Australian Government
Department of Agriculture,
Water and the Environment
ABARES

Pathways to sustainable and productive agriculture: an Australian perspective

Dr Steve Hatfield-Dodds
Executive Director
Australian Bureau of Agricultural
and Resource Economics and Sciences

28 October 2020

S Hatfield-Dodds, J Greenville, K Burns and R Downham, 2020, *Pathways to sustainable and productive agriculture – An Australian perspective*, Notes prepared for webinar on EU–Australia Farming: One goal but many paths to sustainability on 28 October 2020, ABARES, Canberra.

Research by the
Australian Bureau of Agricultural and Resource Economics and Sciences

Cataloguing data
This publication (and any material sourced from it) should be attributed as: Hatfield-Dodds, S Greenville, J, Burns, K & Downham, R 2020, Pathways to sustainable and productive agriculture: an Australian perspective, ABARES Conference Paper, Canberra, October, DOI: https://doi.org/10.25814/2twd-0018. CC BY 4.0.

ISSN 1447-3666

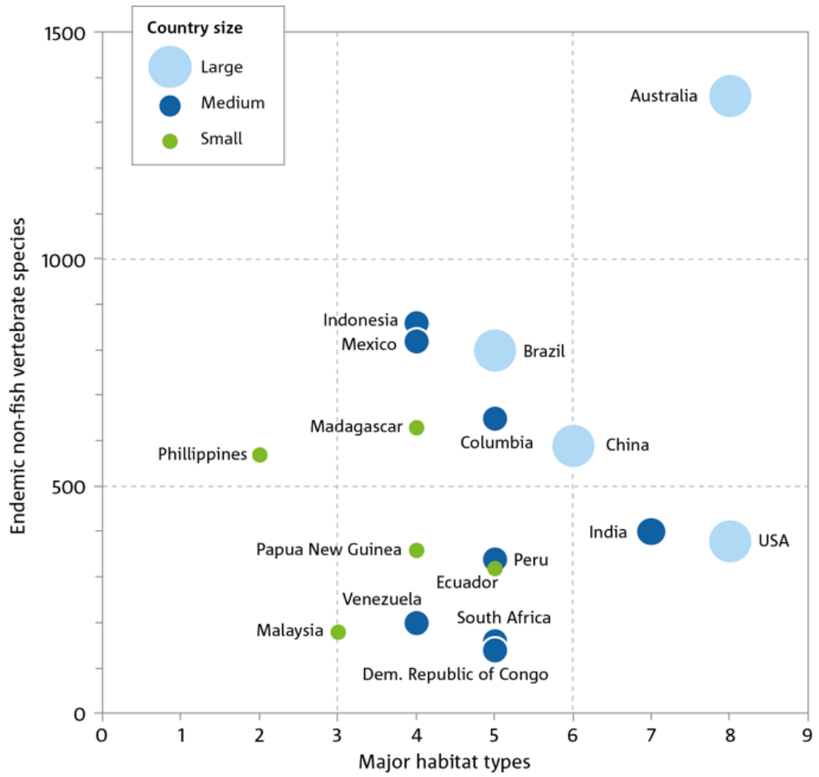
Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)
GPO Box 858 Canberra ACT 2601
Telephone 1800 900 090
Web awe.gov.au

Australian Government
Department of Agriculture, Water and the Environment
ABARES

Australian biodiversity and ecosystems are unique and globally significant

- Australia is renowned for its globally distinct ecosystems, made up of diverse flora and fauna.
- Our biodiversity is highly regarded for its diversity, endemism, and evolutionary adaptations.
- Australia is considered one of the world's 17 megadiverse countries, which together account for 70% of the world's biological diversity across less than 10% of the world's surface.
- Around 150,000 species have been formally described in Australia, but this is only about 25% of the total number present.
- Australia has many different climates zones primarily due to the vast size of the continent—equatorial, tropical, subtropical, desert, grassland, and temperate.
- Australia's land mass is around three-quarters the size of Europe (Aus: 7,692,024 km^2 ; Europe: 10,180,000 km^2).

Australia has globally distinctive biodiversity



Australia is around three-quarters the size of Europe

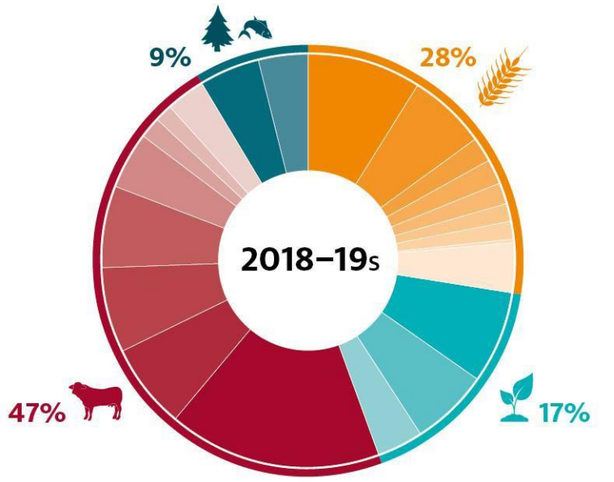
Cresswell, ID & Murphy, HT 2017, Australia State of the Environment 2016: Biodiversity, Australian Government Department of the Environment and Energy, Canberra.

Hatfield-Dodds et al. 2015, Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050, CSIRO, Canberra.

Australian Government
Department of Agriculture, Water and the Environment
ABARES

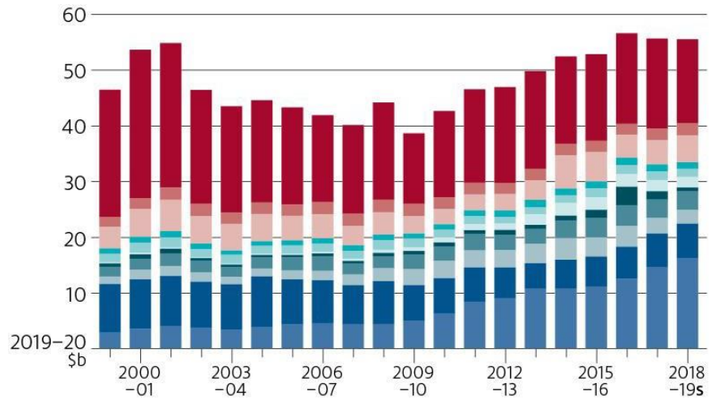
Australian agriculture produces high-quality food and fibre, focusing on minimally processed products

Agriculture, fisheries and forestry value of production, by commodity, 2018–19



Wheat	9%	Cattle & calves	17%
Coarse grains	6%	Sheep & lambs	7%
Canola	2%	Wool	7%
Cotton	2%	Milk	6%
Sugar cane	2%	Poultry	4%
Wine grapes	1%	Pigs	2%
Pulses	1%	Other livestock products	2%
Other grains & oilseeds	0%	Other livestock	3%
Other crops	4%		
Fruit & nuts	7%	Fisheries	5%
Vegetables	6%	Forestry	4%
Other horticulture	4%		

Agriculture, fisheries and forestry exports by destination, 1999–2000 to 2018–19

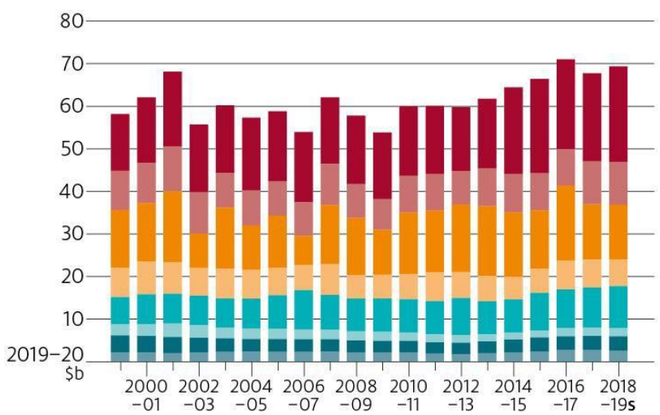


▼ 22%
Exports to other markets
- All others
- New Zealand
- United States

▲ 86%
Exports to top 8 markets in Asia
- Singapore
- Hong Kong
- Vietnam
- India
- Korea, Rep. of
- Indonesia
- Japan
- China

Change from 1999–2000
▲ 19% Value of production
▲ 19% Value of exports

Agriculture, fisheries and forestry production, 1999–2000 to 2018–19



20 years to 2018–19

	Production	Exports
Meat & live animals	▲ 44%	▲ 34%
Livestock products		
Grains & oilseeds	▼ –7%	▲ 3%
All other crops		
Fruit & vegetables	▲ 30%	▲ 69%
All other horticulture		
Forests products	▼ –4%	▼ –6%
Fisheries		

- Agriculture accounts for 11% of Australia's good and services exports, 2.2% of value added (GDP), and 2.6% of employment in 2018–19.
- Australia exports around 70% of the total value of agriculture, fisheries and forestry production (around $49 billion in 2018–19) and is the 12th largest global agricultural exporter.
- The mix of Australian agricultural activity is determined by climate, water availability, soil type and proximity to markets.
  - Livestock grazing is widespread, occurring in most areas of Australia.
  - Cropping and horticulture are generally concentrated in more southern areas relatively close to the coast.
- Agricultural production is growing—the value of agriculture, fisheries and forestry production has increased by 19% in the past 20 years in real terms (adjusted for inflation), from approximately $58 billion in 1999–2000, to around $69 billion in 2018–19.
- Economic performance is driven by the largest and most productive farms.
  - A range of factors has seen large farms (with receipts above $1 million per year in real terms) grow from around 3% to around 15% of the farm population over the last four decades.
  - Meanwhile, their share of output has increased from 25% to around 58% of the value of output.
- Australian farmers have historically achieved strong productivity growth.
  - Agricultural productivity growth has been comparable to competing farmers in other high-income countries and faster than most other sectors of the Australian economy.
  - This growth has been driven by improvements in technology and structural change.

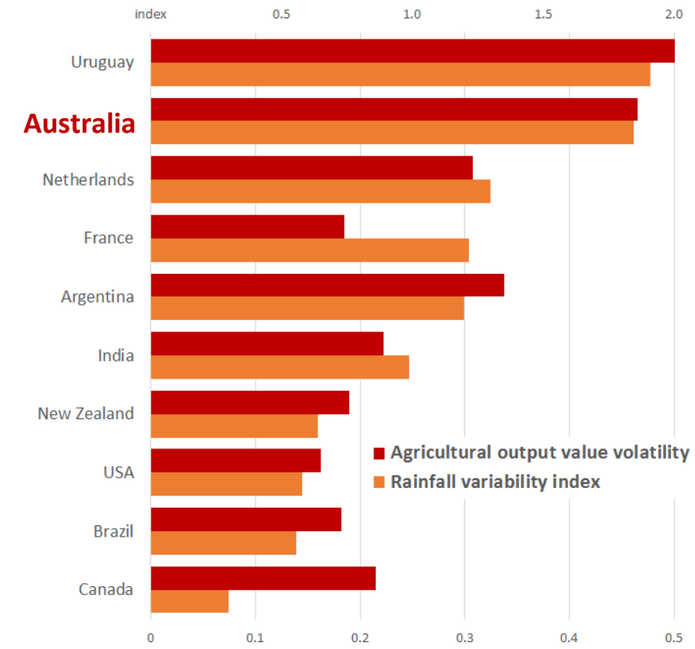
Jackson, T, Zammit, K & Hatfield-Dodds, S 2020, Snapshot of Australian Agriculture 2020, ABARES, Canberra.

Greenville, J 2019, Australia's place in global agriculture and food value chains, ABARES, Canberra.

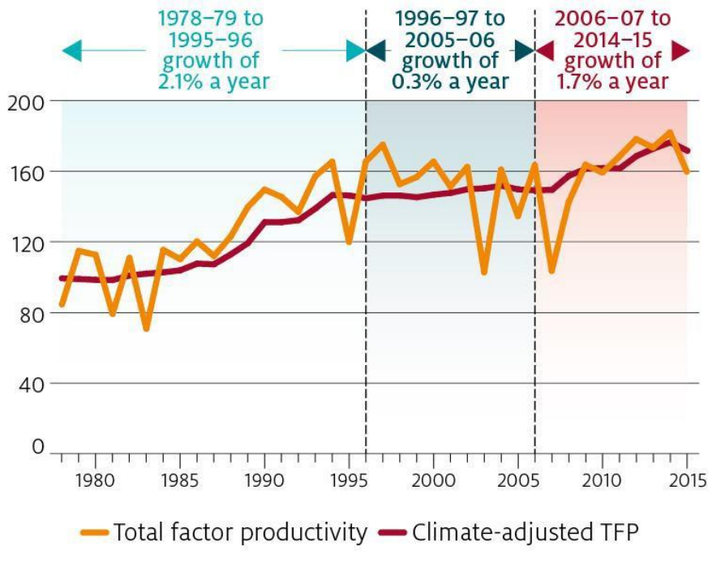
Australian Government
Department of Agriculture, Water and the Environment
ABARES

Strengths in sustainability: Australian agriculture works with nature, not against it

Australia's climate and agricultural output value is more variable than most other countries



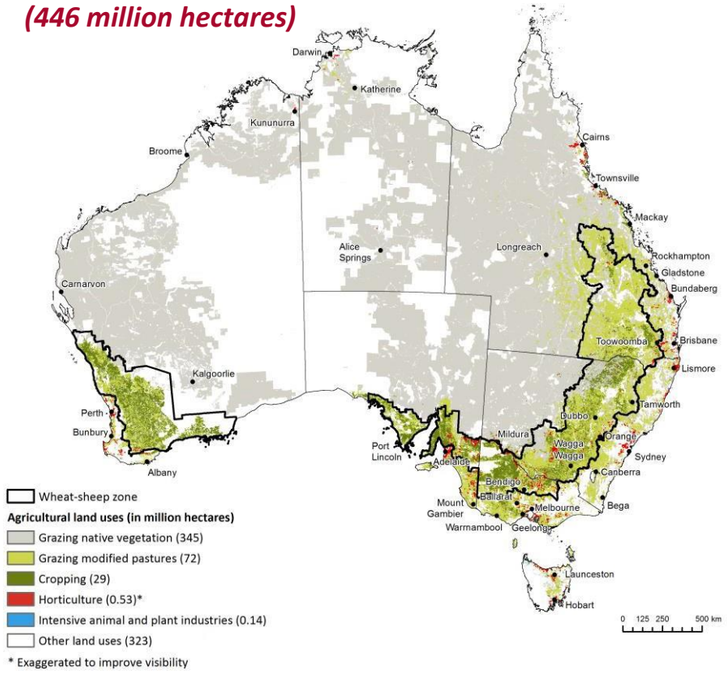
Climate-adjusted productivity growth, cropping farms, 1978–79 to 2014–15



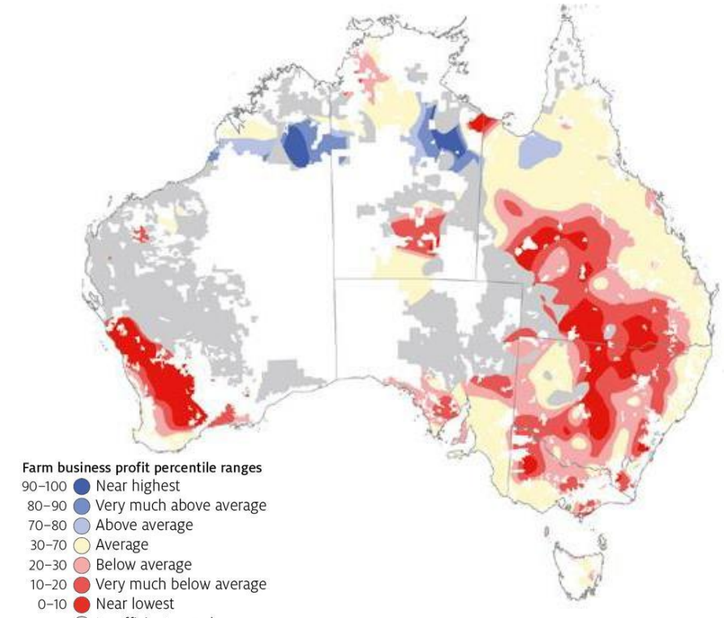
- Australian agricultural producers manage very significant variability, particularly a highly variable climate.
- Agriculture is undertaken across diverse conditions, and accounts for 58% of Australian land use.
- These factors generate substantial variation in farm output, greater than that experienced by farmers in most other countries, and greater than that experienced by business owners in other sectors of the Australian economy.
  - Australian agricultural output value and rainfall are more variable than most agricultural producers (see figure top left).
  - Low rainfall years have become more frequent over much of the wheat-sheep zone in recent decades (see impacts bottom right).
- Evidence that crop producers have adapted to changing climate conditions and in doing so have partly restored productivity growth (Hughes, Lawson & Valle 2017).
  - Strong growth in climate-adjusted productivity since 2006–07 has helped the cropping industry to offset the decline in climate conditions.
  - Farm productivity and wheat yields have become less sensitive to climate since 2005–06.

Notes to figure top left: Figure presents agricultural output value volatility (1961–2009) on top axis as an index where the average volatility across 15 countries = 1 and year-to-year rainfall variability index (1901–2015) on low axis, defined as 90th rainfall percentile minus 10th rainfall percentile divided by 50th rainfall percentile.
Source: Value from Keogh (2012) and rainfall from World Bank Group – Climate Change Knowledge Portal

Agriculture accounts for 58% of Australian land use (446 million hectares)



Shifts in climate and seasonal conditions in the last two decades have impacted farm business profits



Source: Data from Hughes et al. (2019) *ABARES Insights* (2019.06)

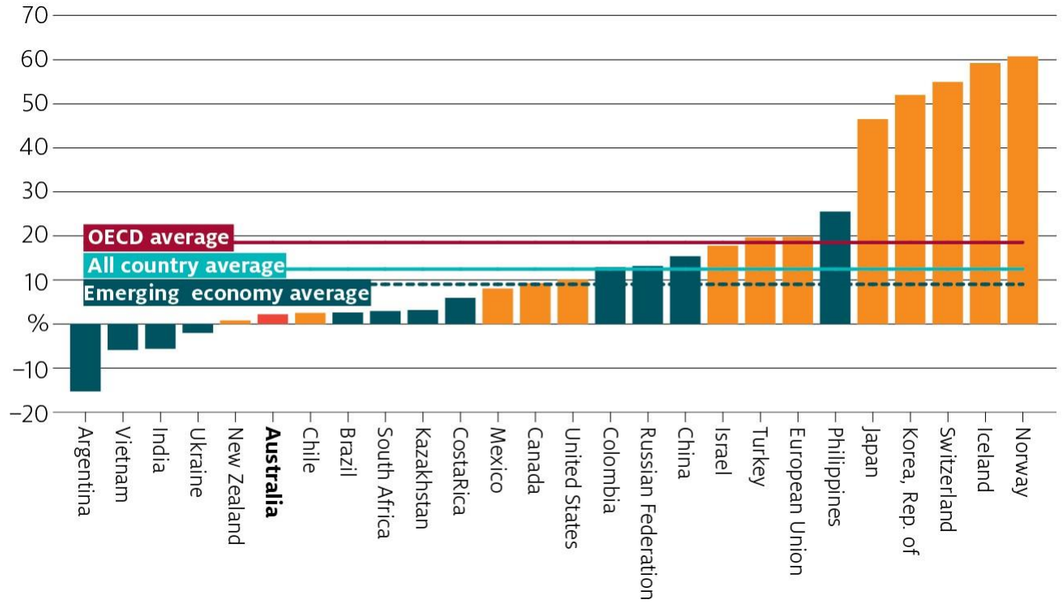
Jackson, T, Zammit, K & Hatfield-Dodds, S 2020, Snapshot of Australian Agriculture 2020, ABARES, Canberra.
Hughes, N, Lawson, K, & Valle, H 2017, Farm performance and climate: Climate-adjusted productivity for broadacre cropping farms, ABARES, Canberra.
Keogh, M 2012, Including risk in enterprise decisions in Australia's riskiest businesses, 2012 Conference (56th), February 7-10, 2012, Fremantle, Australia 124202, Aust. Agricultural and Resource Economics Society.

Australian Government
Department of Agriculture, Water and the Environment
ABARES

Policy settings: Farming practices – lean and sustainable

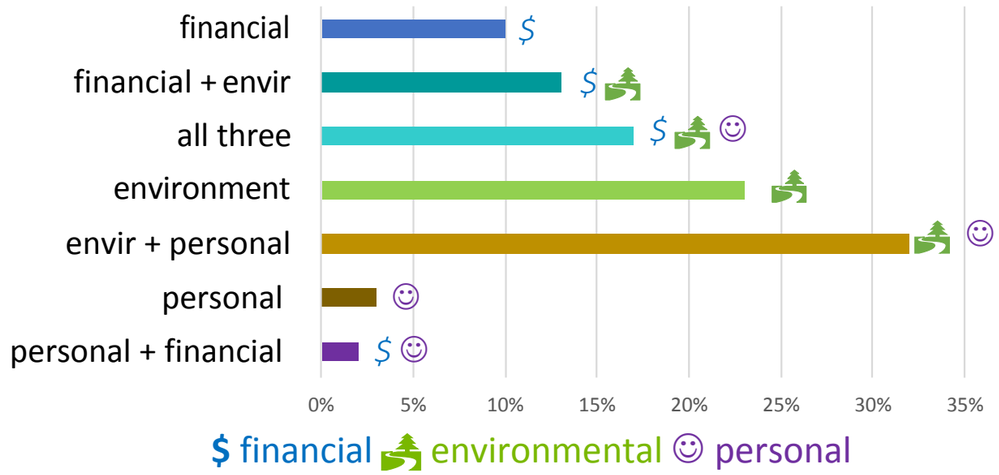
Careful stewardship is central to economically and environmentally sustainable production

Australia has one of the lowest levels of support



Notes: Support measures as a share of gross farm receipts. The All countries total includes all OECD countries, non-OECD EU Member States, and the 12 Emerging Economies. The OECD total does not include the non-OECD EU Member States. Latvia and Lithuania are included only from 2004. The 12 Emerging Economies include Argentina, Brazil, China, Colombia, Costa Rica, India, Kazakhstan, the Philippines, Russian Federation, South Africa, Ukraine and Vietnam.
Source: Greenville (2020)

Farmer motivations for native vegetation management



Notes: Bars represent proportion of respondents citing each combination of motivations for vegetation management. Sums to 100%. Source: Kancans et al. (2014)

- Australian agriculture is globally competitive and operates with virtually no direct producer support. Sustainable practices facilitated by policy approach and open markets.
- Policy seeks to ensure competitive pressure helps drive sustainability outcomes, with the right rules to balance resource use and conservation.
- There have been significant changes in agricultural and environmental policies since European settlement.
  - Early phase pro-development (sometimes farmers had to clear land and demonstrate use). This has shifted over time to promote environmentally sustainable development.
- Over time (since the 1990s), governments in Australia have moved away from directly supporting farmers with payments, to encouraging:
  - increased self-reliance and profitability through improving productivity via R&D; and
  - economies of scale through expansion of export markets.
- Australian farmers cannot afford to maintain unsustainable farming practices, as these erode long term productivity through running down the natural capital stock on farms. Our system of agricultural support reinforces this—virtually no direct farm support.
- Instead, main policies aimed at more environmentally sustainable agricultural development include regulation, suasion, Market Based Instruments (MBIs) and RD&E.
  - Regulation—imposed restrictions on land clearing in 1980s and 1990s.
  - Suasion and capacity building —introduced Landcare in 1989 (still operates today); objectives include increased environmental awareness and sustainable agriculture.
  - Market Based Instruments since 2000s: competitive tenders to cost effectively allocate funds for biodiversity; currently used to purchase GHG reductions under ERF.
  - Government investment in RD&E also used to increase adoption of technologies that have on and off-farm benefits (e.g., minimum till).
- This has led to sustainable practices such as crop rotations (an issue that exists in Europe current CAP funding arrangements), limits to pesticide and fertilizer use, and practices such as no-till farming becoming the norm.
- More than half of Australian farmers choose to manage native vegetation based on environmental motivations.

Greenville, J 2020, Analysis of government support for Australian agricultural producers, ABARES, Canberra.

Kancans, R, Ecker, S, Duncan A, Stenekes, N & Zobel-Zubrzycka, H 2014, Drivers of practice change in land management in Australian agriculture: Synthesis report—Stages I, II and III, ABARES, Canberra.

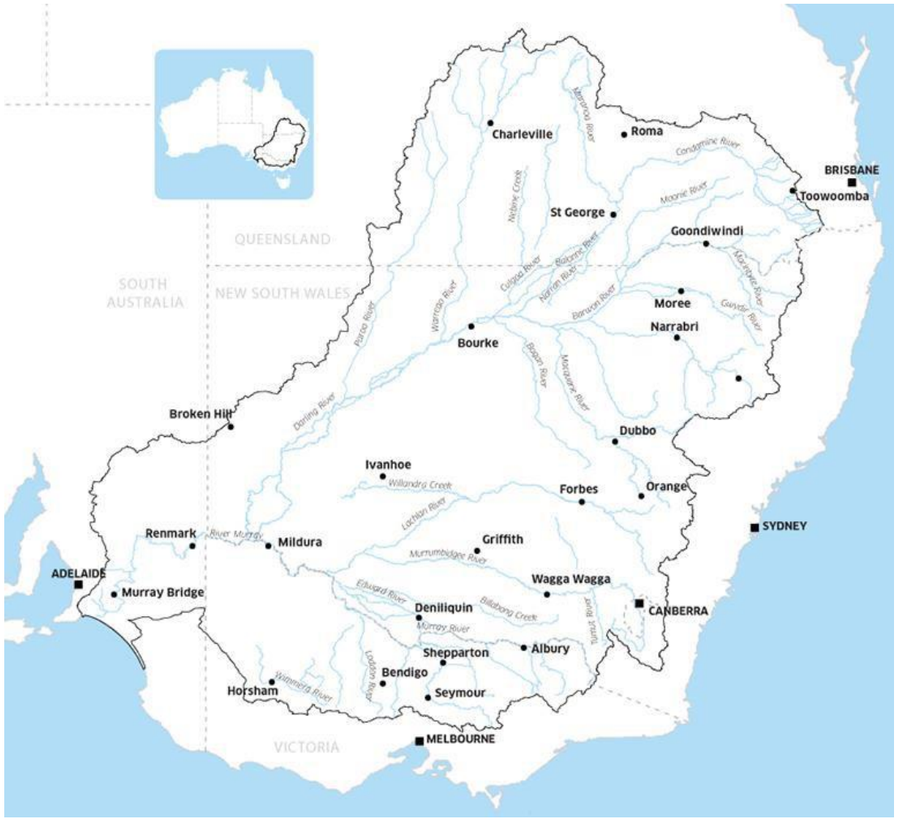
Australian Government
Department of Agriculture, Water and the Environment
ABARES

Policy settings: Water markets and reforms deliver for agriculture and the environment

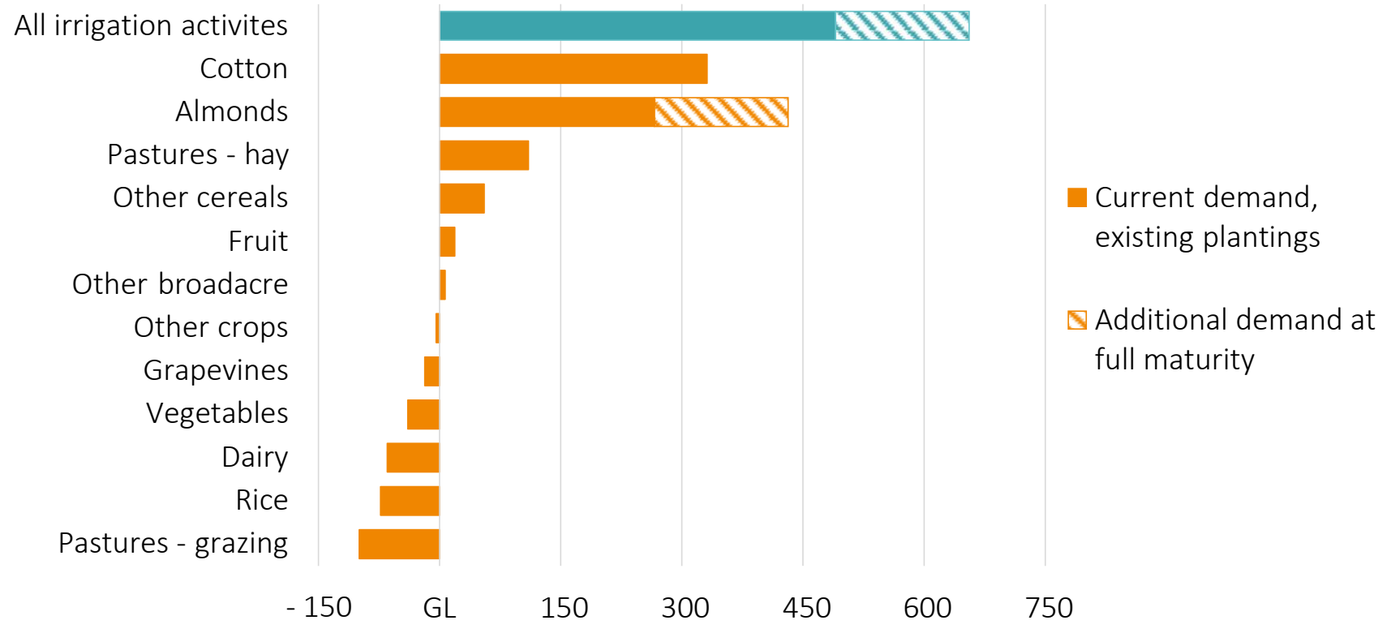
- Water markets are widely accepted in Australia as an efficient way to allocate scarce resources, allowing irrigators to adapt to changing seasonal conditions and water supply.
- Water markets in the Murray–Darling Basin (MDB) are highly developed and well managed relative to other places in the world (Grafton & Horne 2014, Wheeler 2014), and environmental water has been integrated into our largest operating water market the southern MDB.
- A wide range of policy reform has been undertaken since the early 1900s, that has resulted in water becoming a more economic and transferable commodity (Wheeler 2014).

- The Murray–Darling Basin (MDB) is the largest and most complex river system in Australia. The basin is essentially the food bowl of the nation.
- Entitlements are issued by state governments and help regulate water use.
- Water can be bought and sold in markets—prices reflect scarcity and vary very significantly with conditions. Prices in dry years are around three times higher than in typical years.
  - ABARES estimate average annual prices in the southern MDB to be around $550/ML under dry seasonal conditions, compared to around $180/ML under typical seasonal conditions (Figure 5 Whittle et al 2020).
- Markets facilitate the movement of water to its highest-value use, including allocation between years, within districts, and between different regions.
- Since 2007 around 20% of surface water rights have been recovered through purchase of entitlements from farmers. This water has been permanently retired from irrigation use, and is managed by government for the environment.

Murray–Darling Basin



Water demand and prices are likely to increase



Changes in demand for water by sector, from 2006 to 2019 at $200 per ML.
Note: Modelled estimates from ABARES Water Trade Model, including demand associated with existing perennial plantings coming to maturity.
Source: Goesch et al. (2020)

Grafton, R.Q. & Horne, J, 2014, "Water markets in the Murray-Darling basin", *Agricultural Water Management*, 145(C), pp.61-71.
Wheeler, S.A., 2014, "Insights, lessons and benefits from improved regional water security and integration in Australia", *Water Resources and Economics*, 8, pp.57-78.
Westwood, T, Qin, C & Whittle, L 2020, Water Market Outlook: July 2020, ABARES, Canberra. Whittle et al 2020 Economic effects of water recovery in the Murray Darling Basin, ABARES Canberra.
Goesch, T, Legg, P & Donoghoe, M 2020, Murray–Darling Basin water markets: Trends and drivers 2002–03 to 2018–19, ABARES, Canberra.

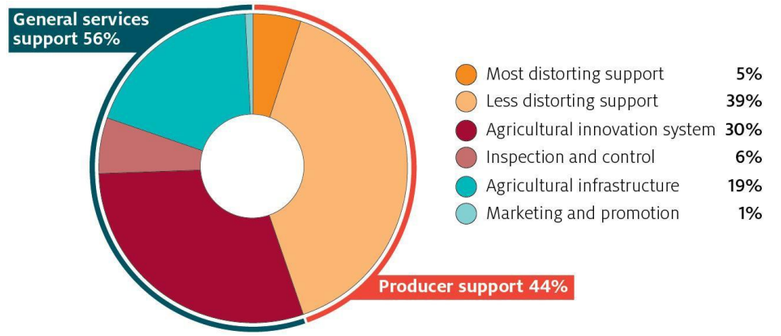
Australian Government
Department of Agriculture, Water and the Environment
ABARES

Policy & industry settings: Innovation and industry awareness

Agriculture is on the front foot

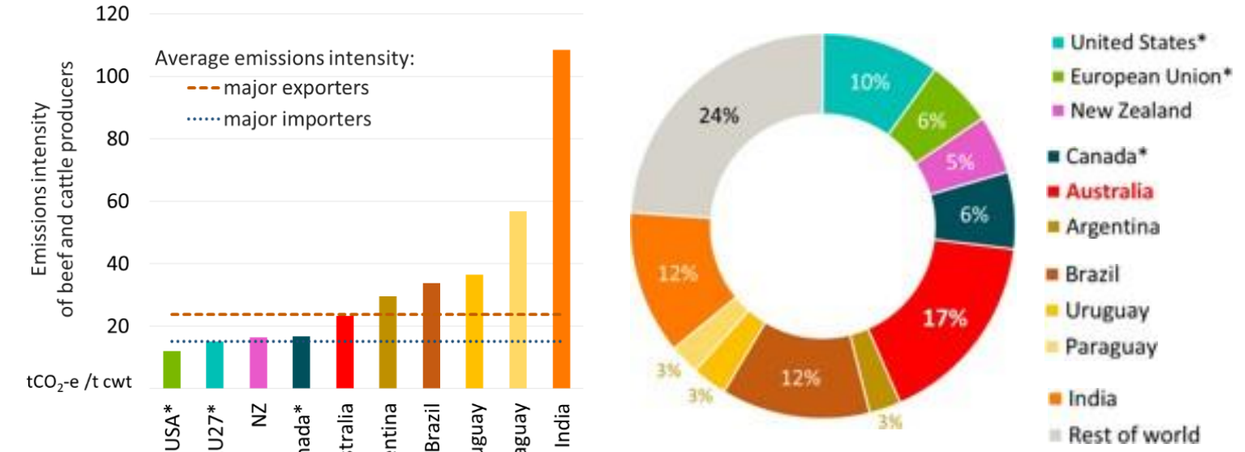
- R&D programs helping develop better practices and climate suited varieties.
  - Australia looks to market approaches to drive innovation and sustainability in land use, complemented with government incentives where appropriate.
- According to the OECD, most (56%) of the current support provided by Australia is general services (e.g., R&D). The remaining 44% of support was assessed to be producer support.
  - Total support provided to Australian farmers contributes very little directly to farmer revenues (around 2% over the period 2016 to 2018).
- Some RDCs have highlighted the need for further research into GHG mitigation and productivity growth.
  - MLA research has identified possible areas for further work, including feed supplements, genetics, vaccination and early life programming of livestock.
  - Some of these are more prospective than others, but those with the highest mitigation and productivity potential also require the highest investment (MLA 2015).
- Australian agriculture has improved emissions intensity over time.
  - Livestock emissions, which form the majority of agricultural emissions, have fallen since 1990, similar to trends in some other countries.
- Australia's agricultural sector is acting—driven by market opportunities and threats.
  - Most industry associations support GHG mitigation, and R&D is increasingly focused on responding to climate change (both mitigation and adaptation).
- Australian farmers are internationally focused, and looking forward to consumer and investor trends. Driven by these incentives, all farming industry bodies have commitments to sustainability initiatives.
  - The NFF 2030 Roadmap identifies growing sustainably as one of their key pillars to making Australian agriculture a $100b industry by 2030.

Australia's support is heavily R&D focused



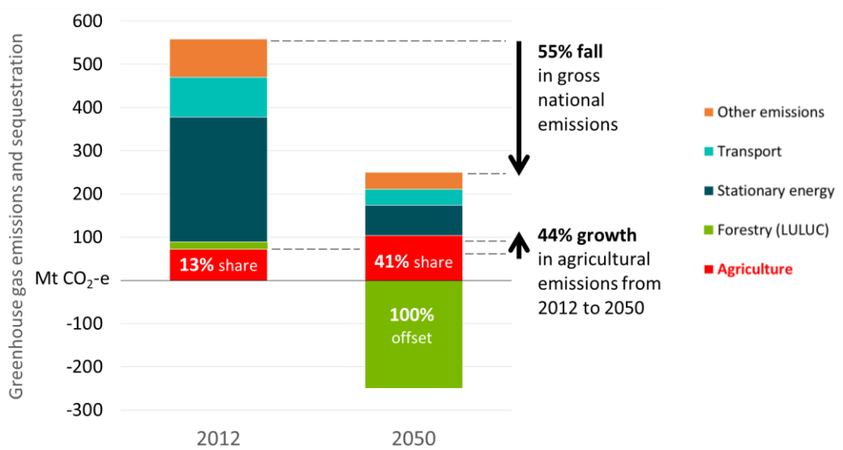
Notes: Most distorting support relates to payments linked to production in some form, such as inputs or where production is required. Least distorting support is not linked to production.
Source: Greenville (2020)

Australia's beef emissions intensity appears lower than most major exporters, but higher than major importers



* Country or region is both a major importer and a major exporter

Agriculture's share of emissions likely to rise as other sectors cut emissions more cost-effectively



Notes: Chart presents modelling results for an illustrative scenario. Agricultural output value and gross emissions are projected to rise, despite reduced emissions intensity and some shift of land into carbon offsets. Carbon forestry projected to offset all gross national emissions in 2050.
Source: Data from ClimateWorks Australia (2014); *Pathways to Deep Decarbonisation in 2050*

Notes for Figure middle right: Data is the average for 2006–2016. Left panel shows emissions per unit of output for ten largest beef and veal exporters. Right panel shows major exporter's shares of global beef and veal exports in increasing order of emissions intensity, followed by Rest of world. Source: OECD/FAO (2019) *Agricultural Outlook 2019–2028*

Greenville, J 2020, Analysis of government support for Australian agricultural producers, ABARES, Canberra.
OECD/FAO, 2019, OECD-FAO Agricultural Outlook 2019-2028, OECD Publishing, Paris.

Australian Government
Department of Agriculture, Water and the Environment
ABARES

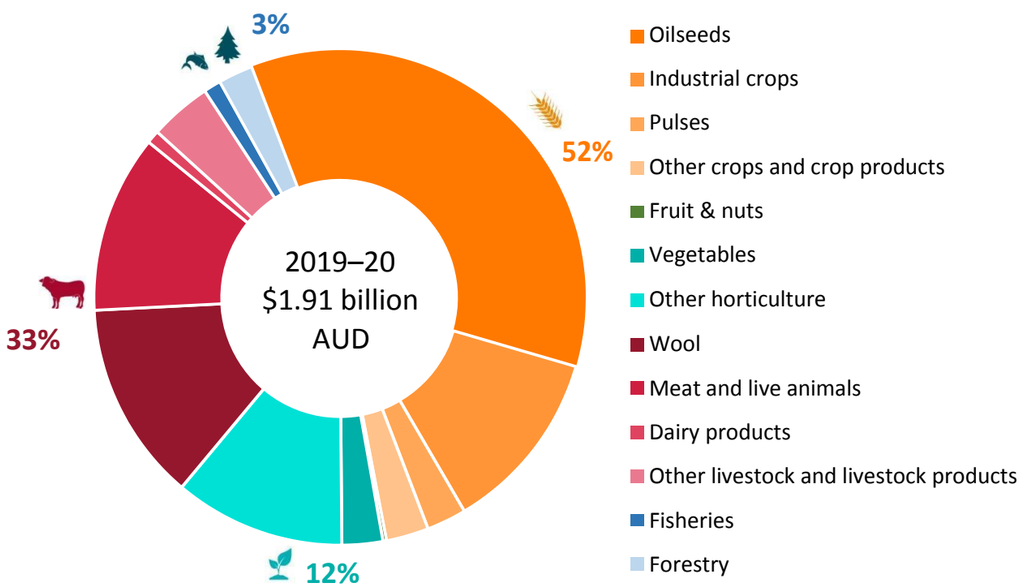
Shared challenge:
Achieving consistent outcomes from different approaches

Achieving more by working together

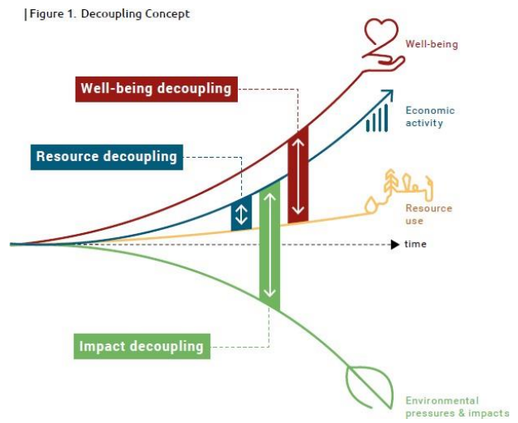
- Trade rules should encourage innovation across different approachesto meeting the sustainability challenge and avoid a prescription of one approach over the other.
- Rules on land use and policies that promote farmers to work with the environment, not against it, can deliver as good (if not better) sustainability outcomes compared to direct intervention models.
- Trade rules should not get in the way of market based instruments as a tool to help achieve sustainability outcomes.
- Trade can allow production to shift and occur in the most sustainable location. This will help deliver on global goals of emissions reduction, food security and rural growth.
- Free trade where countries are acting on these issues promotes global action.
- Closer ties will help with sharing lessons and approaches and help both contribute more effectively to solving sustainability challenges.

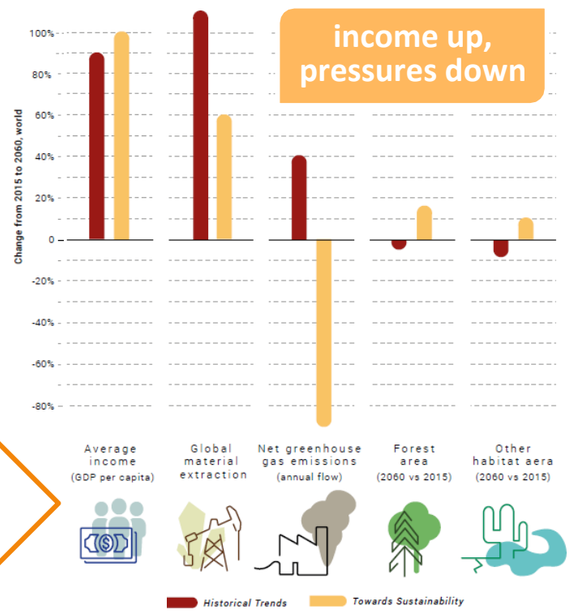
- Australia and the EU export to a range of countries and regions contributing to global food security and development
- 64% of Australia's food exports are sent to countries in Asia, while only 5% of our food exports are sent to Europe (EU-27). Around one-third of our food exports are minimally transformed.
- 33% of Australia's imports are sourced from Asia, and 25% from Europe. Over 90% of our food imports are substantially or elaborately transformed.
- Australia's high quality agricultural exports to the EU consist mainly of minimally transformed products such as oilseeds, horticulture and animal products. These become important inputs into Europe's further processing of food and agricultural products.
- Around 90% of the EU's agricultural exports to Australia are substantially transformed: processed meats, fruit & vegetables, confectionary and beverages.

Australia's agricultural exports to EU in 2019–20



Australia and the EU bring complementary perspectives to global sustainability challenges – including ensuring food security and protecting natural capital





decoupling is required to see income, resource-based services and **well-being increase** while environmental **pressures decrease** or reverse, in stark contrast to **unsustainable historical trends**

Source Figure above: ABARES analysis.
Source Figure on right: IRP (2019) *Global Resources Outlook 2019 – Implications for Business Leaders,* Figure 1 p.10 and Figure 6 p.25 – see also Figure 4.24 in main GRO2019 report

Australian Government
Department of Agriculture, Water and the Environment
ABARES

Dr Steve Hatfield-Dodds

Executive Director,
Australian Bureau of Agricultural and Resource Economics and Sciences

Honorary Professor,
Crawford School of Government,
Australian National University

Expert Member,
International Resource Panel,
UN Environment

awe.gov.au/abares

The Australian Bureau of Agricultural and Resource Economics and Sciences is the research arm of the Australian Government Department of Agriculture, Water and the Environment.

Our mission is to provide professionally independent data, research, analysis and advice that informs public and private decisions affecting Australian agriculture, fisheries and forestry.