

**AN INVESTMENT IN NATURE IS
AN INVESTMENT INTO OUR FUTURE**



**PART ONE
AN OUTLOOK ON
AUSTRALIAN FARMING**



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Defend the Wild acknowledges the Wurundjeri, Bundjalung and Gadigal People as the Traditional Custodians of the land in which this report was written on. We pay our respects to all Elders, past, present and emerging, and further pay our respects to First Nations long surviving connection to Country, their Totem animals, and sacred culture. Sovereignty has never been ceded - this always was, and always will be Aboriginal land.

ACKNOWLEDGEMENT OF COUNTRY

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INTRODUCTION

Australia is a vast and beautiful country filled with natural wonders. Sadly, these natural wonders are fast disappearing. Just 50% of Australia's forests and bushlands remain intact as compared to pre-european arrival.¹ Rapid expansion of agriculture, mining, and urbanisation across the country has reduced native habitat and wildlife populations to a devastating degree.

Though there is a necessity to balance the needs of the wider community - providing employment, housing, and food - with the management of the natural world, some important considerations must be added to the conversation. These considerations are the huge areas of land benefitting a comparatively small percentage of the population, as well as vast areas being used and degraded for overseas markets.

Our current farming system is a leading driver of species extinction, both in Australia and across the world.²⁻³ According to the Intergovernmental Panel on Climate Change, Australia is suffering the worst impacts of climate change than any other advanced economy.⁴

Australia is no longer farming to feed Australia - we are farming to export around the world, and

this has had a devastating impact on our natural environment and the native wildlife who rely on it.

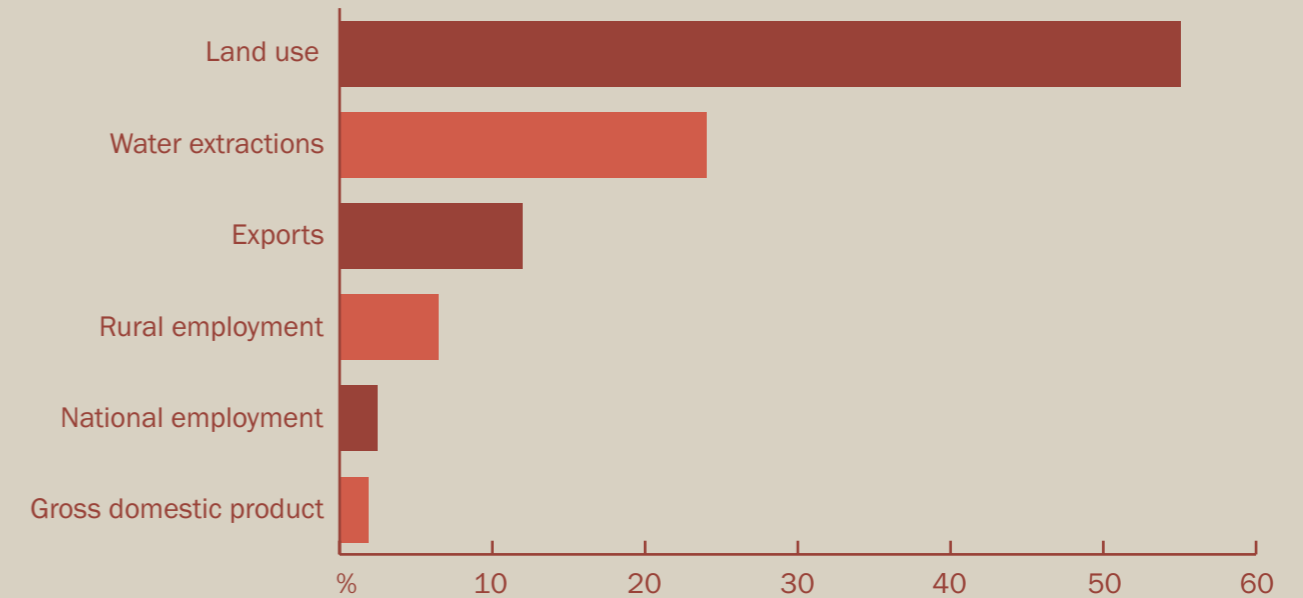
As our natural world continues to shrink and the population continues to grow, the need to ensure our natural assets are both preserved and utilised in a sustainable way is becoming ever more urgent. Coupled with a need to create more climate resilient food systems to reduce instances of food shortages and rising food prices, there has never been a more important time to think critically about our future in this country, and act accordingly.

Fortunately, there are solutions available to us. These solutions could not only preserve our native wildlife and their habitat, but create better and more diverse economic opportunities for local communities, serve to ensure a more self-sufficient Australia, and improve the mental and physical health of our citizens.

In part one of this three part report series we will examine Australia's farming system based on the benefits it provides to the Australian community in the form of employment, as well as its contribution to greenhouse gas emissions, water and land usage.

AUSTRALIAN FARMING AN OVERVIEW

SELECTED CONTRIBUTIONS IN AGRICULTURE



Original source: ABARES Insights, Snapshot of Australian Agriculture 2023.

Australia’s farming industry can be broken down into three major categories: animal agriculture, broadacre cropping and horticulture. Animal agriculture encompasses the raising of animals either on pasture, or within intensive production systems, for slaughter. Broadacre cropping includes the growing of cereals, oilseeds, lupins, sugar cane, legumes, hops, cotton, hay and silage. A vast amount of the industry’s production is used for domestic animal feed. Horticulture is the cultivation of fruits, vegetables, nuts, flowers, turf and nursery products.

Agriculture has been identified as a primary driver of species extinction and habitat loss across the country.² According to the 2021 State of the Environment report, Australia’s agriculture industries are a major contributor to food production, catering to both domestic and international markets.⁵ However, it notes that the industry’s extensive land clearing, grazing, cropping, and water use for irrigation has placed significant pressure on the environment. As a result, the quality of native vegetation, soil, and carbon stocks in intensive land-use areas has deteriorated and remains in poor condition.

For the purpose of understanding the benefits these industries provide to the Australian community, we will explore the most resource intensive animal rearing sector: red meat, broadacre cropping and horticulture.


Agriculture accounts for 427,000,000 hectares, or around 55%, of the surface of Australia.⁶ The vast majority (87.63%) is dedicated to livestock grazing. Agriculture accounted for around 14.6% of Australia’s total greenhouse gas emissions in 2020.⁷

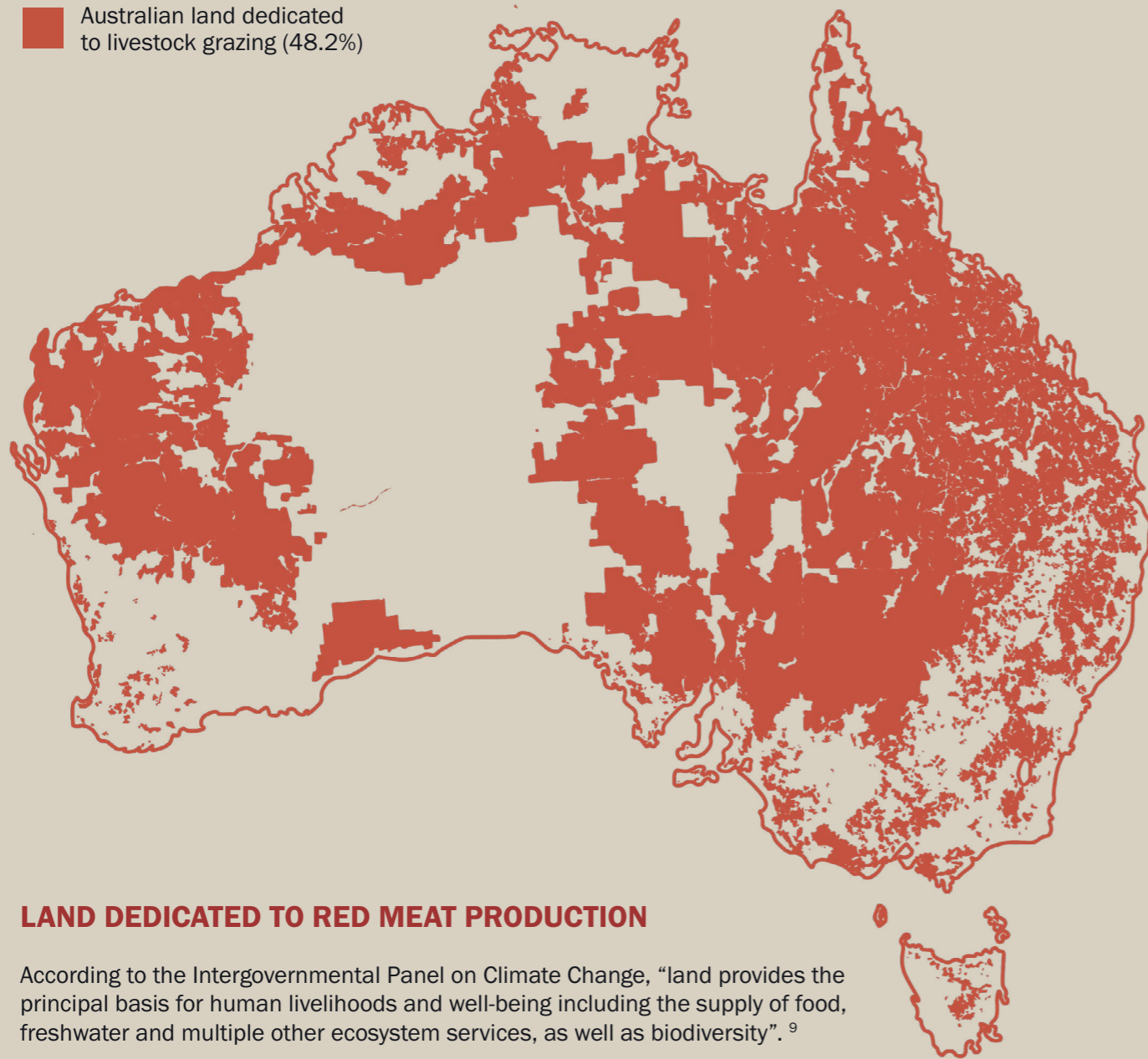
According to the Australian government Department of Agriculture, Fisheries, and Forestry, the agricultural industry employs 239,000 people across the country.⁸ In 2021-22 it accounted for 2.5% of national employment, and around 6-8% of rural employment.⁶

Whilst this report will take a closer look at employment across the red meat, broadacre cropping and horticulture industries, it is important to note that there are discrepancies in data between government and peak industry bodies.

AUSTRALIA'S RED MEAT INDUSTRY

HOW AUSTRALIA BENEFITS

 Australian land dedicated to livestock grazing (48.2%)



LAND DEDICATED TO RED MEAT PRODUCTION

According to the Intergovernmental Panel on Climate Change, “land provides the principal basis for human livelihoods and well-being including the supply of food, freshwater and multiple other ecosystem services, as well as biodiversity”.⁹

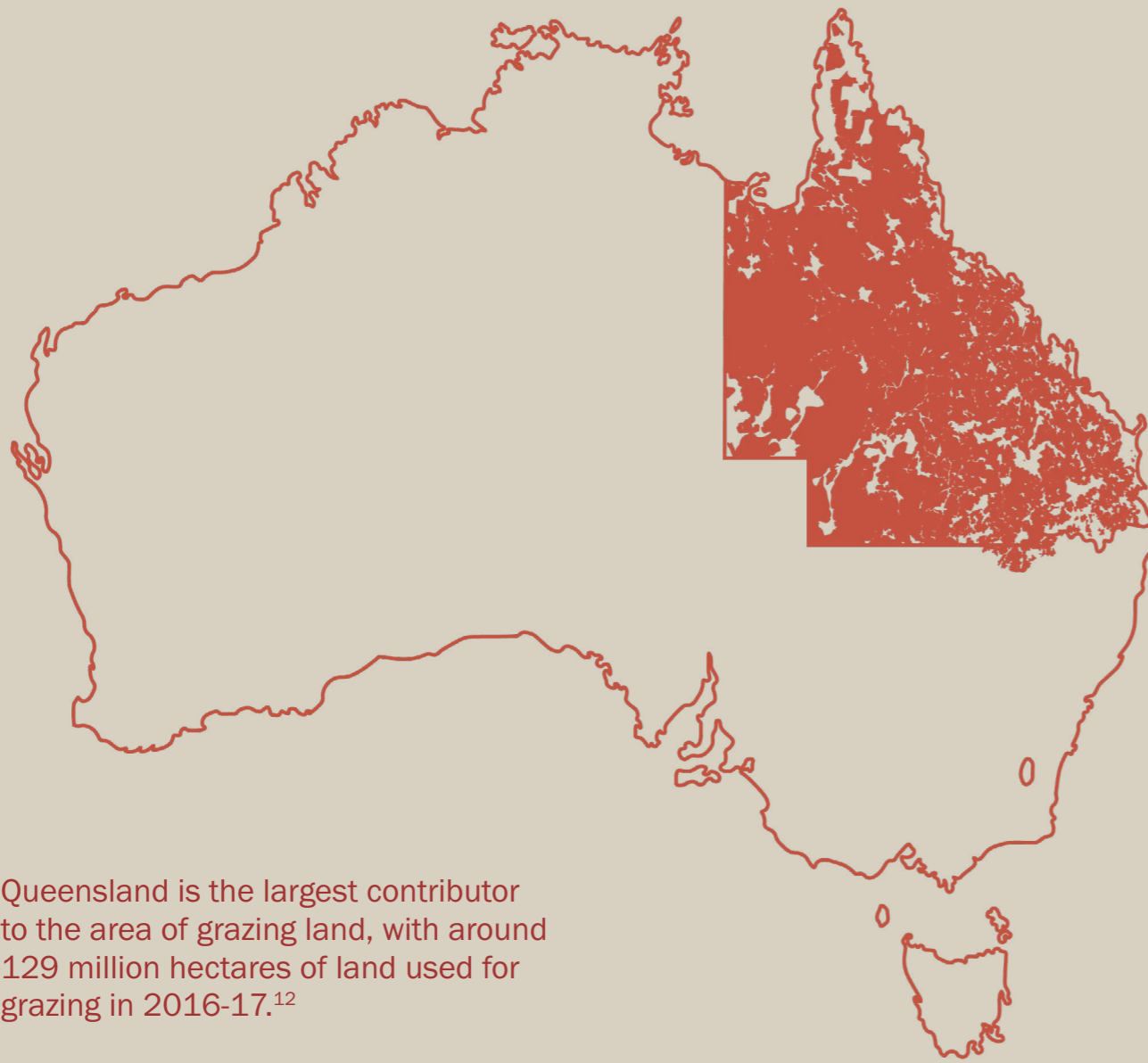
The raising of ruminant animals is the most land intensive industry in Australia. Almost half of the country’s surface area is utilised for dryland grazing on native vegetation or modified pastures (48.2% in 2015/16).⁵ This figure amounts to around 374,207,273 hectares of Australian land used for red meat farming.

Grazing native vegetation occurs when ruminant animals such as cattle, sheep, and goats, eat native plants, grasses and shrubs from the environment. This occurs on 42.3% of Australia’s surface area.⁵ The grazing of native vegetation reduces available food sources for native animals and contributes to ecosystem degradation and a decline in biodiversity.¹⁰

Grazing native vegetation has been found to reduce the abundance of native plant species and promotes the occurrence of invasive, non-native plant species.¹¹ Comparatively, grazing by native species such as kangaroos has been found to do the opposite, increasing native plant diversity rather than hindering it.

Australia’s 2021 State of the Environment Report highlighted that the greatest degree of environmental conversion (the conversion of land area to an alternative use) would be from ‘grazing native vegetation’ to ‘grazing modified pastures’ and ‘dryland cropping’ (2.4 million hectares between 2010/11-2015/16).⁵ This trend suggests that more areas that once had a presence of native plants have now been cleared to make way for pastures or cropping to the detriment of biodiversity and climate change mitigation.





Queensland is the largest contributor to the area of grazing land, with around 129 million hectares of land used for grazing in 2016-17.¹²

SPOTLIGHT ON ENVIRONMENTAL DAMAGE DRIVEN BY RED MEAT FARMING

Livestock grazing and associated land clearing in Australia have significant impacts on the environment. These activities have been linked to soil erosion, loss of topsoil, soil compaction, and reduced soil fertility. Moreover, land clearing can result in habitat fragmentation.¹³ Australia has lost almost 40% of its forests, and the remaining native vegetation is fragmented.¹⁴ Land clearing is also a leading cause of habitat loss which drives species extinction.¹⁵⁻¹⁶ It also decreases ecosystem resilience against the impacts of climate change.¹⁷

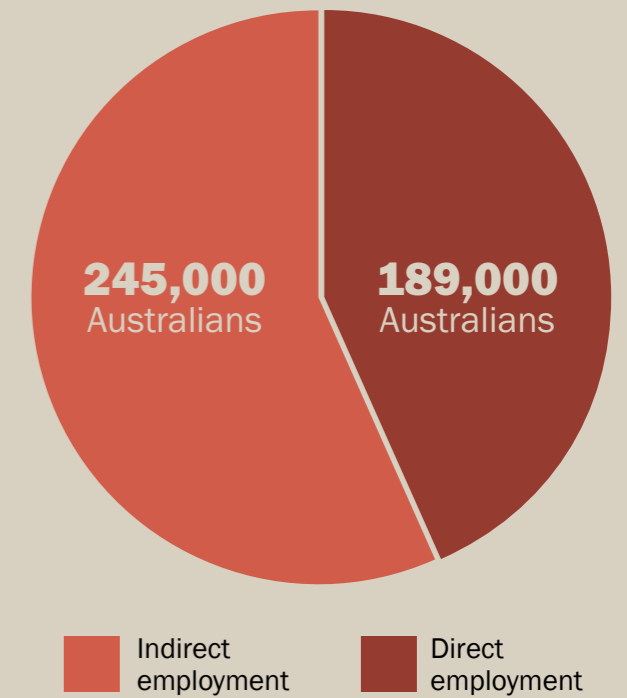
RECOMMENDATION

Further research should be undertaken to quantify the damage cattle are causing on natural landscapes, especially when grazing on native vegetation. Topsoil loss, soil compaction, eutrophication, and loss of native vegetation are all issues associated with the grazing of livestock on natural landscapes, and more data should be collected on this in the context of Australia. First Nations people have a unique understanding of the Australian landscape and could provide valuable insights into the impacts caused.

EMPLOYMENT

According to Meat and Livestock Australia's 2020 State of the Industry Report, the red meat sector provides 189,000 Australians with direct employment and a further 245,000 with indirect employment through servicing the sector.¹⁸ Indirect employment includes services such as transporting red meat or live animals to slaughter. Overall employment generated by the red meat sector equates to a total of 434,000 people across the country.

Based on a population of 25,978,935 people, 0.72% of Australia's population is directly employed in the red meat sector while an additional 0.94% is indirectly employed.¹⁹ In total, this makes up 1.7% of Australia's population.



Based on direct employment, the red meat sector employs 1 person for every 1,980 hectares of land farmed. Based on overall employment, the red meat industry employs 1 person per 862.2 hectares of land farmed.

It is important to note that jobs available within the red meat industry are extremely important for many communities. This is especially true in rural and remote communities where other employment opportunities are often scarce.



1 person employed by the red meat industry



862.2 hectares of land farmed





SPOTLIGHT ON JBS FOODS: AUSTRALIA'S LARGEST MEAT AND FOOD PROCESSING COMPANY

JBS foods is the largest multinational meat producing company and seventh largest food company in the world.²⁰ The Brazilian owned company has grown significantly in Australia since first entering the market over 22 years ago, and has surged to become the largest meat processing company in the country.²¹

JBS has received significant attention internationally for both their environmental crimes and human rights abuses, including slavery throughout their supply chain.²²⁻²³

In 2022, the ABC aired *The Butchers from Brazil: The Corporate colossus devouring Australia's food business*, which highlighted grave concerns for the company's increasing stronghold on Australia's food producing industry.²²

Across the country, the company now employs 14,000 people throughout their supply chains and continues to grow, as do community concerns over the risk of their mismanagement of Australian landscapes and workers.²⁴

RECOMMENDATION

Further investigation should be undertaken to gain deeper insight into the market power of JBS as a major processor of red meat in Australia. More data is needed to better understand how this may dictate livestock pricing at slaughter, wages within the red meat processing sector, and how this impacts producers.

EXPORTS

In 2022 Australia exported 72% (1.45 million tonnes) of its red meat production to overseas markets including Japan, China, US, South Korea, South East Asia, MENA, Taiwan, Canada and Europe.²⁵ This represented a 10.4% decline on 2021 exports of 82.4%.

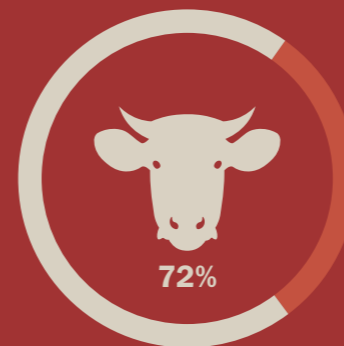
This means that around 269,429,237 hectares of Australian land was grazed for overseas markets in 2022 and 308,346,793 hectares in 2021. These figures do not include land utilised by the cropping industry to produce animal feed.

BEEF

Australia has the seventh largest population of cattle (including dairy herds) in the world, with 44% residing in Queensland alone.²⁶⁻²⁷

Beef is Australia's seventh largest export, representing 2.4% of the country's total exports, and producing 4% of global beef production.²⁸

Approximately 72% of Australia's beef production is exported to overseas markets.²⁹ In 2022, beef and veal exports declined by 14.6% (887,682 tonnes).²⁵

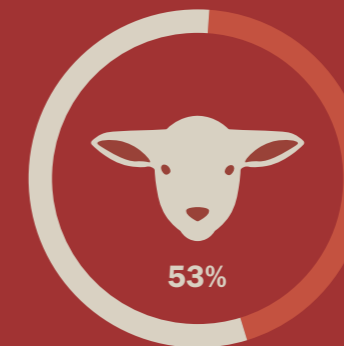


Beef exported overseas

LAMB & MUTTON

Australia is the world's largest exporter of sheep meat, representing 36% global share of sheepmeat exports.³⁰⁻³¹

According to Meat and Livestock Australia, 534,500 tonnes of lamb meat was produced in Australia in 2022.³² Of this total, 284,257 or 53% was exported.³³



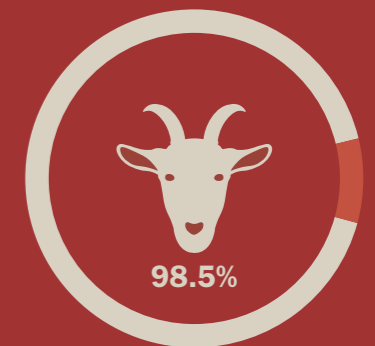
Lamb & mutton exported overseas

GOAT

Australia is the largest exporter of goat meat in the world, with a 34% value share of global goat meat exports.³⁴⁻³⁵

In 2021, Australia produced 20,847 tonnes of carcass weight, exporting 98.5% overseas.³⁵ A further 12,000 head of live goats were exported overseas in the same period.

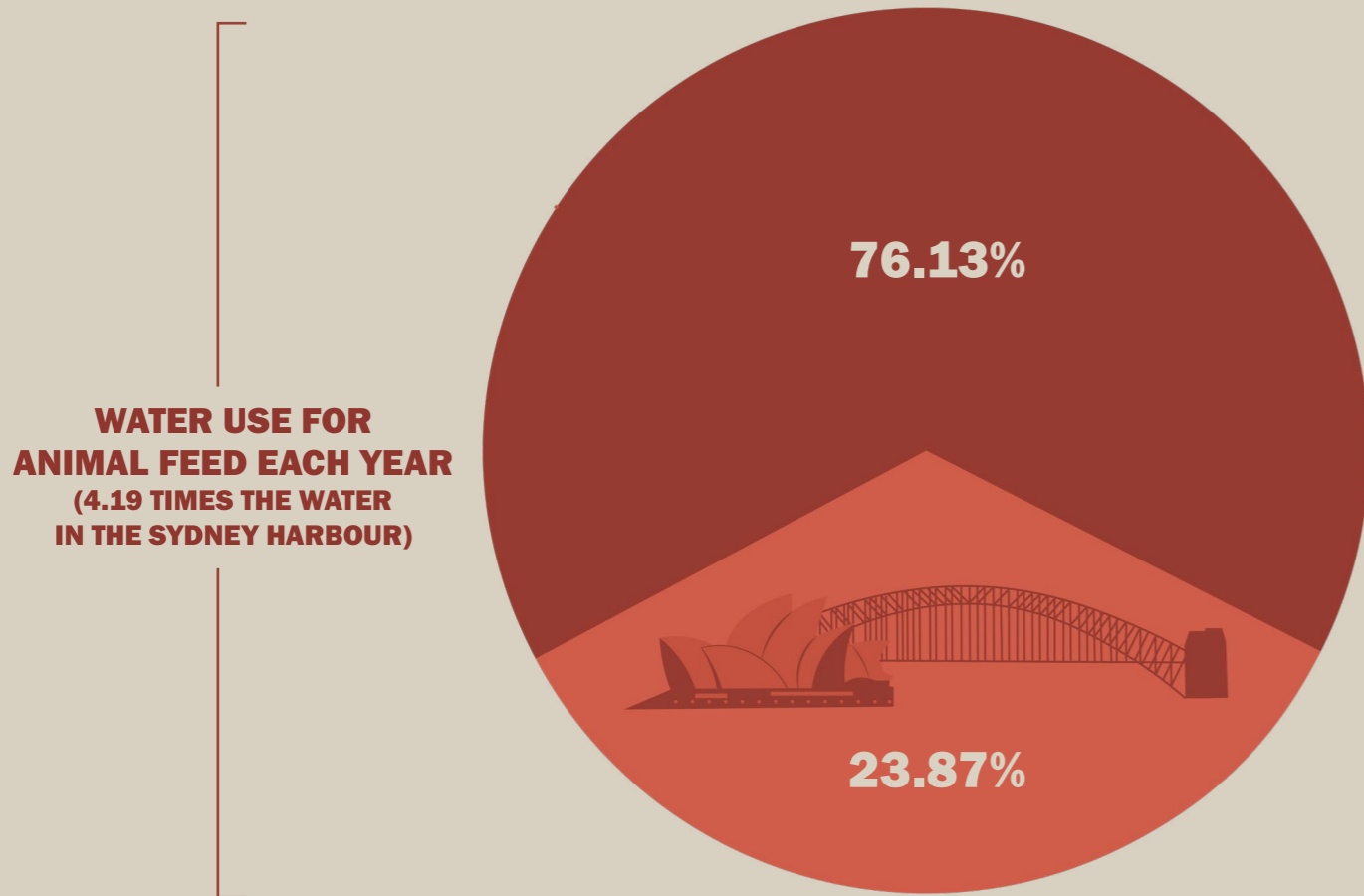
According to Meat and Livestock Australia, goat meat exports were up by 58% in the first quarter of 2022 compared with the first quarter of 2021.³⁶



Goat meat exported overseas

WATER REQUIRED FOR RED MEAT PRODUCTION

Agriculture is by far the most water intensive industry in Australia.³⁷ According to the Australian Bureau of Statistics, pastures and cereal for livestock grazing accounted for the most water, applying 1,429,495 megalitres of water in 2020-21.³⁸ This includes lucerne pastures and areas of cereal crops fed to livestock. A further 664,712 megalitres was applied to pastures and cereals for silage, which is animal feed that is stored and used later.



GREENHOUSE GAS EMISSIONS EMITTED BY RED MEAT SECTOR

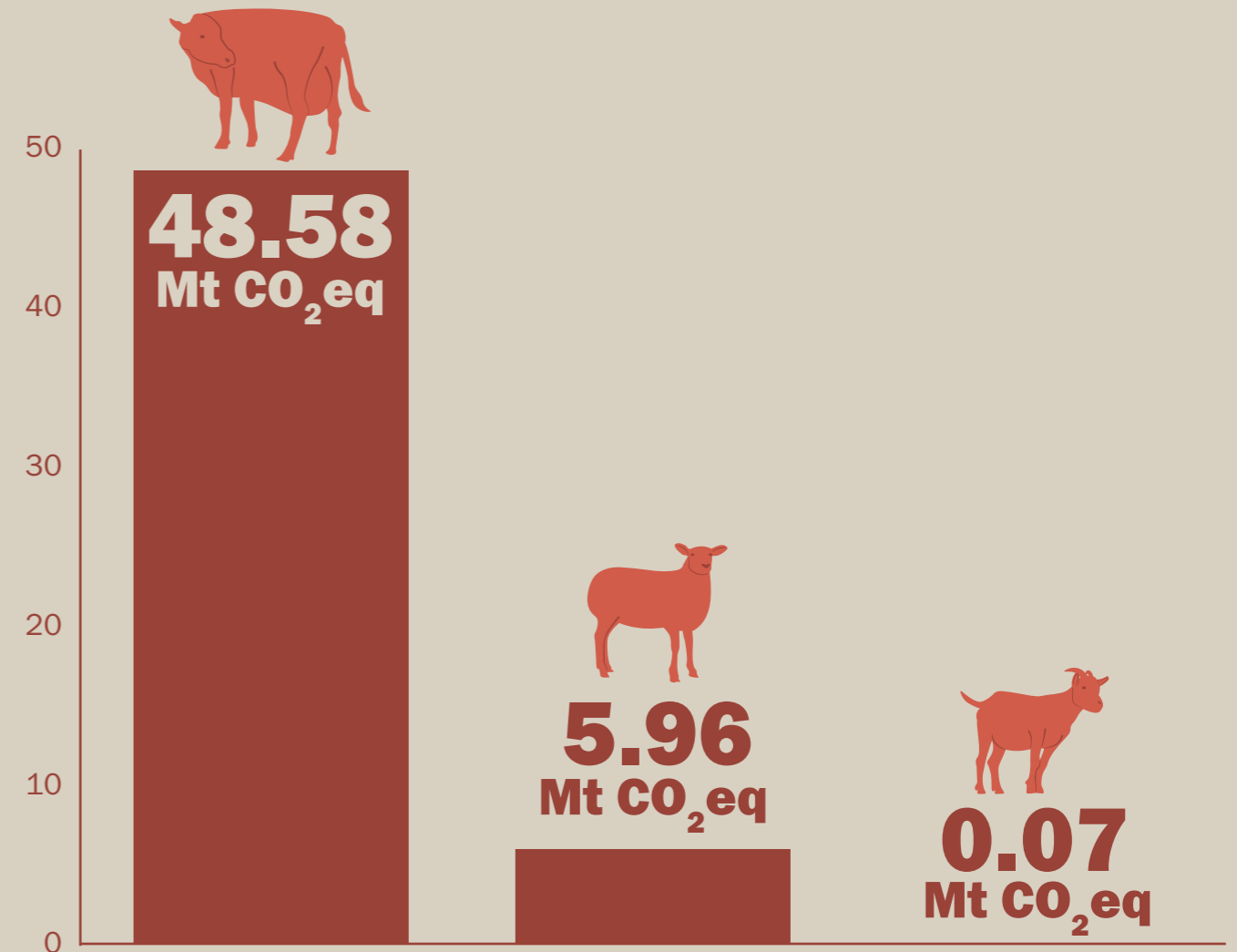
The most significant source of the red meat sector's greenhouse gas (GHG) emissions is methane emitted by ruminant animals, including cattle, sheep and goats.³⁹ This occurs through a digestive process known as enteric fermentation, which occurs naturally in ruminant animals.⁴⁰ The microbes in their digestive tract, or rumen, decompose and ferment food, producing methane, which is released into the atmosphere when they burp, pass wind, or their manure breaks down. Methane is 84 times more potent than CO₂ as a heat trapping gas over a 20 year period.⁴¹

According to Meat and Livestock Australia, the red meat sector accounted for 54.6 Mt CO₂eq or 10.7% of Australia's total greenhouse gas emissions in 2019.³⁹

In the year to September 2022, agriculture accounted for 16.6% of Australia's national greenhouse gas inventory.⁴² The increase in previous years is said to be primarily driven by an increase in livestock numbers and crop production.

Across Australia, livestock are the third highest emitters of greenhouse gas emissions after the energy and transport sectors.⁴³ In New South Wales, agriculture accounts for around 14% of greenhouse gas emissions, with livestock methane accounting for approximately 80% of this total.

Cattle are the most significant emitters, emitting 48.58 Mt CO₂eq in 2019, this is followed by sheep who emitted 5.96 Mt CO₂eq, followed by goats who emitted 0.07 Mt CO₂eq.³⁹



According to the Red Meat Advisory Council, 12.6kg CO₂eq is emitted per kilogram of live weight beef.¹⁸

In 2018, Queensland generated the highest greenhouse gas emissions out of any state across the country.⁴⁴ Methane produced by ruminant animals (cattle, goats and sheep) through enteric fermentation was responsible for the most, accounting for 75%, with beef cattle responsible for 97% of these emissions. The Queensland agriculture sector's other emission sources were manure management (12%), carbon emissions released from the tilling of soils (11%) and the application of urea as a fertiliser (1%).

Another one of the red meat sectors' most significant sources of CO₂ emissions is attributed to land use changes, like deforestation, to make way for pastures.⁴⁵ This is because trees play a vital role in capturing and storing carbon.⁴⁶ When trees are cleared, they release the carbon they have been storing into the atmosphere.

Beef farming is the most significant driver of land clearing across Australia. Between 2010 and 2018, grazing native vegetation was responsible for more than 1.8 million hectares of clearing and grazing modified pastures was responsible for 125,000 hectares of clearing.⁴⁷

ANTIBIOTIC USE AND RISK OF ANTIMICROBIAL RESISTANCE

Antibiotics are used within the red meat sector in order to control disease in ruminant animals raised for slaughter.⁴⁸ Excessive use of antibiotics can lead to antimicrobial resistance.⁴⁹ This occurs when bacteria, viruses, fungi and parasites evolve over time and no longer respond to medicines. This can result in difficulty in treating infections and increases the risk of disease spread.⁵⁰

A recent study commissioned by World Animal Protection and undertaken by researchers at Monash University looked at how well antibiotics worked against bacteria in beef and salmon and also searched for antibiotic-resistant genes the microorganisms may be harbouring.⁵¹ The research found 55% of the beef samples and 39% of the salmon samples were found to be harbouring resistance to a variety of commonly utilised antibiotics.⁵²

A recent report by the CSIRO described antimicrobial resistance as a "looming global health crisis" as it has the ability to render some of the most important drugs to modern medicine ineffective.⁵³



AUSTRALIA'S CROPPING AND HORTICULTURE INDUSTRIES

HOW AUSTRALIA BENEFITS

AUSTRALIA'S CROPPING AND HORTICULTURE INDUSTRIES: HOW AUSTRALIA BENEFITS

Australia's broadacre cropping industry is the country's second largest agricultural industry. Stretching across 21,080,000 hectares of land, it represents around 2.74% of Australia's total landmass.⁶ According to Grain Central, around 40% of Australia's total grain production is destined for domestic animal feed.⁵⁴ This growth in grain consumption by animal farming industries reflects the continued growth of intensive farming of cattle in feedlots and factory farming of chickens used for meat production.⁵⁴



Australia's cropping industry markets are often influenced by the climate, with opportunities heavily dependent on weather patterns in any given year, which are becoming increasingly challenging due to climate change.⁵⁵⁻⁵⁶ Australia's climate is volatile, and experiences both heavy rainfall, and prolonged drought.⁵⁷

Horticulture, which encompasses the cultivation of fruit, vegetables, nuts, flowers, turf and nursery products, is Australia's third largest agricultural industry.⁵⁸ Horticulture requires comparatively less land than broadacre cropping, accounting for 0.46 million hectares of land.⁵ Most horticulture growers are said to be small-scale family farms, however the number of medium to large farms is growing.⁵⁸

EMPLOYMENT

BROADACRE CROPPING

According to GrainGrowers, 100,000 people are directly employed in the grain growing industry in Australia, representing around 0.40% of Australia's population.⁵⁹ Like raising livestock, cropping is a valuable industry in rural and remote areas where employment opportunities are limited.

Based on direct employment, the broadacre cropping industry employs 1 person for every 210.8 hectares of land farmed.

HORTICULTURE

On average, 135,100 workers were employed in horticulture over the course of 2020-21.⁶⁰ This represents 0.52% of the Australian population.

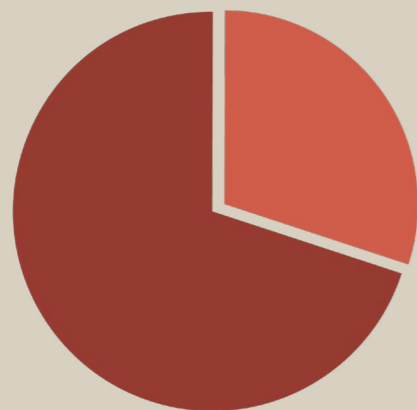
Horticulture employs 1 person for every 4.6 hectares of land farmed.

Whilst horticulture provides the highest level of employment based on area of land used, it is known that horticulture relies on backpackers, consistently making up 50-85% of the seasonal workforce.⁶¹ The Fair Work Commission has identified that workers are vulnerable to exploitation.⁶² Whilst this is a serious matter that needs to be considered, it is outside of the scope of this report.

EXPORTS

BROADACRE CROPPING

Australia's grain industry is overwhelmingly export focused, sending approximately



70% of total production overseas in normal, non-drought years.⁵⁹

This means that around 14,756,000 hectares of Australian land is being utilised to grow crops for overseas markets.

HORTICULTURE

In 2020, the value of fresh horticulture products exported from Australia was valued at \$2.7 billion AUD and \$0.3 billion in processed horticulture products.⁶³ Fresh exports represented 13% of horticulture's total production.

Compared with red meat and cropping, horticulture exports are relatively low, representing the lowest exported agricultural commodity.⁶⁴

SPOTLIGHT ON GRAINS AND COTTON AND THEIR USES



65-67%
exported

WHEAT

Wheat is Australia's primary crop, accounting for more than half of the national grain production.⁶⁵ Australia's wheat industry is predominantly export focused, shipping approximately 65%-75% of the nation's total production to over 50 countries.⁶⁶ Whilst wheat is predominately utilised to produce a variety of products, including breads, pastas and noodles, it is also utilised to produce animal feed.

Sprouted Australian wheat is marketed to Asia as a reliable feed source for dairy and beef cattle, as well as pigs and poultry animals.⁶⁷ Wheat is also marketed as a feed source for broiler poultry.

63.5%
exported

SORGHUM

In 2021, Australia produced 2.6 million tonnes of sorghum and was estimated to have exported 1.64 million tonnes, or 63.5%, of production.⁶⁸⁻⁶⁹ Australian sorghum is primarily used for feed grain for the beef, dairy, pig and poultry industries.⁷⁰



**70%
exported**

BARLEY
Australia's barley industry is heavily export focused, with approximately 70% of the total crop exported overseas each year.⁷¹ On average, Australia produces 2-2.5 million tonnes of malting barley (used for distilling, malting and brewing) and more than 6 million tonnes of barley for other uses (predominantly animal feed). Australian barley is used mainly in the beer brewing industry and for animal feed.



**20%
exported**

OATS
The current five-year average production for oats is around 1.4 million metric tonnes in Australia.⁷² Of this, around 1-1.1 million metric tonnes of oats are used annually within Australia for seed, food and animal feed purposes. Around 20% of Australia's total crop is exported internationally, with the majority of export grain used for human consumption.⁷³

Oats are retained on some farms for animal feed or used in domestic production of compound feed.⁷⁴ They are also grown to produce hay for both domestic and export animal feed markets.



**98%
exported**

PULSES
Pulses include beans, lentils, chickpeas, and lupins. Australia is a large exporter of pulse crops, with around 98% of production being destined for export markets.⁶⁵

Lupins are the largest pulse crop grown in Australia.⁷⁷⁻⁷⁸ The majority of lupin production is used by livestock feed manufacturers to produce animal feed.⁷⁹ Ruminant animals are the largest market, followed by pigs and poultry. There is also a small, but growing use of lupins in aquaculture.



**76% - 91%
exported**

CANOLA
Australia produces around 3.5 million metric tonnes of canola seed each year.⁷⁵ The country is the world's second largest exporter of canola seed, sending 2.5-3 million metric tonnes, or 76%-91%, overseas annually.^{76,75} Australian canola is sought after around the world for food-grade cooking oil, biofuel production and stock feed.



**90%
exported**

COTTON
Each year Australian cotton producers grow enough cotton to clothe 500 million people.⁸⁰ Australia is one of the world's largest exporters of cotton, with over 90% of total production being exported, predominantly to Asia spinning mill customers.⁸¹

Cotton lint makes up approximately 42% of picked cotton by weight and contributes around 85% of the total income for cotton crop.⁸² Cotton seed makes up the remainder, and is utilised to feed cattle and crushed to create oil.⁸³ The by-product of cotton seed oil-extraction is known as 'meal', which is also used to feed domestic livestock.⁸⁴

WATER USE

IRRIGATED WATER USE

Irrigated water use refers to the artificial application of water to soil through various systems of tubes, pumps and sprays.⁸⁵ It is often used in areas where rainfall is irregular or dry time and drought is expected.

Irrigated agriculture uses approximately 60% of water available for human use in Australia.⁸⁶ Irrigated crops make up around 30% of the value of Australia’s agricultural production.

Irrigated water accounts for 73% of all water applied to crops in Australia.³⁸

BROADACRE CROPS

Water use for farmed animal feed crops is by far the biggest user of irrigated water in Australian crop farming. According to the Australian Bureau of Statistics, pastures and cereal for livestock grazing accounted for the most, applying 1,429,495 megalitres of water in 2020-21. This included lucerne pastures and areas of cereal crops fed to livestock. A further 664,712 megalitres was applied to pastures and cereals for silage, which is animal feed that is stored and used later.³⁸ The water applied to pastures and cereal for livestock grazing, as well as for silage is 4.19 times the amount of water in the Sydney harbour.

Cereal crops grown for other (non-animal feed) uses are significantly less, accounting for 718,870 megalitres of water use.³⁸

Cotton crops irrigated water use increased 249% from 2019-20 to 1,300,000 megalitres of water in 2020-21.³⁸

LAND USE IRRIGATED AGRICULTURE

Irrigated agriculture covers 1,900,000 hectares of agricultural land in Australia.³⁸

Irrigated agricultural land for animal feed crops and pastures accounts for 706,170 hectares or 37.2% of all irrigated agriculture in Australia.³⁸ Irrigated cereal crops for other (non-feed related uses) accounts for 320,100 hectares or 16.8% of irrigated agricultural land. Cotton growing accounts for 197,401 hectares, or 10.4% of irrigated agricultural land use in Australia.

HORTICULTURE

In 2021-2022, the Australian Bureau of Statistics reported that 197,000 hectares of irrigated land, which accounts for 10.4%, was used for fruit and nut cultivation, requiring 1.1 million megalitres of water.³⁸

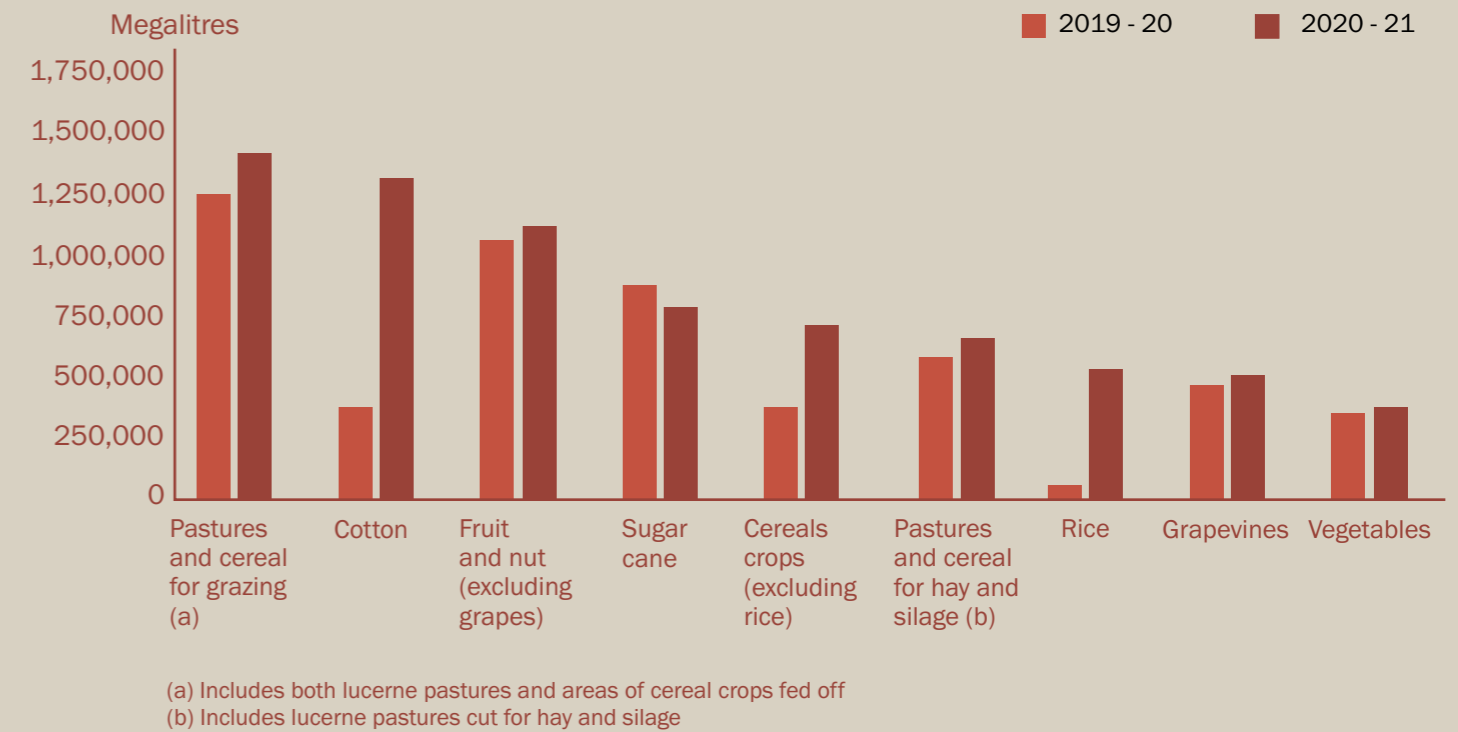
Vegetables accounted for 98,785 hectares, or 5.2%, of irrigated land use accounting for 382,626 megalitres of water.

A further 516,550 megalitres of water was applied to grow grapevines across 130,534 hectares of land.

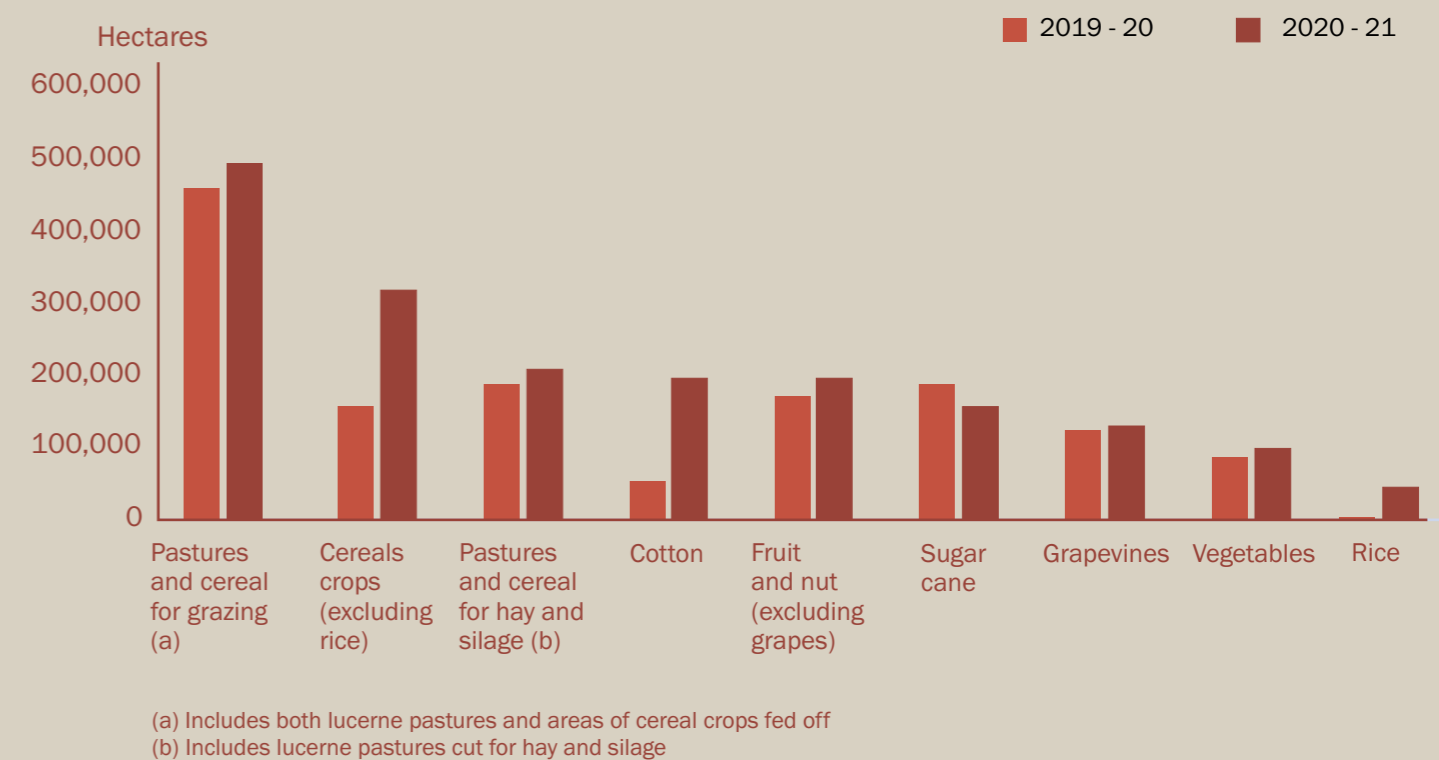
OTHER WATER SOURCES

Another 2,108,219.18 megalitres of non-irrigated water is applied to crops in Australia each year. These water sources may include rivers, creeks, dams, lakes, bores, natural springs or recycled water.³⁸

WATER APPLIED TO SELECTED CROPS AND PASTURES, MEGALITRES



IRRIGATED AGRICULTURAL LAND FOR SELECTED CROPS AND PASTURES, HECTARES



Original source: Australian Bureau of Statistics, Water Use on Australian Farms, 2020-21 financial year.

SPOTLIGHT: MURRAY DARLING RIVER BASIN

The Murray-Darling River Basin (MDB) is Australia’s largest and most important river system. It goes through 5 out of 8 of Australia’s states and territories, and its water is extracted by 40% of Australia’s farms to produce AUD \$24 billion worth of agricultural products.⁸⁷⁻⁸⁹

As summarised by Australia’s Department of Climate Change, Energy, the Environment and Water, “Over time, as our population and agricultural needs have grown, the amount of water being diverted from the river system became unsustainable and the health of the Basin began to decline”.⁹⁰ The impacts on the Basin from recent years are a clear reflection of the exploitation and unsustainable extraction of the Basin’s water resources.

The MDB is important to Australia, but it’s not being well cared for. Though the Water Act 2007 was ostensibly passed to address the problem of excessive water removal, drought, low water reserves, and traumatic fish deaths, demonstrate that the management of the basin has not improved.^{91,88} This degradation of the ecosystem and shortage of water resources will be made worse by climate change.⁹²

It’s notable that the Basin’s management plan was poorly executed and people were found to be illegally taking water from its already depleted water resources.⁹³⁻⁹⁴ The biggest reason the ecosystem of the basin became less able to withstand changes was due to excessive water removal over many years.⁹⁵ Despite this, at least one study has found that there has been insufficient attention paid to the actual, underlying reasons for the degradation of the MDB, which is a failure in governance including long term over-allocation.⁹⁶

Additionally, there is a gap in the literature on how the exploitation of the MDB has supported an agricultural sector that exports most of its produce. This raises concerns about the integrity of Australia’s food system and how it prioritises exporting goods over preserving the environment and ensuring long-term sustainability.

RECOMMENDATION

Limited information on the breakdown of alternative water sources for the Australian cropping and horticulture industries are available. More research is needed to better understand how this water is distributed and applied across farms.

PESTICIDE USE ON CROPPING FARMS

Pesticides are a substance used to eliminate insects or other organisms that might interfere with agricultural production and yields.⁹⁷ These include insecticides, herbicides and fungicides. Over 8000 pesticide products are registered for use across Australia. Agriculture accounts for 75% of the use of pesticides whilst households account for the remaining 25%.⁹⁸

Pesticide emissions are a leading contributor to surface water pollution.⁹⁹

Australia has been criticised for its use of pesticides that are no longer in use overseas.¹⁰⁰ One example is the use of paraquat, a herbicide utilised since the 1950s, which has been banned in over 50 countries including the UK. Studies have linked their use to negative impacts on aquatic ecosystems and it is highly toxic to humans.¹⁰¹⁻¹⁰²

FERTILISER USE ON CROPPING FARMS

Fertilisers are used by the cropping sector to enhance, promote or regulate plant growth.¹⁰³ Until the onset of the last century, fertiliser was made up of composted manure or harvested bat faeces.¹⁰⁴ Today, most commercial cropping and horticulture operators rely on nitrogen, phosphorus and potassium fertilisers.¹⁰⁵ Between 2016-17, an estimated 57,300 agricultural businesses applied 5 million tonnes of fertiliser to a total of 50 million hectares of agricultural land. Increased use of fertilisers has significant costs, particularly in terms of greenhouse gas emissions and pollution.^{12, 106} It harms the climate and the ecosystem while causing soil degradation that ultimately lowers productivity.¹⁰⁷

The value of fertiliser importation increased from \$2.5 billion in 2020-21 to \$4.9 billion in 2021-22, this was due to a 110% increase in average import unit value.¹⁰⁸ Those imported into Australia can be categorised into three main groups:

1. **Chemical fertilisers** (products that are the result of manufacturing).
2. **Mined fertilisers** (natural, non-organic products mined from the earth).
3. **Organic fertilisers** (may be made of animals or microbes).¹⁰⁹

FERTILISER	TYPE
Nitrate slow release fertiliser	-
Urea slow release fertiliser	-
Urea	Chemical - produced by combining ammonia and carbon dioxide.
Ammonium sulphate	Chemical - inorganic salt containing nitrogen and sulphur.
Urea ammonium nitrate	Chemical - solution of urea and ammonium nitrate in water.
Anhydrous ammonia	Chemical
Potassium nitrate	Chemical
Single superphosphate	Chemical
Muriate of potash and/or sulphite of potash	Chemical

CHEMICAL FERTILISER

Chemical fertilisers are manufactured, and have been widely used to achieve maximum productivity in standard agriculture systems.¹¹⁰ Excessive use of chemical fertilisers has led to numerous issues including soil degradation, nitrogen leaching, and reduction in soil organic matter.¹¹¹⁻¹¹³

The ongoing and excessive use of chemical fertilisers is a major driver in directly and indirectly changing environmental conditions.¹¹⁴

MINED FERTILISER

Mined fertilisers are in-organic products mined from the earth. Examples include rock phosphate, sulphur, mineralised humic-based fertiliser and guano-based fertilisers.¹¹⁰

Phosphorus is a critical element because all life depends on it.¹¹⁵ Rock phosphate is treated with sulphuric acid to produce phosphoric acid. This is then concentrated or mixed with ammonia to produce a range of phosphate fertilisers.

ISSUES WITH FERTILISER PRODUCTION AND APPLICATION

EUTROPHICATION

The use of fertilisers increases the risk of nutrients moving from agricultural land into natural waterways.¹¹⁶ The two nutrients of most concern are nitrogen and phosphorus as they can lead to excessive algae growth, which kills aquatic plants and animals including fish and coral. Eutrophication can also impact the suitability of water to be used for drinking and recreation.

Agricultural run-off has been of particular concern in Queensland as poor water quality has been a major contributor to the current poor state of many coastal and inshore marine ecosystems of the Great Barrier Reef.¹¹⁷ The reef is vulnerable to exposure to pollutants (mostly sediments, nutrients and pesticides) transported from land-based run-off.

There has also been public concern regarding the nutrient levels in the waterways and estuaries of the Swan and Scott River Coastal Plains of Western Australia.¹¹⁶ The discharge of nutrients from the soil's reserves and the use of fertilisers are significant contributors to the degradation of water quality in both instances.

NUTRIENT DEPLETION AND SOIL EROSION

Some agricultural systems take more nutrients from soils than are replaced.¹¹⁶ This results in soil that is depleted of nutrients, which leads to a decline in plant production, and soil that is more vulnerable to erosion by wind and rain.¹¹⁸⁻¹¹⁹ Eroded soil and any accompanying nutrients can enter waterways and contribute to poor water quality.¹²⁰

INCREASED FERTILISER PRICES HITTING FARMERS

Fertiliser is energy intensive to manufacture, so rises in energy costs impact the cost of production.¹²¹ In 2022, fuel and fertiliser prices reached never-before-seen highs, causing Australian farmers to struggle to keep up with the costs of production.¹²²

A distinct lack of transparency causes an imbalance of market power between farmers and fertiliser importers, particularly benefitting importers in a market dominated by big players.¹²³

In Australia, there is no publicly accessible pricing information for fertilisers. The sector does not publish their pricing data, which means farmers do not have the means to do quick and easy searches for the most cost effective products to buy.

GREENHOUSE GAS EMISSIONS

Limited data is available to quantify the total greenhouse gas contributions of Australia's cropping and horticulture industry, however emissions from both sectors is significantly less than the red meat sector's contribution.

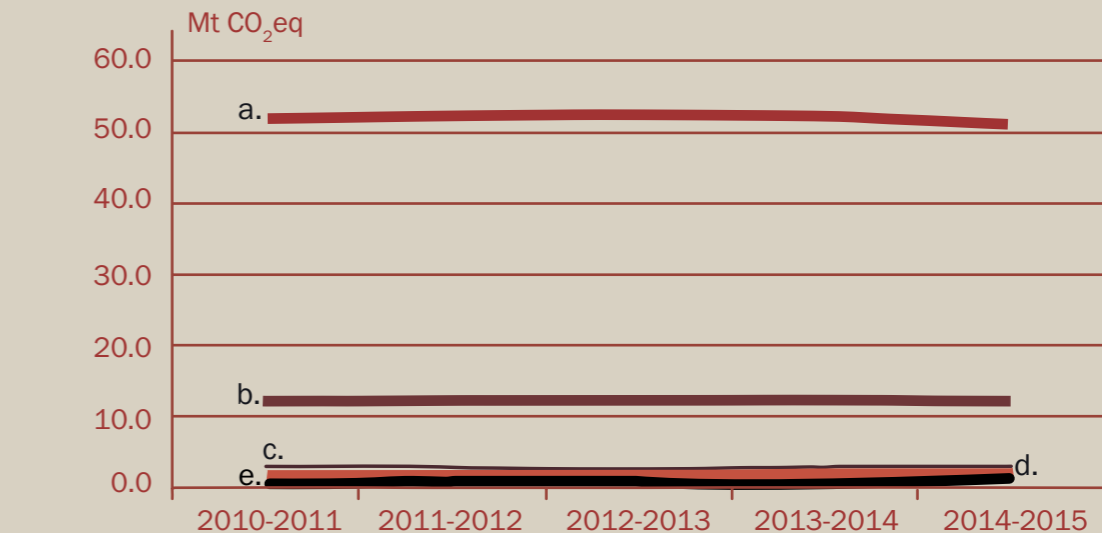
In 2014-15, Australian agriculture's three greatest contributors to greenhouse gas emissions were enteric fermentation, agricultural soils and manure management.¹²⁴

Producing fertilisers for Australia's cropping industry emits greenhouse gas.¹²⁵ The production of some fertilisers, like synthetic nitrogen, is considered unsustainable.¹²⁶

The incorporation of nitrogen in these fertilisers to boost crop yield leads to the release of nitric oxide, which has 300 times more global warming potential than carbon dioxide, thereby exacerbating global warming.¹²⁷

According to the Department of Agriculture, fertiliser production and use accounted for 58% of the Australian wheat cropping industry's greenhouse gas emission contribution over 5 years.¹²⁸

GHG EMISSIONS FROM AGRICULTURAL ACTIVITIES AUSTRALIA, 2010-2011 TO 2014-2015



- a. Enteric fermentation
- b. Agricultural soils
- c. Other (a)
- d. Manure management
- e. Liming and urea application

Original source: Australian Bureau of Statistics, Discussion Paper: From Nature to the Table: Environmental-Economic Accounting for Agriculture, 2015-2016.

RECOMMENDATION

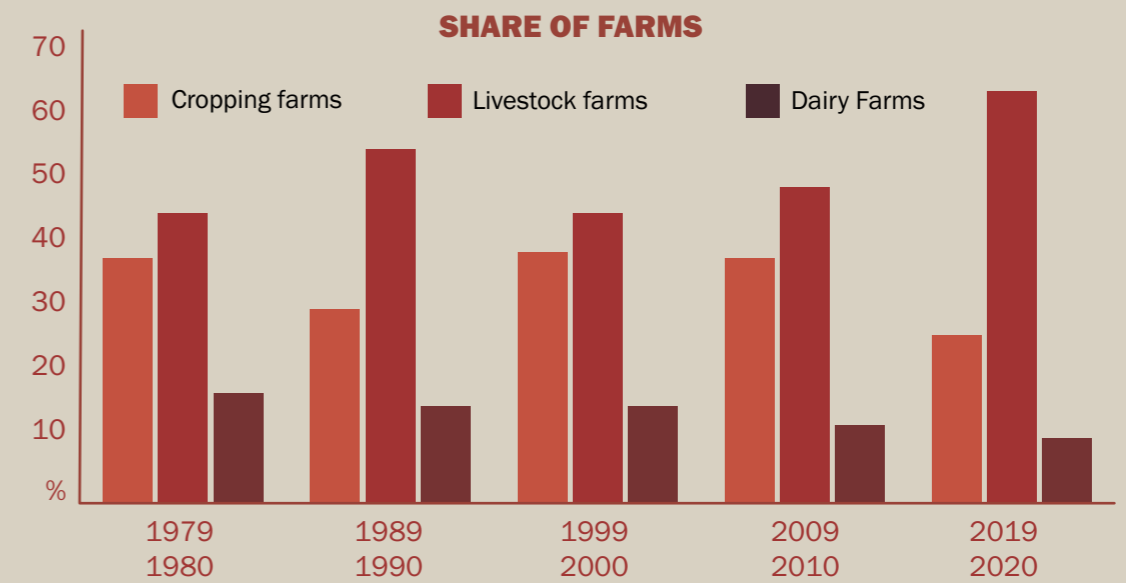
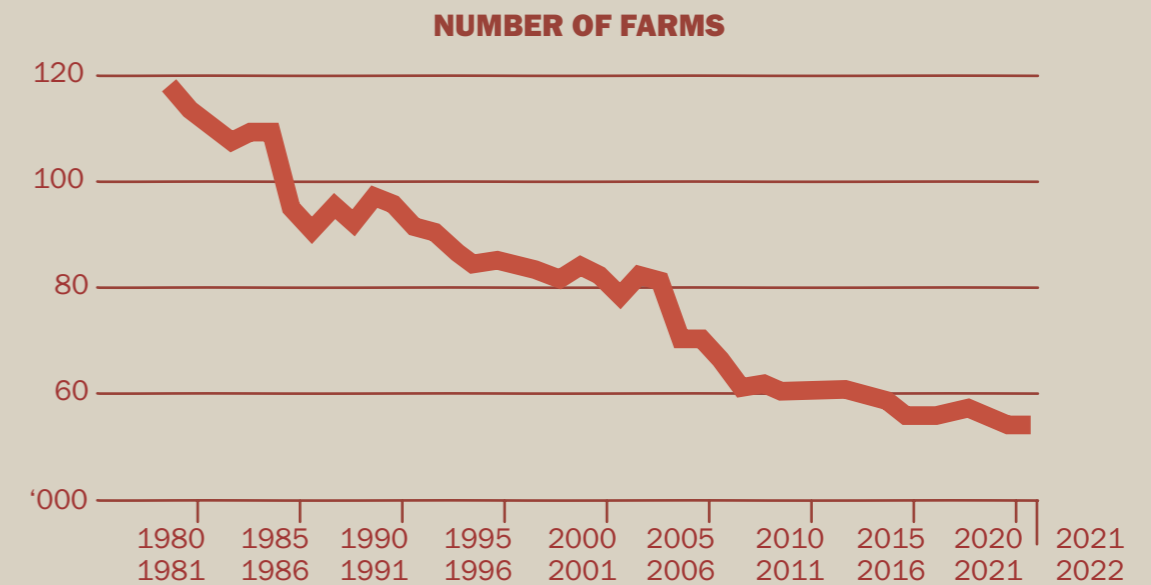
More research should be undertaken to accurately quantify the total greenhouse gas emissions the cropping and horticulture sectors are emitting across their supply chains.

FARMING EMPLOYMENT AND FARM NUMBERS ARE TRENDING DOWNWARDS

Over the past two decades there has been an overall decline in the number of people employed within the agricultural production sector, decreasing 19% between 1996 and 2016.¹²⁹ This shift coincides with an increase in intensive production systems.¹³⁰

According to the Australian Government Productivity Commission, over the twenty year period to 2002-03 considerable changes occurred within agriculture.¹³⁰ The number of farms decreased by approximately 25% and the average farm size increased by around 23%. Farming production also became more concentrated on larger farms - the top 20 percent of broadacre cropping farms surged to produce 64% of output. Notably, a shift towards more intensive production was observed, as well as greater integration of production along the agri-food chain.

This trend has continued, with an overall decline in the number of farms observed between 2003 and 2019.⁶



Original source: ABARES Insights, issue 1, 2022. Snapshot of Australian Agriculture 2022.

AUSTRALIAN FARMLAND

A BARGAIN FOR CORPORATIONS, OUT OF REACH FOR THE MASSES

An interesting element to consider in this conversation is the price of commercial farmland across the country. Whilst many Australians are experiencing a housing crisis, farmland across Australia is sold for a relatively low cost when considered on a hectare by hectare basis.¹³¹ Of course, most agricultural properties are sold in large land holdings - sometimes in the tens of thousands of hectares, meaning that the land is out of reach for regular citizens and smaller farmers, and a bargain for larger agribusiness and corporations.

Last year, the Rural Bank released a report 'Australian Farmland Values 2022', which is based on actual farm sales data from official government agencies in each state and territory. According to the report, the price of Australian farmland has experienced considerable rapid growth, attributed to a combination of agricultural commodity prices, seasonal conditions and interest rates.¹³²

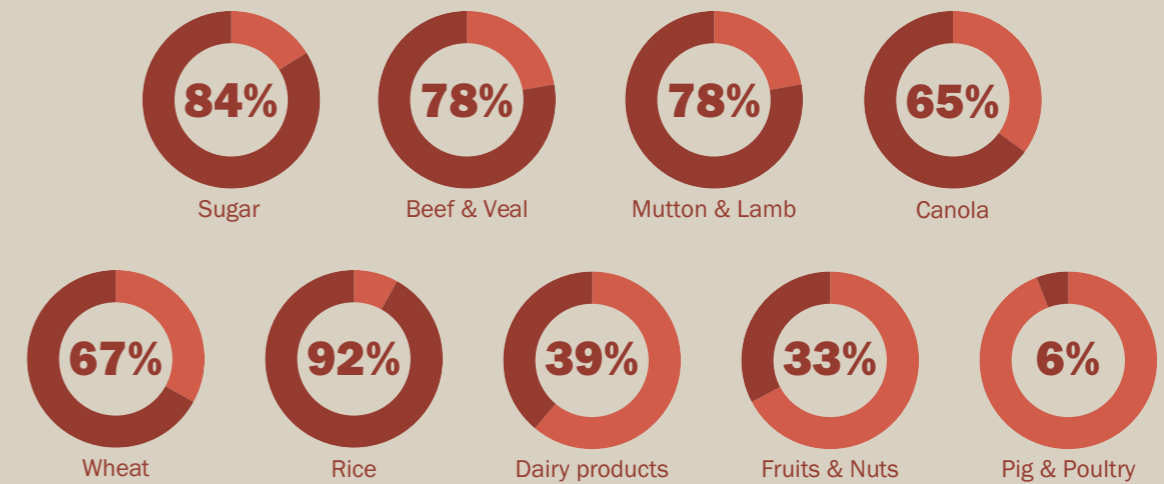
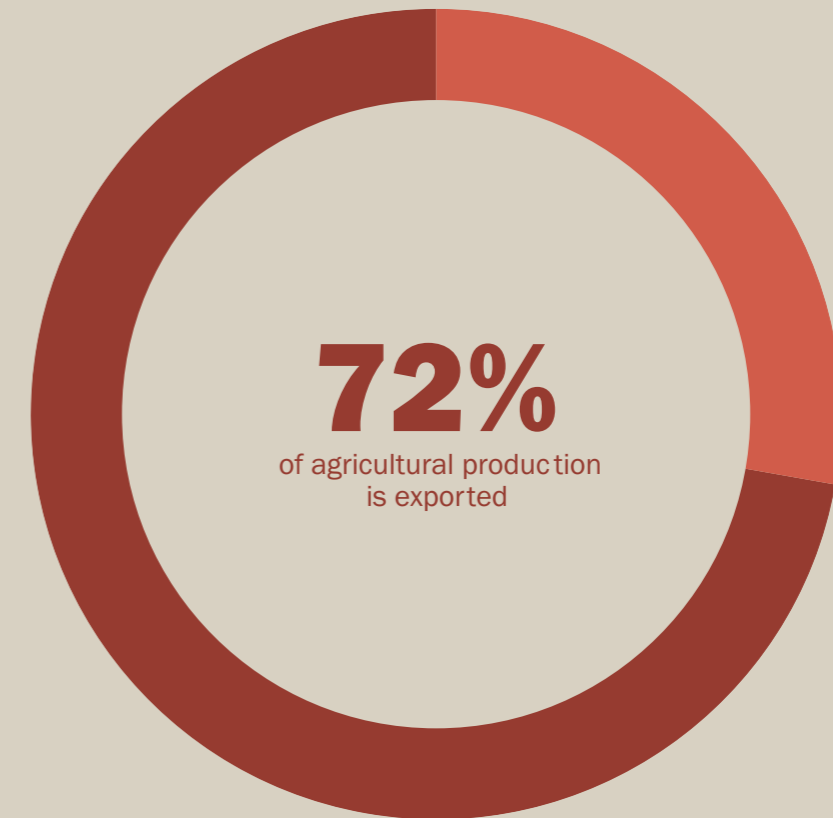
Obviously, the price of land in each region is also influenced by what can be produced in that area - whether the ground is fertile for cropping or suitable for livestock. However, some regions in Australia can see price point averages of less than \$1,000 per hectare. Western New South Wales, for example, has an average price of \$216 per hectare for farmland in the region. Similarly, Western Queensland sees an average of \$589 per hectare.

The value of farmlands should be questioned for a number of reasons. With an increase in farming size, an overall long term decrease in the number of farms across Australia, and downward trending employment being observed, it seems that Australian land is being owned by fewer and fewer businesses or individuals.

AREA	MEDIAN PRICE PER HECTARE	MEDIAN PRICE GROWTH	HECTARES OF LAND TRADE	COMPOUND ANNUAL GROWTH OVER 20 YEARS
Queensland	\$6,827	31.3%	4,102,958	9.4%
Central	\$3,992	22.1%	621,011	8.8%
North	\$10,150	15%	1,180,259	7.9%
South	\$9,434	26.6%	159,193	8.4%
West	\$589	33.6%	2,142,495	9.4%

AREA	MEDIAN PRICE PER HECTARE	MEDIAN PRICE GROWTH	HECTARES OF LAND TRADE	COMPOUND ANNUAL GROWTH OVER 20 YEARS
New South Wales	\$6,339	8.3%	2,199,808	8.0%
Central	\$5,893	-0.5%	497,736	7.6%
Northern	\$6,094	5.5%	552,510	7.9%
Southern	\$6,425	28.2%	250,120	8.6%
South East	\$8,761	18.6%	80,970	7.6%
Western	\$216	22.4%	817,473	11.3%
Victoria	\$10,583	30.4%	256,327	8.4%
Gippsland	\$13,463	28.8%	52,247	7.0%
Northern	\$9,275	25.4%	74,694	7.4%
North West	\$4,024	16.3%	48,882	8.6%
South West	\$13,363	35.2%	80,504	9.7%
Tasmania	\$14,730	7.6%	46,971	8.9%
Northern	\$13,377	4.8%	16,801	8.9%
North West	\$18,832	7.8%	14,871	7.6%
South	\$7,630	50.9%	11,157	8.6%
South Australia	\$5,940	8.4%	247,880	7.5%
Adelaide and Fleurieu	\$13,152	-7.7%	16,681	5.9%
Eyre Peninsula	\$1,962	30.2%	59,388	10.4%
South East	\$4,415	9.0%	127,074	8.2%
Yorke and North	\$6,205	-8.7%	44,739	6.8%
Western Australia	\$4,178	36.3%	303,909	8.4%
Central	\$4,269	28.8%	53,053	7.3%
Eastern	\$1,080	31.7%	89,222	5.4%
Northern	\$1,818	38.7%	123,972	5.8%
South Coast	\$5,325	28.5%	51,048	11.2%
South West	\$13,335	46.6%	13,614	5.2%
Northern Territory		-18%		
Top end region		-11.3%		
Cattle regions		57.9%		

EXPORT FOCUSED AGRICULTURE DEGRADES AUSTRALIAN LANDSCAPES FOR OVERSEAS MARKETS



Original source: ABARES, Share of agricultural production exported by sector, 3 year average, 2017-18 to 2019-20.

Australia's agriculture sector is overwhelmingly export focused, with around 72% of Australia's agricultural production sent across the world.⁶ In a changing climate, and biodiversity crisis, this can present as an opportunity to shift some agricultural ventures towards other, more sustainable uses. These alternatives should have the ability to replace or surpass the employment opportunities currently offered through farming in those areas.

RECOMMENDATION

Whilst this report series will explore the opportunities available with investment into protected areas to generate economic returns, there is more research needed to identify and better understand other sustainable business models.

CONCLUSION

With 55% of Australia's land dedicated to agriculture, whilst exporting 72% of production and employing just 2.5% of Australia's working population, there are clear inequities in the way Australian land and natural resources are benefitting the wider Australian community.

Agriculture is the biggest threat facing wildlife populations across the world. Habitats are diminishing rapidly to make way for farming ventures, destroying the homes of native animals. Wildlife are also subjected to lethal control when they interact with farming ventures. Harmful pesticides and herbicides are being applied to the natural environment and non-native hard hooved animals cause significant damage to the Australian landscape.

In a climate and biodiversity crisis, it has never been more critical for us to look to the future and ensure our land is not only benefiting the community more effectively, but also supporting ecological communities, rather than destroying them.

Excitingly, we have opportunities for change available to us, ones that can ensure our natural environment is protected and our local communities are supported.

In the next part of this report series, we take a look at the risk to our food systems and security in a climate crisis, and identify opportunities to adapt to a more climate resilient system.

TECHNICAL ANNEX

STATEMENT	FACTORS	CALCULATIONS
Agriculture accounts for 427,000,000 hectares, or around 55%, of land use in Australia with the vast majority (87.63%) dedicated to livestock grazing. ⁶	<ul style="list-style-type: none"> Agricultural land use accounts for 55% of land use in Australia (427,000,000 hectares).⁶ 48.2% of Australia's land use is dedicated to grazing.⁵ 	$48.2/55 = 0.87636364$ $\times 100$ $=$ 87.6363636%
Almost half of the country's surface area is utilised for dryland grazing (48.2% in 2015/2016) on native vegetation or modified pastures. ⁵ This figure amounts to around 374,207,273 hectares of Australian land used for red meat farming.	<ul style="list-style-type: none"> 427,000,000 hectares of Australian land used for farming. 87.6363636% is dedicated to grazing. 	$427,000,000 / 100$ $= 4,270,000$ $4,270,000 \times$ 87.6363636 $=$ $374,207,273$ hectares dedicated to grazing.
0.73% of the Australian population is directly employed by the red meat sector.	<ul style="list-style-type: none"> 189,000 directly employed.¹⁸ Australian population = 25,978,935¹⁹ 	$189,000 / 25,978,935$ $= 0.00727513 \times 100$ $= 0.7275125\%$ 0.72%
0.95% of the Australian population is indirectly employed by the red meat sector.	<ul style="list-style-type: none"> 245,000 people employed indirectly by the red meat sector.¹⁸ Australian population = 25,978,935¹⁹ 	$245,000$ indirect employment $/ 25,978,935$ $\text{Australian population}$ $= 0.00943072$ $\times 100$ $= 0.94307176\%$ 0.94%
Based on direct and indirect employment, 1.7% of the Australian population is employed within the red meat industry.	<ul style="list-style-type: none"> 0.72% population employed directly in the red meat sector. 0.95% of the Australian population indirectly employed by the red meat sector. 	$0.72 + 0.95 = 1.67$ 1.7% of the Australian population employed within the red meat industry.
According to Meat and Livestock Australia, in 2022 Australia produced 534,500 tonnes of lamb meat, exporting 284,257, or 53%, of this total. ³²⁻³³	<ul style="list-style-type: none"> 534,500 total production. 284,257 exported production. 	$284,257 / 534,500$ $= 0.53181852$ $\times 100$ $= 53.1818522\%$

STATEMENT	FACTORS	CALCULATIONS
Based on direct employment, the red meat sector employs 1 person for every 1,964.8 hectares of land farmed.	<ul style="list-style-type: none"> 374,207,273 hectares used for livestock grazing. 189,000 people employed directly by the red meat industry.¹⁸ 	<p>374,207,273 hectares / 189,000 people employed directly = 1,979.93266 hectares of land per employee.</p>
Based on overall employment, the red meat industry employs 1 person for every 862.2 hectares of land farmed.	<ul style="list-style-type: none"> 374,207,273 hectares used for livestock grazing. 434,000 people employed directly and indirectly in the red meat industry.¹⁸ 	<p>374,207,273 hectares / 434,000 people employed directly and indirectly = 862.22874 hectares of land per employee.</p>
Based on direct employment, the broadacre cropping industry employs 1 person for every 210.8 hectares of land farmed.	<ul style="list-style-type: none"> Broadacre cropping stretches across 21,080,000 hectares of land in Australia.⁶ 100,000 people are directly employed in the cropping industry.⁵⁹ 	<p>21,080,000 hectares / 100,000 employees = 210.8 hectares of land per employee.</p>
Horticulture employs 1 person for every 4.6 hectares of land farmed.	<ul style="list-style-type: none"> The horticulture industry accounts for 0.46 million hectares or 460,000 hectares of land use in Australia.⁵ 135,100 workers employed annually.⁶⁰ 	<p>460,000 hectares / 135,100 employees = 4.6 hectares of land per employee.</p>
The water used to grow crops for animal feed each year is 4.19 times the water in the Sydney harbour.	<ul style="list-style-type: none"> Water in the Sydney harbour = 500 ggalitres (1 ggalitre = 1000 megalitres) = 500,000 megalitres.¹³³ Irrigated water use for pastures and cereal for livestock grazing = 1,429,495 megalitres.³⁸ A further 664,712 megalitres is applied for pastures and cereal for silage.³⁸ 	<p>(1,429,495 + 664,712) = 2,094,207 megalitres / 500,000 megalitres = 4.188414 times.</p> <p>500,000 megalitres in the Sydney harbour / 2,094,207 water used for livestock feed = 0.23875386 X 100 = 23.8753858%</p> <p>The water in the Sydney harbour amounts to 23% of the water applied to crops for livestock feed annually.</p>

STATEMENT	FACTORS	CALCULATIONS
In 2022 Australia exported 72% (1.45 million tonnes) of its red meat production to overseas markets including Japan, China, US, South Korea, South East Asia, MENA, Taiwan, Canada and Europe. This represented a 10.4% decline on 2021 exports of 82.4%. ²⁵	<ul style="list-style-type: none"> 72% of Australia's agricultural production sent overseas in 2022. 82.4% of Australia's agricultural production was exported in 2021. 	<p>374,207,273 hectares used for livestock grazing / 100 = 3,742,072.73 x 72% = 269,429,237 hectares used and degraded for overseas markets.</p> <p>374,207,273 hectares used for livestock grazing / 100 = 3,742,072.73 x 82.4% = 308,346,793 hectares used and degraded in 2021.</p>
This means that around 267,894,360 hectares of Australian land was grazed for overseas markets in 2022 and 306,590,212 hectares in 2021.		
In 2021, Australia produced 2.6 million tonnes of sorghum and was estimated to have exported 1.64 million tonnes, or 63.5%, of production. ⁶⁸⁻⁶⁹	<ul style="list-style-type: none"> 2,600,000 tonnes of sorghum produced. 1,640,000 tonnes sorghum exported. 	<p>1,640,000 exported / 2,600,000 produced = 0.63076923% X 100 = 63.0769231 %</p>
Why have we used an outdated state of the industry report from Meat and Livestock Australia?	There is a more current state of the industry report available from Meat and Livestock Australia. However, values in this report have a 9,000 person discrepancy on employment figures. We contacted them for the correct figures, however they did not respond. For this reason, we have utilised the 2021 installment for the sake of this report.	<p>https://www.mla.com.au/globalassets/mla-corporate/prices-markets/documents/trends-analysis/soti-report/2879-mla-state-of-industry-report-2022-d6_low-res_spreads.pdf</p>

STATEMENT	FACTORS	CALCULATIONS
Irrigated agricultural land for animal feed crops and pastures accounts for 706,170 hectares or 37.2% of all irrigated agriculture in Australia. ³⁸	<ul style="list-style-type: none"> 495,779 hectares of irrigated land for pastures and cereals for livestock grazing. 210,391 hectares of irrigated land for pastures and cereals used for hay and silage. 	<p>495,779 hectares of irrigated land for pastures and cereals for grazing + 210,391 hectares of irrigated land for pastures and cereals for hay and silage = 706,170 hectares of irrigated land for livestock feed</p> <p>706,170 hectares / 1,900,000 hectares total = 0.37166842 x 100 = 37.2%</p>
Irrigated cereal crops for other (non-feed related uses) accounts for 320,100 hectares or 16.8% of irrigated agricultural land.	<ul style="list-style-type: none"> 320,100 hectares of irrigated land for cereal crops (excluding rice).³⁸ 1,900,000 hectares total irrigated land 	<p>320,100 hectares of irrigated land for cereal crops (excluding rice) / 1,900,000 hectares of irrigated land = 0.16847368 x 100 = 16.8%</p>
Cotton growing accounts for 197,401 hectares, or 10.4% of irrigated agricultural land use in Australia.	<ul style="list-style-type: none"> 197,401 hectares for cotton.³⁸ 1,900,000 hectares total irrigated land. 	<p>197,401 hectares for cotton / 1,900,000 hectares total irrigated land = 0.10389526 x 100 = 10.4%</p>
According to the Australian Bureau of Statistics, 197,000 hectares, or 10.4% of irrigated land was utilised to grow fruit and nuts in 2021-2022. ³⁸	<ul style="list-style-type: none"> 197,000 hectares for fruits and nuts. 1,900,000 hectares of irrigated land. 	<p>197,000 hectares for fruits and nuts / 1,900,000 hectares of irrigated land = 0.10368421 x 100 = 10.3684211 %</p>
Vegetables accounted for 98,785 hectares, or 5.2%, of irrigated land use. ³⁸	<ul style="list-style-type: none"> 98,785 of irrigated land for vegetables.³⁸ 1,900,000 hectares of irrigated land.³⁸ 	<p>98,785 / 1,900,000 = 0.05199211 x 100 = 5.19921053%</p>

STATEMENT	FACTORS	CALCULATIONS
On average, 135,100 workers were employed in horticulture over the course of 2020-21. ⁶⁰ This represents 0.52% of the Australian population.	<ul style="list-style-type: none"> Australian population = 25,978,935¹⁹ 135,100 workers were employed in horticulture.⁶⁰ 	<p>135,100/25,740,000 = 0.00524864 X 100 = 0.52486402%</p>
According to GrainGrowers 100,000 people are directly employed in the grain growing industry in Australia, representing around 0.40% of Australia's population. ⁵⁹	<ul style="list-style-type: none"> Australian population = 25,978,935¹⁹ 100,000 people are directly employed in the grain growing industry in Australia.⁵⁹ 	<p>100,000 / 25,978,935 = 0.00384927 X 100 = 0.38492725%</p>
Around 14,756,000 hectares of Australian land is being utilised to grow crops for overseas markets.	<ul style="list-style-type: none"> Australia's grain industry is overwhelmingly export focused, sending approximately 70% of total production overseas in normal, non-drought years.⁵⁹ Australia's broadacre cropping industry is the country's second largest agricultural industry. Stretching across 21,080,000 hectares of land.⁶ 	<p>21,080,000 / 100 = 210,800 X 70 = 14,756,000 hectares of broadacre cropland utilised for export markets.</p>

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