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Recommended reference

Department of Primary Industries and Regional Development (2021), Perth.

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DPIRD acknowledges the Traditional Owners of Country, the Aboriginal people of the many lands that we work on and their language groups throughout Western Australia and recognise their continuing connection to the land and waters.

We respect their continuing culture and the contribution they make to the life of our regions and we pay our respects to their Elders past, present and emerging.

Artwork: "Kangaroos going to the Waterhole" by Willarra Barker.



Department of
**Primary Industries and
Regional Development**

Research

Highlights

Primary Industries Development 2021

Introduction



Minister's Foreword

Hon Alannah MacTiernan MLC

MINISTER FOR AGRICULTURE AND FOOD

Primary industries are a fundamentally important sector of the Western Australian economy.

This publication showcases, for the first time, the collective research and development achievements of the Department of Primary Industries and Regional Development, which was formed in 2017 to combine the former Department of Agriculture and Food with the Departments of Fisheries and Regional Development and the staff of nine Regional Development Commissions.

The new department is providing a strong and unified service for Western Australia's vital primary industries, which contribute more than \$10 billion in value to the state's economy each year while underpinning the social fabric of our regions with 156 000 direct and indirect jobs.

To remain globally competitive and compete on export and domestic markets, our primary industries must continue to boost productivity in the face of climate change while meeting consumer expectations for sustainable, ethical farming systems that supply high quality and safe products.

The State Government is committed to reinvigorating research and development in WA's primary industries and improving commercial outcomes, industry performance, economic growth and employment.

To achieve this, we are investing in research and digital infrastructure across the regions while building scientific, industry and export capacity and safeguarding the foundations of the state's agricultural industry – its valuable soil, water and land resources.

The State Government has refurbished and built new agricultural and fisheries research and development facilities from the Kimberley and Pilbara regions through to Albany on WA's south coast and Merredin in the eastern grainbelt. The new facilities are being used for an impressive and broad array of activities including: developing the state's shellfish and marine finfish industries; advancing the genetics of the WA sheep flock; breeding export-quality horticultural and agricultural crops and pastures; and investigating ways to reduce the carbon footprint of the primary industries sector while adapting farming systems to a changing climate.

Through the department's \$50 million Building Grains Research and Development Capacity project and scientific research partnerships with the Grains Research and Development Corporation, Horticulture Innovation Australia and Meat and Livestock Australia, the department will continue to deliver world-leading grains, horticulture and livestock research and development, driving Western Australian jobs, productivity and export earnings.



Minister for Agriculture and Food Alannah MacTiernan at the launch of the new high-yielding wheat variety RockStar bred by WA plant breeding company Intergrain. Also pictured are Intergrain's wheat breeder Dan Mullan (far right), CEO Tress Walmsley (centre) and CFO Troy Keenan (back right), DPIRD's former deputy director general Dr Mark Sweetingham (far left) and Goomalling farmer Darren West (back left).

Introduction



Apple breeder Steele Jacob from the WA Department of Primary Industries and Regional Development and WA Minister for Agriculture and Food Alannah MacTiernan farewell a shipment of Bravo™ apples on its way to Singapore.

Introduction



Cotton in the Ord River Irrigation Area, Kununurra. Left to right: DPIRD Director General Ralph Addis, DPIRD Director of Northern Agricultural Development Gordon Verrall, Minister for Agriculture and Food Alannah MacTiernan, and CEO Kimberley Development Commission Jeff Gooding.



Minister for Agriculture and Food Alannah MacTiernan (centre) investigates irrigated fodder production trials with DPIRD staff at Skuthorpe near Broome.

Expanding the digital capacity of the state's primary industries remains a top priority for the government – with \$8.1 million invested over four years in the successful eConnected program. At the heart of the project is a digital platform that integrates and delivers real-time weather data from a network of 187 automated weather stations across WA. The weather data is an integral resource for farmers, emergency services and the general public and facilitates the development of online agricultural decision-support tools.

Balancing productivity growth with agricultural resource management is central to the ongoing sustainability of WA's primary industries and the government is committed to improving the resilience of agricultural and horticultural systems through investments in water harvesting and desalination, nutrient management and soil amelioration and biological health.

The following publication contains a snapshot in time of the extensive efforts of the Department of Primary Industries and Regional Development. Outcomes from over 60 of the more than 140 recently completed and current research projects are presented along with the contribution these projects are making to the ongoing success of WA's primary industries.

Hon Alannah MacTiernan MLC

MINISTER FOR REGIONAL DEVELOPMENT; AGRICULTURE AND FOOD;
HYDROGEN INDUSTRY

Introduction



Development of Western Australia's aquaculture industry is a high priority for the State Government, with a commitment to grow productivity and market share for our farmed seafood products.

Minister's Foreword

Hon Don Punch MLA
MINISTER FOR FISHERIES

The industry-supported Aquaculture Development Plan that was launched in 2020 is driving expansion of WA's blue economy and increasing investment in the emerging sector.

In the past four years we have opened a new hatchery in Albany, secured Huon Aquaculture to invest in the Mid-West, invested in a \$1 million fish health lab and committed \$10 million for a state-of-the-art marine finfish nursery in Geraldton, which will provide juvenile stock for commercial grow-out for Huon Aquaculture and other licence-holders in the region.

We have also upgraded research and development facilities at Hillarys to expand production of tropical and local species of rock oysters and scallops that will support industry growth.

The development plan is enabling local operators to take advantage of the rising global demand for quality seafood, which is expected to grow by more than 30 per cent this decade.

An expanding aquaculture industry creates upstream and downstream business opportunities such as feed and equipment manufacturing, processing and value-adding. When fully operational, the Aquaculture Development Plan is expected to create an estimated 6000 direct and indirect jobs across WA.

Prospective growth areas include: barramundi and rock oyster in the Kimberley; rock oyster and other shellfish species in the Pilbara and on the west coast; finfish, coral and seaweed in the Mid West; and abalone and shellfish in the Great Southern region.

The government has declared and fully allocated the finfish aquaculture zone for the Mid West and is establishing a south coast development zone for shellfish.

The Aquaculture Directorate was established within the Department of Primary Industries and Regional Development in 2017 and has a core team of 30 scientists, managers and technicians who work hand-in-hand with industry to supply juvenile fish and shellfish for commercial production and carry out research and development into fish and shellfish genetics, breeding, nutrition and diseases.

This publication showcases the recent achievements of the aquaculture team who operate from facilities from Derby in the Kimberley right through to Albany on the south coast.



Subcon's artificial reef modules being loaded at Fremantle, with Minister for Fisheries Don Punch, Emily Hamilton MLA, Tim Grose from Recfishwest and Cameron Stirling from Subcon.

The stories in this publication demonstrate that much has been achieved over the past five years and I am looking forward to seeing the potential of the WA aquaculture industry realised as its growth continues to deliver new jobs and opportunities.

Hon Don Punch MLA

MINISTER FOR DISABILITY SERVICES; FISHERIES; INNOVATION AND ICT;
SENIORS AND AGEING

Introduction



Ralph Addis

DIRECTOR GENERAL, DEPARTMENT OF PRIMARY INDUSTRIES AND REGIONAL DEVELOPMENT

The primary industries and food sector must have a dynamic and vibrant research, development and innovation environment to protect its major position in the Western Australian economy.

Every dollar spent on research and development delivers \$4.80 in productivity value to Western Australia's primary industries (Rao et al. 2020)¹.

It therefore goes without saying that the state's primary industries and food sector – which has an annual worth of more than \$10.3 billion – must have a dynamic and vibrant research, development and innovation environment to protect its major position in the Western Australian economy and capture real growth and job creation opportunities.

Following consultation across government and industry, the Department of Primary Industries and Regional Development has released a Primary Industries Plan that recognises 'strategic science' as a key driver of the ongoing innovation required to grow and sustain our primary industries.

¹Rao, X., Hurley, T.M. and Pardey, P.G. (2020), Recalibrating the reported returns to agricultural R&D: what if we all heeded Griliches?. Aust J Agric Resource Econ, 64: 977-1001

WA needs a collective scientific capacity to protect our competitive advantage and drive the innovation required to capture new market opportunities and overcome the climate change challenges for the sector.

To do this, we are rebuilding internal science capacity and building new partnerships with industry and academia in areas of critical need for WA. There has also been a renewed commitment to revitalising our facilities in the regions, with significant investments in Kununurra, Carnarvon, Merredin, Katanning and Albany.

To remain competitive, Western Australian grain, livestock, horticulture and aquaculture producers need ongoing access to improved genetics, better production technologies, market and consumer intelligence and decision-making tools that help manage the risks to their businesses.

This publication showcases the breadth and depth of DPIRD's research and development activities over the past few years. The stories outlined in the following pages stem from over 60 of the more than 140 recently completed or current projects carried out by the department's 1100 scientists, technical experts and economists located from Kununurra in the Kimberley through to Esperance on the state's south coast. In addition to the direct and positive contribution these efforts have made to WA's primary industries the work has also generated an impressive 160 scientific papers, 111 conference presentations and 38 books and book chapters.

The geographic spread of our operations is matched by the extraordinary array of our activities – from the development of nitrogen-fixing bacteria capable of producing \$4 billion worth of free nitrogen fertiliser each year through to the breeding and management of shellfish, finfish, crops and livestock and the delivery of real-time weather data and decision-support



DPIRD Director General Ralph Addis with former Deputy Director General Dr Mark Sweetingham.

tools from more than 200 automatic weather stations across WA onto the phones of the state's primary producers.

The significant achievements outlined in the following pages were made possible by a wide range of collaborators from across Australia, and the financial co-investment from the Rural Research and Development Corporations and the State Government's Royalties for Regions Program.

I remain incredibly proud of the work that DPIRD staff perform and look forward to supporting their future success.

Ralph Addis

DIRECTOR GENERAL, DPIRD

Introduction

Reflection

Dr Mark Sweetingham

DPIRD DEPUTY DIRECTOR GENERAL (2020)

Governments the world over invest in agri-food research and development because it has proven to be a powerful and equitable lever to secure and grow sustainable food and fibre production.



Private investment is also substantial because investors appreciate that agri-food is a large and profitable sector of the global economy.

Western Australian agri-food industries continue to face unique challenges but we will not overcome these by merely importing technologies designed for other agricultural, geopolitical and economic ecosystems. Our research and development pursuits must be adapted to our unique environment.

The formation of the Department of Primary Industries and Regional Development in 2017 created an opportunity to refresh our research portfolio, curate and build on WA's rich legacy of scientific knowledge in agriculture, horticulture and fisheries.

DPIRD's activities all underpin our mission to deliver practical outcomes for a Western Australian context. The department's successes have been achieved through active encouragement and collaboration from our primary producers, agribusinesses and industry groups. Projects are increasingly networked with researchers from a wide range of local, national and global partners – both public and private.

The productivity, risk mitigation and environmental sustainability gains made in the Western Australian primary industries over the past 40 years are impressive by any global comparison, given the significant drop in growing season rainfall we have suffered during this time in the face of climate change.

While some think the industry may have picked all the low hanging fruit, I instead see us entering a golden age of genetic improvement with even greater rewards from genomic and gene editing tools, and the deployment of digital and robotic technologies to enable more efficient and profitable crop and animal production.

My hope is that investment in agri-food research and development continues to grow so that the economic, environmental and community benefits still to be realised can be captured for Western Australia.

Dr Mark Sweetingham

MARCH 2021

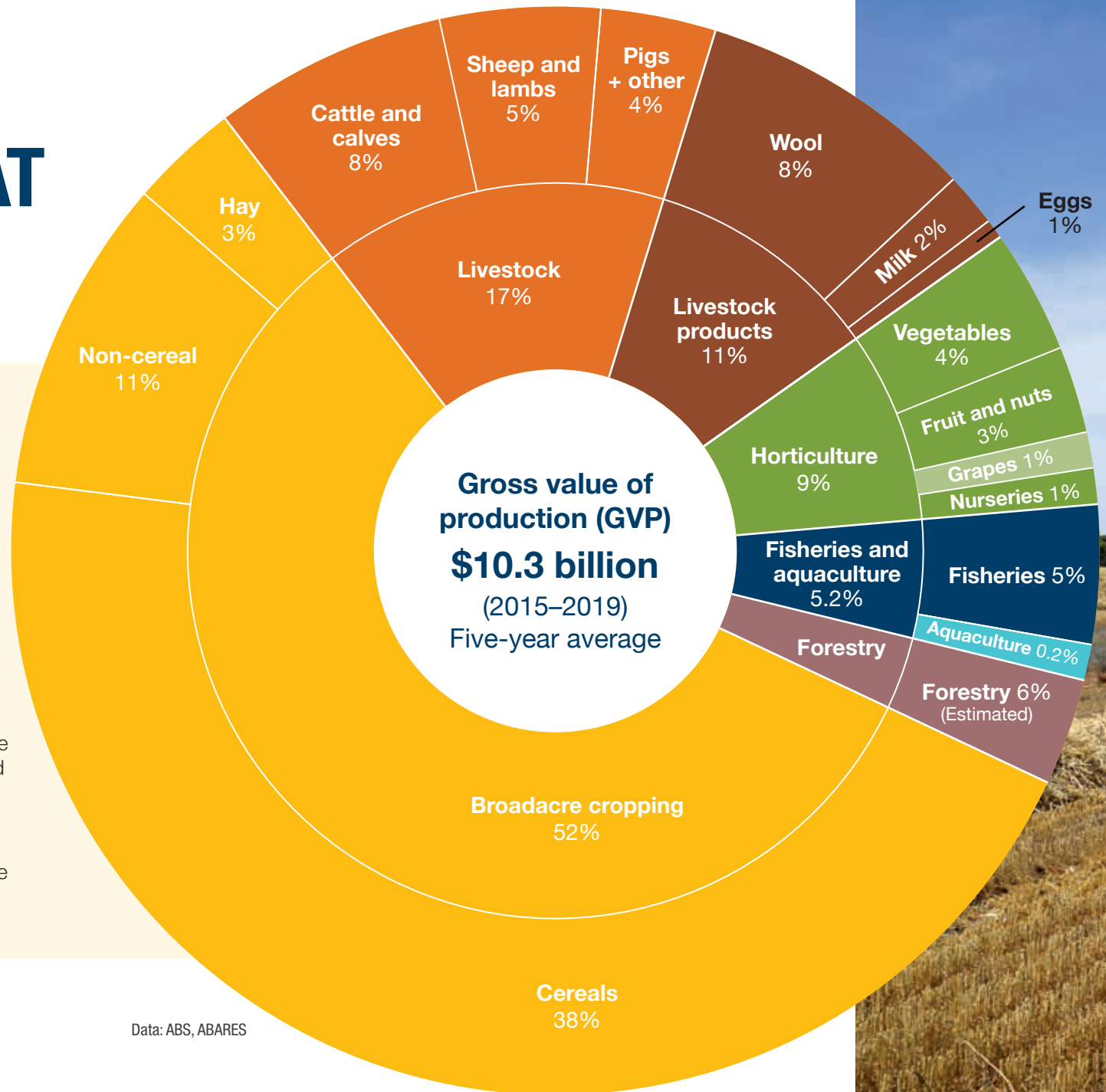


Western Crop Genetics Alliance director, Professor Chengdao Li (right), former DPIRD Deputy Director General, Dr Mark Sweetingham (left), and Murdoch University Pro Vice Chancellor Food Futures Institute, Professor Peter Davies (back), inspect oat varieties in the alliance's glasshouse at Murdoch University.

Introduction

INDUSTRY AT A GLANCE

- Primary industries have played an important part in the history and development of Western Australia. They are integral to the fabric of our cities and regions, and a critical part of our economy.
- WA has a diversity of established industries spanning broadacre grains, pastoral, seafood and horticultural industries.
- The majority (52%) of the state's primary production is based on broadacre cropping followed by livestock systems (28%), horticulture (9%), forestry (6%) and fisheries and aquaculture (5%).
- Numerous emerging industries – including avocados, wine, aquaculture, and food and beverage manufacturing – are increasing diversity of the sector.



Data: ABS, ABARES

“*Every dollar spent on research and development delivers \$4.80 in productivity value to Western Australia’s primary industries.*

It therefore goes without saying that the state’s primary industries and food sector – which has an annual worth of more than \$10.3 billion – must have a dynamic and vibrant research, development and innovation environment to protect its major position in the Western Australian economy and capture real growth and job creation opportunities.

RALPH ADDIS, DPIRD DIRECTOR GENERAL

EMPLOYMENT ACROSS WA PRIMARY INDUSTRIES

More than 150 000 jobs underpin WA's agri-food, forestry, aquaculture and fishing industries, which collectively contribute more than \$10 billion to the state economy each year.



Road, rail, air transport
15 622



Input suppliers
1634



Primary producers
31 457



Manufacturing and processing
22 750



Wholesale distribution
4157



Agri-food and forestry retail
36 120



Accommodation and food services
44 214



Agri-food, forestry, aquaculture and fishing employment
155 954

- Primary industries have played an important part in the history and development of WA. They are integral to the fabric of our cities and regions, and a critical part of our economy.
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- Numerous emerging industries — including avocados, wine, aquaculture, and food and beverage manufacturing — are increasing diversity of the sector.



PRIMARY INDUSTRIES DEVELOPMENT

OUR PURPOSE

Boosting primary industry productivity and global competitiveness for sustainable economic and regional development

HIGH-LEVEL STRUCTURE AND FUNCTIONS



AQUACULTURE

Greg Jenkins

- Aquaculture Industry Development
- Marine Fish
- Marine Molluscs
- Freshwater Fish and Crustaceans
- Aquaculture Health
- Research Facilities



GRAINS

Kerry Regan

- Grains Industry Development
- Crop Science and Grain Production
- Soil Science and Crop Nutrition
- Crop Protection
- Crop Genetics
- Field Research Operations



LIVESTOCK

Bruce Mullan

- Livestock Industry Development
- Sheep and Beef Production
- Livestock Systems R&D
- Northern Beef Development
- Feedbase R&D
- Meat and Wool Value Chains
- Biometrics
- Research Operations

PRIMARY INDUSTRIES DEVELOPMENT

DPIRD Deputy Director General

CHIEF SCIENTIST

(New)



HORTICULTURE AND IRRIGATED AGRICULTURE

Rohan Prince

- Fruit and Perennials Industry Development
- Vegetable Industry Development and Horticulture Systems
- Ord Irrigation Crop Development
- West Kimberley and Pilbara Irrigated Agriculture
- Insect and Disease Management
- New Industries
- Field Research Operations



FARMING SYSTEMS

David Ferris

- System Modelling
- Climate and Weather
- Future Systems Research
- Nitrogen Fixation
- Regional Farming Systems
- Regional Intelligence and Adoption



POLICY, INNOVATION AND PERFORMANCE

Kerrine Blenkinsop

- WA Research and Innovation Ecosystem
- Intellectual Property and Business Performance
- Industry Economic Analysis
- e-Connected Business Platform
- Primary Industries Workforce Capability
- Agriculture Policy

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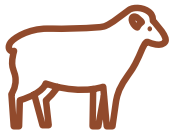
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