA, and had representation from Birchip Cropping Group, Mallee Sustainable Farming and Agriculture Victoria. The project was also supported by the management and staff of the Mallee CMA, with technical input from partner agencies.

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Images

Cover images: Upper: Mallee wheat crop.
Centre: Harvest time in the Mallee.
Lower: Stock containment area.

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Executive Summary

Our Vision

To optimise the productive capacity of Mallee dryland agricultural landscapes, while enhancing our natural and cultural landscapes and communities.

The Mallee region in Victoria is recognised nationally and internationally for its agricultural produce and is a key part of Victoria's food bowl. Despite the semi-arid nature of the region, the predominance of winter rainfall and access to reliable water from the Murray River has allowed the Mallee to develop into an agriculturally diverse region with important irrigation areas along the Murray, and extensive dryland cropping and grazing areas in the south, east and west. Within the Mallee region there is an estimated 2.4 million hectares (ha) of dryland farming and a further 72,500 ha of irrigation.

Today, dryland agriculture occurs in the northern, central and southern parts of the Mallee region. Most farm businesses derive the majority of income from cropping cereals such as wheat and barley, grown in rotation with canola and pulses.

Over the past 30 years enormous change has occurred in the way the land is managed in the Mallee, driven by a common will to minimise soil erosion. Cultivation has reduced, the area sown to crop has increased, stubbles are mostly retained and livestock grazing is better managed to minimise erosion. The area of land with poor ground cover and high erosion risk has diminished.

Despite these positive changes in the region, a range of threatening processes including climate change, salinisation, wind erosion, fertility decline, soil structure decline and loss of biodiversity present significant challenges to the sustainability of farming practices in the region. To achieve greater agricultural sustainability, stakeholders within the region will need to continue to develop, define and enhance strategic and practical measures and adopt a regionally coordinated approach towards sustainable agriculture that enhances, strengthens and builds relationships.

The Mallee Dryland Sustainable Agriculture Strategy aims to strengthen the future of agriculture by optimising productivity through improving on-farm resilience and enhancing collaboration between stakeholders, while also addressing current threatening processes for the Dryland Agricultural Catchment Asset. The Strategy focuses on private land only within the Mallee agricultural landscape.

Aims of the strategy include:

- Strengthening sustainable agriculture in the region over the next six years through strategic and practical measures;
- Providing a regionally coordinated approach towards sustainable agriculture that enhances and builds relationships between the region's service providers, producers, manufacturers and consumers; and
- Supporting future investment and additional resources to achieve sustainable agriculture in the region.

The Strategy draws on the experiences and feedback of a number of regional partners who have participated in dryland sustainable agriculture programs in the Mallee over many years. Experienced practitioners, both from private industry and government agencies, have contributed by providing their perspective and feedback.

Workshops and meetings were conducted to develop a vision and identify aspirations, issues, objectives and strategic actions which focus on key issues and critical threats relevant to the Dryland Agricultural Catchment Asset.

The Strategy also includes establishment of a Monitoring Evaluation Reporting and Improvement (MERI) Framework including monitoring indicators and timeframe(s) which will assess the status of key issues and critical threats; and, the effectiveness of each strategic action.

The draft Strategy was released for public comment and feedback in August 2017. Feedback was provided from regional partners, agencies and a number of landholders from within the region.

The Mallee Dryland Sustainable Agriculture Strategy does not impose any new legal or statutory requirements. The Strategy aims to have a positive impact on the management of dryland agriculture in the region by defining strategic intent and strengthening partnerships, communication and collaboration between regional partners.

Figure 1 illustrates the vision, key themes, objectives, outcomes and actions contained in the Strategy.

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Canola crop (right of fence) and wheat crop (left of fence).

VISION

To optimise the productive capacity of Mallee dryland agricultural landscapes, while enhancing our natural and cultural landscapes and communities

Key Theme: Soil Health and Productive Capacity	Key Theme: Farm Business Risk, Viability and Resilience	Key Theme: Pests, Diseases and Weeds	Key Theme: Regional Infrastructure and Capacity
Objective: To maintain and enhance the productive capacity of Mallee soils, while improving and sustaining the profitability of the agricultural sector	**Objective:** To identify and manage farm business risks for a sustainable, competitive and diversified agriculture sector in the Mallee	**Objective:** To support land managers in the Mallee to minimise the economic, social and environmental impacts of pests, diseases and weeds	**Objective:** To support stakeholders to improve infrastructure, increase connectivity and enhance wellbeing and participation of our agricultural communities
Outcomes: Improved soil health Application of improved soil management practices Increased confidence to implement change (on -ground)	**Outcomes:** Increased capacity to adapt and respond to change	**Outcomes:** Improved prediction and control of emerging outbreaks Recovery from pests, disease and weed impacts	**Outcomes:** Partnerships established to promote quality, cost-effective infrastructure that meets the needs of the dryland agricultural community
Actions 1 Improve understanding of the spatial variation in soil type and landform, the productive capacity of soils and extent of threats (physical, chemical and biological constraints) to soil health in the dryland agricultural region 2 Enhance collaboration between research and extension to promote skills and knowledge transfer in the agricultural industry 3 Deliver targeted extension activities that promote sustainable agricultural production systems, improved land management practices and improve farm productive capacity (including understanding productive capacity in various climatic scenarios) 4 Engage and support land managers to understand and adapt to new technologies to improve on-farm monitoring, efficiency and management (case studies, pilots, targeted extension programs)	**Actions** 5 Encourage a culture of diverse, adaptable and flexible farming systems that minimise risk and enhance viability 6 Co-operatively manage unproductive land for competitive advantage and investment in supply chain activities 7 Support economic research in the Mallee including yields, farm performance and earning capacity, transition options, production costs, and trends in local and global markets 8 Increase collaboration to bring climate change readiness, productivity improvement and validation research into the Mallee (including solutions for land managers facing long term declines in rainfall and implications for heavier soil types)	**Actions** 9 Encourage an anticipatory and adaptive approach to pests, diseases and weeds management and encourage and support multiple control mechanisms (including uptake of innovative cost effective ways to reduce chemical use and resistance) 10 Targeted compliance against regulatory requirements to support sustained community-led action 11 Collaborate and strengthen partnerships to manage weeds and pest animals on public and private land 12 Work collaboratively to implement sound biosecurity practices on-farm including quick and simple measures which can be built into everyday practice	**Actions** 13 Collaborate and advocate for new investment (regional, state and national) in regional and community infrastructure improvements and improved digital connectivity 14 Increase collaboration to support greater recognition of dryland agriculture as an important economic driver with regional development organisations 15 Collaborate and strengthen partnerships to support healthy and vibrant rural communities

Figure 1 | Mallee Dryland Sustainable Agriculture Strategy: key themes, objectives, outcomes and actions

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1 Context

1.1 Aims of the strategy

The Mallee Dryland Sustainable Agriculture Strategy aims to strengthen the future of agriculture by optimising productivity through improving on-farm resilience and enhancing collaboration between stakeholders, while also addressing current threatening processes for the Dryland Agricultural Catchment Asset. The Strategy will be in effect for six years.

Aims include:

- Strengthening sustainable agriculture in the region through strategic and practical measures;
- Providing a regionally coordinated approach towards sustainable agriculture that enhances and builds relationships between the region's service providers, producers, manufacturers and consumers; and
- Supporting future investment and additional resources to achieve sustainable agriculture in the region.

The Strategy takes an overarching perspective to guide sustainable agriculture and does not provide detail for land managers at the farm scale. The Strategy focuses on the Mallee agricultural landscape (private land only) and feeds into the broader Mallee Soil Health Plan (to be developed) which will encompass both public and private land tenure, including environmental values and ecosystem services provided by Mallee soils (See Figure 2).

1.2 Sustainable Agriculture

For the purpose of the Strategy, Sustainable Agriculture is defined as follows:

Sustainable agriculture is the production of food, fibre, or other plant or animal products using farming techniques that optimise the environment, public health, human communities, and animal welfare

1.3 Policy context

Figure 2 illustrates the Mallee Dryland Sustainable Agriculture Strategy and linkages with stakeholder groups of the Mallee Catchment area. Figure 2 also illustrates linkages with national and state policies and strategies.

1.4 Vision

The following vision statement describes a clear and aspirational long-term desired outcome resulting from the prioritisation and implementation of key actions outlined in this Strategy. The region's service providers, producers, manufacturers and consumers will play a key role in achieving this vision. The vision statement is defined as follows:

To optimise the productive capacity of Mallee dryland agricultural landscapes, while enhancing our natural and cultural landscapes and communities

Old man saltbush (*Atriplex nummularia*)

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Left: Pulse crop. Right: Stock containment area.

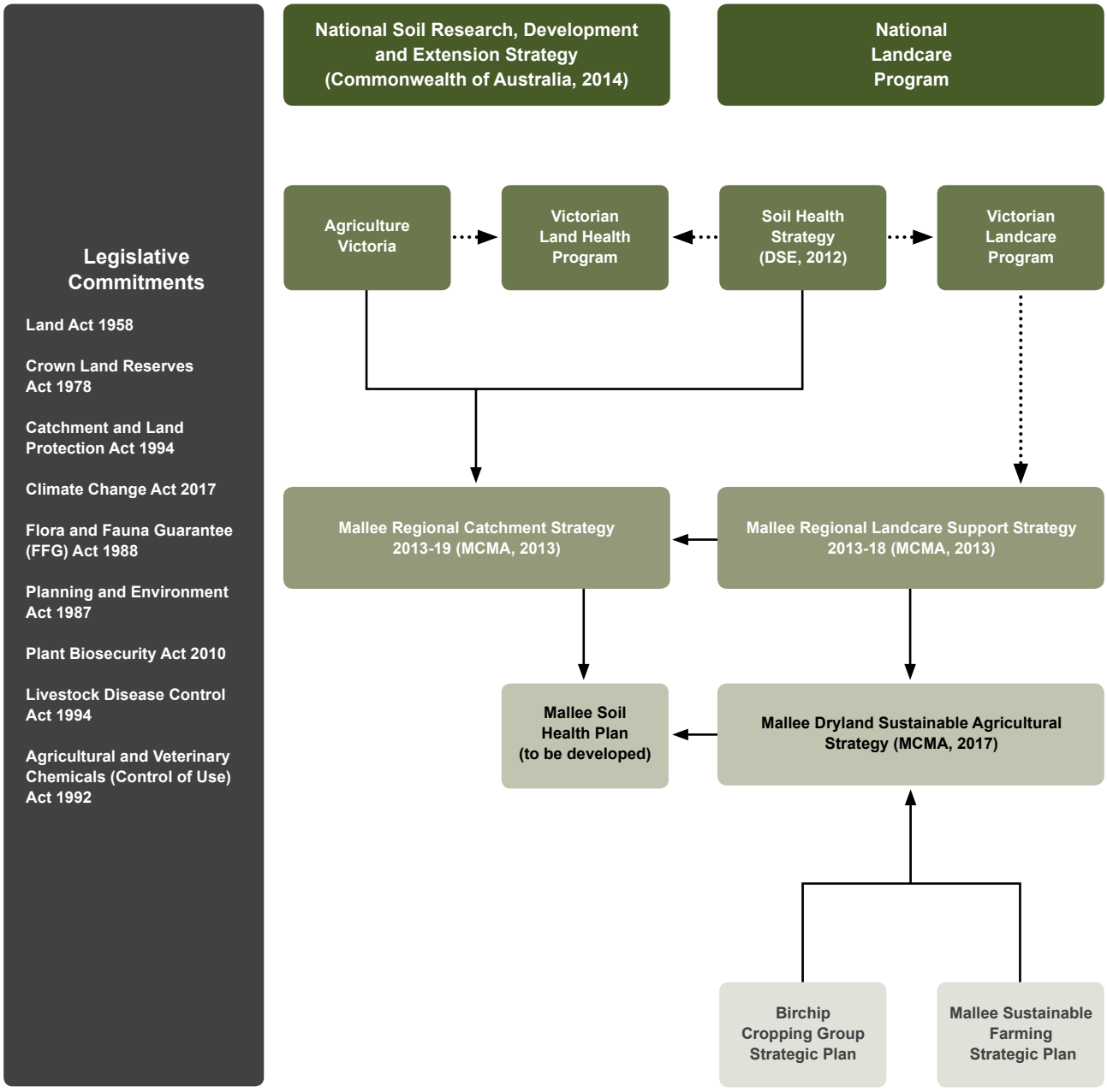

Figure 2 | Policy Context

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1.5 Dryland agriculture in the Mallee

Today, dryland agriculture occurs in the northern, central and southern parts of the Victorian Mallee region. Most farm businesses derive the majority of income from cropping cereals such as wheat and barley, grown in rotation with canola and pulses including vetch, lupins, lentils, field peas and chickpeas, a fallow phase or a pasture phase. On some farms medic based pasture (annual self-generating legumes) forms the feed basis for livestock enterprises, particularly sheep for wool and meat production.

Clearing of the Mallee for wheat-growing first commenced around 1890 and by the turn of the century this was the main agricultural activity. By the 1930s, as post war settlement intensified crop production and cultivation, rabbit infestations and the use of bare fallow resulted in disturbing levels of erosion (Newell 1961). A combination of medic-based pastures and sheep, replacing some bare fallow, coupled with improved rainfall in the 1950s and 60s, led to a reduction in the erosion levels that were witnessed in the 1930s and 40s (Newell 1961). Other key issues of concern to evolve over 100 years of farming on private land included soil salinity, weed infestations, pest animal control, particularly rabbits, native vegetation die back and loss of native fauna (MCMA 2008).

Following the severe drought of 1982, wind erosion of soil reached critical proportions due to low levels of ground cover, with 1.8 Megatonne (Mt) of top soil estimated to have swept over Melbourne in February 1983. The majority of dust was from south-west (SW) Victoria; however, the north-west (NW) Mallee was also a contributor to this event (DustWatch 2011). This was a pivotal moment that prompted a multi-agency approach to changing farming systems and reducing wind erosion (Amor et al 1985).

Over the past 30 years, enormous change has occurred in the way the land is managed in the Mallee, driven by a common will to minimise soil erosion. Cultivation has reduced, the area sown to crop has increased three fold, stubbles are mostly retained and livestock grazing is better managed to minimise erosion. The area of land with poor ground cover and high erosion risk has diminished (MCMA 2008). The terms “no-till” or “minimum tillage” refer to these farming techniques that were first adopted in the late 1980s (MCMA 2011b).[1]

Key to the success of these changes include agronomy practices such as summer weed control for moisture conservation, earlier sowing, improved nutrition and timely in-crop weed, disease and insect control. As a result, crop input costs increased and there has been significant capital investment in machinery, including no-till seeding rigs, high capacity boom sprays and harvesting equipment. Infrastructure investment in sheds and grain storage is also evident as is the increase in land under management per farm business unit. This has been driven by land managers seeking economies of scale and wishing to utilise increased capacity brought about by higher capacity machinery. In general, the level of sophistication required to run a Mallee farm business has increased with some land managers approaching their maximum yield potential (MCMA 2011b).

Parallel to this was the development of precision agriculture with GPS guided steering of tractors now commonplace. Further iterations of precision agriculture including yield mapping, variable rate seed and fertiliser placement, selective spot spraying of weeds and remote sensing via satellite provide the opportunity to more effectively monitor and manage agricultural systems (MCMA 2011b).

While changes to Mallee farming systems over the past 30 years have been largely positive, recent problems have emerged. The weeds, pest and disease spectrum is continually changing and weed species such as annual ryegrass, brome grass, and wild radish have developed resistance to commonly used herbicides. The habitat created by retained stubble is conducive to outbreaks of pests such as mice and common white snails. On many farms, more cereal crops and less legume based pastures depleted soil nutrient reserves in the early years of no-till. Adopting pulse crops has partly arrested this issue but brings its own set of production challenges (MCMA 2013).

Overlaying this period of evolving change is an increasingly variable climate with periods of drought, extreme heat, late season frosts punctuated with years of record rainfall and crop yields (2010 and 2016).

The mode of delivery of agricultural extension has also changed. Services in the mid-1980s were largely government based and are now mainly provided by commercial entities or not for profit groups with less government investment (MCMA 2012a). Not for profit groups such as Landcare are a major contributor to the achievement of fencing-off and revegetation of land and waterways, protection of remnant vegetation, establishment of windbreaks and corridors across farms, rabbit and weed infestation control works, and the establishment of perennial pastures for soil conservation and salinity prevention. There are 27 Landcare groups operating across the region as part of the Mallee Regional Landcare Network.

The social landscape has also altered. While the overall population in the region has increased over the past decade, population growth has been uneven with strong growth in urban Mildura, and parallel losses from smaller communities (MCMA 2012a). Decreasing population of agricultural areas, particularly in the dryland agricultural areas, has been driven by farm aggregation and other efficiencies.

In summary, erosion of cropping soils in the region has reduced dramatically; however, the region is still faced with a unique set of challenges including population decline and reduced social capital, increased business risk, a warmer, drier and more variable climate and farming challenges that arise from changes in the production system. Improvements in technology and advances in science provide a positive platform to embrace a fresh dryland agriculture strategy for the Mallee.

1 The Resources Report for the Review of the Mallee Area, prepared by the Land Conservation Council (LCC) 1989, provides an overview of land use (and recommendations for land use) in the Mallee in 1986. This report can be used to more fully understand changes in the way land has been managed in the Mallee since this time.

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Farmers at Sea Lake, circa 1900 (credit: Museum Victoria).

1.6 Development of the Strategy

Development of the Strategy was overseen by a number of regional partners including:

- Mallee CMA (MCMA)
- Mallee Sustainable Farming (MSF)[2]
- Birchip Cropping Group (BCG)[2]
- Agriculture Victoria (DEDJTR)
- Victorian No-Till Farmers Association[2]
- Landcare[2].

Workshops (2) and meetings (6) were held with regional partners to identify:

- The aspirations of regional partners over the next six years;
- The issues currently perceived by regional partners that need to be addressed;
- Objectives and associated strategic actions which focus on key issues and critical threats;
- Issues which will benefit from a coordinated regional delivery program; and
- Indicators that form part of the monitoring, evaluation, reporting and implementation plan.

The draft Strategy was released for public comment and feedback in August 2017. Feedback was provided from regional partners, agencies and a number of landholders from within the region.

2 Private land managers were represented through the Farming Systems Groups and Landcare during the development of the Strategy.

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2 Delivery Framework

2.1 Soil health and productive capacity

2.1.1 Objective

To maintain and enhance the productive capacity of Mallee soils, while improving and sustaining the profitability of the agricultural sector.

2.1.2 Challenges and opportunities

Maintenance of soil health and productive capacity has been recognised as a significant issue in the Mallee region for a number of years. The region's soil asset faces a range of threatening processes, a result of the susceptibility of the soil and the impact of historical land use practices. Climate change, salinisation, wind erosion, fertility decline, soil structure decline and loss of biodiversity present significant threats to the sustainability of farming practices in the region.

In the Mallee, Land Forms (and correlating Land Form units) that delineate landscapes of similar landform patterns have been created to assist land managers to monitor and assess land management issues with greater certainty and focus. They provide land owners and the farming industry with terrain information at paddock and landscape scales that correlate with production capability and land degradation risk, assisting the land owners to make decisions about how to best manage soils through appropriate land use and land management, while maximising potential productivity (MCMA 2010).

Mallee Land Forms consist of highly variable dune swale systems and tracts of lower lying heavier plains associated with various waterways. Variation in elevation can influence soil composition and susceptibly to frost and wind. Soil types throughout the Land Forms are dominated by gradationally textured soils with high concentrations of calcareous wind-blown material and form the basis of agricultural activities, varying in consistency from sandy/sandy loam textured soils in the northern Mallee to heavier textured soils in the southern Mallee (calcarosols). Other soil types include: weakly structured soils that are susceptible to erosion (sandy soils); contrasting texture through the soil profile (sodosols); and heavy clay soils (vertosols) (DPI 2005). Mallee subsoils can be highly alkaline with high sodicity, chloride and/or boron which all inhibit plant root growth and access to soil water.

The impacts of soil variations on plant available water and productive capacity have been recognised for some time. Targeted extension and support can improve land managers' capacity to manage soil health issues, identify spatial variation in yields and soils and identify appropriate soil management strategies, both at an on-farm and landscape level. Extension and support can play a pivotal role in assisting land managers to adopt new technologies and provide land managers with greater confidence to manage soil health for increased farm productivity.

Remote sensing for soil and terrain mapping also provides opportunities for identifying spatial variation in soils and improving incomplete spatial and thematic coverage of soil databases for the Mallee.

Sheep grazing salt bush plantings.

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Harvesting wheat.

2.1.3 Strategic actions

1 Improve understanding of the spatial variation in soil type and landform, the productive capacity of soils and extent of threats (physical, chemical and biological constraints) to soil health in the dryland agricultural region.
2 Enhance collaboration between research and extension to promote skills and knowledge transfer in the agricultural industry.
3 Deliver targeted extension activities that promote sustainable agricultural production systems, improved land management practices and improve farm productive capacity (including understanding productive capacity in various climatic scenarios).
4 Engage and support land managers to understand and adapt to new technologies to improve on-farm monitoring, efficiency and management (case studies, pilots, targeted extension programs).

2.2 Farm business risk, viability and resilience

2.2.1 Objective

To identify and manage farm business risks for a sustainable, competitive and diversified agriculture sector in the Mallee.

2.2.2 Challenges and opportunities

Dryland farming communities face several challenges beyond their control including but not limited to:

- Climate change and climate variability including frost and heat shock impacting production;
- Commodity prices largely governed by global supply and demand;
- Increasing input costs; and
- Unpredictable incursions of pests and disease.

Potential climate change and climate variability have been identified as critical issues in the Mallee in the coming years. The future climate of the Mallee is projected to be warmer than it is today. By 2030 (in comparison with the climate of 1986-2005) average annual temperatures are expected to be around 0.6 to 1.3°C warmer with a higher frequency of hot days and longer duration of warm periods. While average annual rainfall totals are not expected to be significantly different from today, rainfall characteristics are expected to change. By 2030 there will be a shift towards more rain in the warmer months rather than during the cooler months; and increasing intensity of rainfall events (MCMA 2016).

The projected climate changes under various emissions scenarios will impact the Mallee region's biophysical, social and productive landscapes to varying degrees, and will pose significant challenges to dryland managers in the region. Risk management strategies may include strengthening communication and collaboration between land managers and climate researchers for the benefit of both groups. Areas of focus may include applying predicted climate change scenarios to summer weed control strategies and related impact on soil health; looking at how predicted climate change may impact the productivity of cereal and broad-leaved crops used for fodder and grain; and, looking at how climate change may affect sowing time and variety selection.

Grain is a major food exporting industry and the demand from Asia is growing. However, local and global commodity markets are volatile. Specific challenges in international grain trading include protectionism in terms of tariff barriers and subsidies in competitor grain export countries and the growth of domestic grain production in major importing countries. There is a need to increase profitability in order to offset continuing decline in terms of trade. This can be achieved through the adoption of efficient production methods that are currently available and are being developed. Road, rail and storage logistics become increasingly important with the improvement in crop yields and production volumes, especially in areas where grain growing is expanding.

Work that examines sources of risk, interests and attitudes to risk management, practical risk management strategies and characteristics of financially successful farms, is pivotal to the development of adaptable, resilient and diverse farming systems in the Mallee. A recently completed national study of grain farm businesses led by Rural Directions Pty Ltd and funded by GRDC, found that financially successful farms are good at optimising enterprise gross margins (skilled producers, sellers and cost managers), running a low cost business model with minimal overheads (well utilised machinery, labour and land), have highly capable business and technical managers and are adept at managing the risk of potential business shocks (Vogt 2017).

Continued investment in research including agricultural economic research and climate change is of crucial importance to help land managers make informed decisions, increase productivity and competitiveness.

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Left: Carting grain. Top right: Mouse holes in paddock. Bottom right: Russian wheat aphid.

Agricultural extension can play an important role in encouraging and supporting innovation and adoption of alternative practices, applying latest scientific research and knowledge to agricultural practices and, anticipating, minimising and offsetting risk. Good communication and working relationships are required between research and extension services to enable effective transfer of knowledge, technology and innovation.

2.2.3 Strategic actions

5 Encourage a culture of diverse, adaptable and flexible farming systems that minimise risk and enhance viability.
6 Co-operatively manage unproductive land for competitive advantage and investment in supply chain activities.
7 Support economic research in the Mallee including yields, farm performance and earning capacity, transition options, production costs, and trends in local and global markets.
8 Increase collaboration to bring climate change readiness, productivity improvement and validation research into the Mallee (including solutions for land managers facing long term declines in rainfall and implications for heavier soil types).

2.3 Pests, diseases and weeds

2.3.1 Objective

To support land managers in the Mallee to minimise the economic, social and environmental impacts of pests, diseases and weeds.

2.3.2 Challenges and opportunities

The management of pests, diseases and weeds are a high priority for communities across the Mallee due to the environmental, economic and social impacts on both private and public land. Management of pests and weeds on public/private boundaries and roads are a threat to agricultural production and difficult to effectively manage.

Pest animals including rabbits are well adapted to the Mallee's dry sandy soils and are a major threat to agricultural production, native vegetation and habitat conservation in the region. While rabbits are still a threat to agricultural production, numbers have significantly decreased due to the introduction of biological control mechanisms and land manager perseverance. Foxes are also abundant across the Mallee (MCMA 2011a).

Pest animal management on private land is a key component of modern day crop production. Less cultivation and more stubble have led to mice becoming a semi-regular occurrence. Recent examples of unexpected incursions of other pests such as insects, that cause yield and quality loss, include the Green Peach Aphid and Russian Wheat Aphid. Incursions of Australian Plague Locust are rare but can have devastating impacts on farm productivity and crop health.

Plant diseases caused by nematodes, fungal, bacterial and viral causal agents are significant threats to crop production. Cereal cyst nematode, a major yield constraint to wheat until the 1980s, is now largely managed through plant variety resistance genes and crop rotation. Managing the impact of crop diseases including cereal rust, blackleg in canola and a range of viral and fungal and bacterial diseases in pulses, requires a combination

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of plant genetics, cultural and chemical control which adds to the complexity, costs and risk of modern day crop production.

Crop weeds are highly adaptable; brome grass, annual ryegrass and wild radish are examples of species that have developed herbicide resistant biotypes and are increasingly difficult to control. The total cost of weeds to grain growers in the Mallee is estimated to be $317 million per year (GRDC 2016). Successful containment of herbicide resistant weed populations requires a multi-pronged approach to weed control incorporating herbicide resistant crop genetics, crop rotation, farm hygiene, weed seed set control and various other non-chemical control measures. Innovation and technology that provides opportunities for more effective weed management include technology to implement site specific weed control, drones and remote sensing for scouting and robotics for non-chemical control.

Reducing cultivation in the Mallee has resulted in a farming system that is reliant on herbicides for the control of weeds including summer weed control to conserve moisture for the following crop and in-crop weed control to prevent plant competition, yield loss and product contamination.

There are many woody weeds that have become common across the Mallee landscape in a relatively short space of time. Bridal creeper, boxthorn and cactus species are highly invasive environmental weeds and impacting on the natural diversity and balance of ecological communities (Mallee CMA 2011a). These changes threaten the survival of many native plants and animal species.

Farm biosecurity is a set of measures designed to protect a property from the entry and spread of pests, diseases and weeds. Producers must play a key role in protecting Australian plant and livestock industries from pests and diseases by implementing sound biosecurity measures on-farm.

Targeted extension and support focusing on a participatory and adaptive approach to pests, diseases and weeds management will help promote sustainable land management and improve productive capacity. Long-term integrated weed management (including physical, chemical, cultural and biological control) is required, particularly for managing and minimising herbicide resistance. Integrated weed management should focus on the most economical and effective control of weeds and include ecological considerations.

Government agencies, industry and land managers all have an important role to play in managing pest animals and weeds. Increased collaboration and community led collective action is necessary, particularly where the problem is beyond the capacity of the individual land manager to address.

2.3.3 Strategic actions

9 Encourage an anticipatory and adaptive approach to pests, diseases and weeds management and encourage and support multiple control mechanisms (including uptake of innovative cost effective ways to reduce chemical use and resistance).
10 Targeted compliance against regulatory requirements to support sustained community-led action.
11 Collaborate and strengthen partnerships to manage weeds and pest animals on public and private land.
12 Work collaboratively to implement sound biosecurity practices on-farm including quick and simple measures which can be built into everyday practice.

Bare dunes contributing to wind erosion in the Mallee.

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2.4 Regional infrastructure and capacity

2.4.1 Objective

To improve infrastructure, increase connectivity and enhance wellbeing and participation of our agricultural communities.

2.4.2 Challenges and opportunities

While not the focus of this Strategy, regional infrastructure and capacity is an important consideration in the context of the Mallee dryland agricultural region.

The Mallee region is located along strategically important interstate and intrastate transport routes. Efficiencies and increases in agricultural production in the region will require major improvements in existing road and rail networks. This includes major and minor roads that are the responsibility of state and local governments.

Highways and main road connections are a constant challenge to meet current and future freight demands. Large quantities of grain are transported by road from the region to the ports of Melbourne, Geelong and Portland resulting in road damage and increased maintenance costs (RDA 2015).

Currently the region is advocating for rail standardisation and an increased proportion of bulk freight to port to be transported by rail. Achieving standardisation of freight rail lines between Mildura and Geelong will raise the longer-term prospect of a connection into the transcontinental rail network that includes linkages to Darwin and Perth (RDA 2015).

Continuous mobile phone and device connectivity and access to high quality broadband is also a high priority in the region. One of the major obstacles preventing land managers from adopting new digital technologies is poor (or no) access to the internet. Currently, the region is advocating strongly for improved coverage and increased broadband speed and rollout. The region's focus on digital infrastructure includes the development of the Mobile Phone and Device Blackspots Connectivity Assessment, which provides Local Government with evidence to advocate for improved connectivity (RDA 2015). The State Government of Victoria announced $45 million in funding in the 2017 budget, which is expected to address regional digital connectivity.

Initiatives to develop and improve infrastructure and services in the areas of health, education, social support and wellbeing are also essential to support a vibrant and thriving agricultural community. Initiatives include direct delivery of services promoting health and wellbeing in the region; advocating to Federal and State Government and agencies on behalf of the community around infrastructure, facilities and improvements; raising awareness around health and wellbeing; and, improving and promoting services and facilities.

Initiatives that use new approaches to attract funding for infrastructure, increase economic activity, and deliver services should be considered, including initiatives that encourage non-traditional investment into the region, cooperative service delivery and other innovative delivery models. The Shire of Buloke is undertaking a project called the Rural Living Campaign to identify and advocate for minimum service levels for small communities in rural Victoria. This project has received support from the Victorian Government as it could provide a model for innovative service delivery to people living in remote communities.

2.4.3 Strategic actions

13 Collaborate and advocate for new investment (regional, state and national) in regional and community infrastructure improvements and improved digital connectivity.
14 Increase collaboration to support greater recognition of dryland agriculture as an important economic driver with regional development organisations.
15 Collaborate and strengthen partnerships to support healthy and vibrant rural communities.

Mallee barley crop.

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3 Implementation

Temporary on-farm storage during harvest.

Implementation requires the enthusiasm and support of regional partners who, collectively, will be responsible for implementing the actions contained within the Strategy. Strong partnerships and collaboration is essential to support the delivery of priority actions across multiple jurisdictions and at various levels, including both Government and non-Government agencies.

Regional partners in the region have committed to proactively work together and report their progress towards achieving the objectives and outcomes within the Strategy at each of the Catchment Partnership Committee (CPC) meetings held within the Mallee region four times per year.

3.1 Roles of regional partners

Broad agreement among the region's partners regarding their roles and interests is pivotal to the successful implementation of the Strategy.

The following table outlines regional partners who have a primary[3] role in the delivery of each of the actions contained within the Strategy. Other regional partners will be engaged where appropriate/necessary to deliver on actions.

3 Primary infers this will be key participants of the planning and where possible implementation, i.e. when resourcing becomes available, and evaluation activities.

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Table 1 | Roles of Regional Partners

Theme	Actions	Regional Partners				
		CMA	Agriculture Victoria	Industry	Private Land Managers	Farming Systems Groups
Soil Health and Productive Capacity	1. Improve understanding of the spatial variation in soil type and landform, the productive capacity of soils and extent of threats (physical, chemical and biological constraints) to soil health in the dryland agricultural region	✓	✓	✓	✓	✓
	2. Enhance collaboration between research and extension to promote skills and knowledge transfer in the agricultural industry		✓	✓	✓	✓
	3. Deliver targeted extension activities that promote sustainable agricultural production systems, improved land management practices and improve farm productive capacity (including understanding productive capacity in various climatic scenarios)	✓	✓	✓		✓
	4. Engage and support land managers to understand and adapt to new technologies to improve on-farm monitoring, efficiency and management (case studies, pilots, targeted extension programs)	✓	✓	✓		✓
Farm Business Risk, Viability, and Resilience	5. Encourage a culture of diverse, adaptable and flexible farming systems that minimise risk and enhance viability	✓	✓	✓		✓
	6. Co-operatively manage unproductive land for competitive advantage and investment in supply chain activities	✓		✓	✓	
	7. Support economic research in the Mallee including yields, farm performance and earning capacity, transition options, production costs, and trends in local and global markets		✓	✓		✓
	8. Increase collaboration to bring climate change readiness, productivity improvement and validation research into the Mallee (including solutions for land managers facing long term declines in rainfall and implications for heavier soil types)	✓	✓	✓		✓
Pests, Diseases and Weeds	9. Encourage an anticipatory and adaptive approach to pests, diseases and weeds management and encourage and support multiple control mechanisms (including uptake of innovative cost effective ways to reduce chemical use and resistance)	✓	✓	✓	✓	✓
	10. Targeted compliance against regulatory requirements to support sustained community-led action.		✓			
	11. Collaborate and strengthen partnerships to manage weeds and pest animals on public and private land	✓	✓	✓	✓	✓
	12. Work collaboratively to implement sound biosecurity practices on-farm including quick and simple measures which can be built into everyday practice	✓	✓	✓	✓	✓
Regional Infrastructure and Capacity	13. Collaborate and advocate for new investment (regional, state and national) in regional and community infrastructure improvements and improved digital connectivity			✓		✓
	14. Increase collaboration to support greater recognition of dryland agriculture as an important economic driver with regional development organisations	✓	✓	✓		✓
	15. Collaborate and expand partnerships with other regional groups to support healthy and vibrant rural communities	✓				✓

Saltbush plantings around saltpans to reduce salinity in the Mallee.

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3.2 Monitoring, evaluation and reporting

Regional partners involved in the development of the Strategy identified a number of key performance indicators which will be used to evaluate the success of the objectives and strategic actions contained in the Strategy. Performance indicators already defined by the partner groups were collated and taken into consideration during the development of the indicators specific to the Mallee Dryland Sustainable Agriculture Strategy.

3.2.1 Key Performance Indicators

The following key performance indicators were chosen based on a number of criteria including:

- Importance - indicators must be meaningful and important to regional partners as well as evaluators;
- Measurable - collection of data is practicable and achievable; and
- Simple - data collected can be widely understood.

Table 2 | Key Performance Indicators

Key Theme	Outcome	Action	Indicators
Soil Health and Productive Capacity	• Improved soil health • Application of improved soil management practices • Increased confidence to implement change (on -ground) • Knowledge, understanding and willingness within the community to strengthen sustainable agriculture in the region	1. Improve understanding of the spatial variation in soil type and landform, the productive capacity of soils and extent of threats (physical, chemical and biological constraints) to soil health in the dryland agricultural region 2. Enhance collaboration between research and extension to promote skills and knowledge transfer in the agricultural industry 3. Deliver targeted extension activities that promote sustainable agricultural production systems, improved land management practices and improve farm productive capacity (including understanding productive capacity in various climatic scenarios) 4. Engage and support land managers to understand and adapt to new technologies to improve on-farm monitoring, efficiency and management (case studies, pilots, targeted extension programs)	1. Soil health (tbc) 2. Land use (area cropped, area pasture, non-producing area, productivity) 3. Land cover (% of exposed soil unprotected by living vegetation) 4. Production capacity (gross value trends) 5. Community capacity (knowledge, participation, skills, awareness, behaviour, attitude, networks, partnerships) 6. Area threatened by shallow or rising water tables (depth to groundwater, area of saline land)
Farm Business Risk, Viability, and Resilience	• Increased capacity to adapt and respond to change	5. Encourage a culture of diverse, adaptable and flexible farming systems that minimise risk and enhance viability 6. Co-operatively manage unproductive land for competitive advantage and investment in supply chain activities 7. Support economic research in the Mallee including yields, farm performance and earning capacity, transition options, production costs, and trends in local and global markets 8. Increase collaboration to bring climate change readiness, productivity improvement and validation research into the Mallee (including solutions for land managers facing long term declines in rainfall and implications for heavier soil types)	7. Gross profit margins/financial viability of farming entities 8. Area of farming entities that are trialling innovative practices 9. Area of farming entities that adopt best management practice and illustrate awareness of impacts of climate change 10. Participation in local Landcare groups and activities
Pests, Diseases and Weeds	• Improved prediction and control of emerging outbreaks • Recovery from pests, disease and weed impacts	9. Encourage an anticipatory and adaptive approach to pests, diseases and weeds management and encourage and support multiple control mechanisms (including uptake of innovative cost effective ways to reduce chemical use and resistance) 10. Targeted compliance against regulatory requirements to support sustained community-led action 11. Collaborate and strengthen partnerships to manage weeds and pest animals on public and private land 12. Work collaboratively to implement sound biosecurity practices on-farm including quick and simple measures which can be built into everyday practice	11. Number of infestations 12. Severity of infestations 13. Length of time to recover from infestations 14. Number of Biosecurity Plans being actioned. 15. Community capacity (knowledge, participation, skills, awareness, behaviour, attitude, networks, partnerships)
Regional Infrastructure and Capacity	• Partnerships established to promote quality, cost-effective infrastructure that meets the needs of the dryland agricultural community	13. Collaborate and advocate for new investment (regional, state and national) in regional and community infrastructure improvements and improved digital connectivity 14. Increase collaboration to support greater recognition of dryland agriculture as an important economic driver with regional development organisations 15. Collaborate and expand partnerships with other regional groups to support healthy and vibrant rural communities	16. Partnerships established and/or underway 17. Investment in regional infrastructure related activities

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