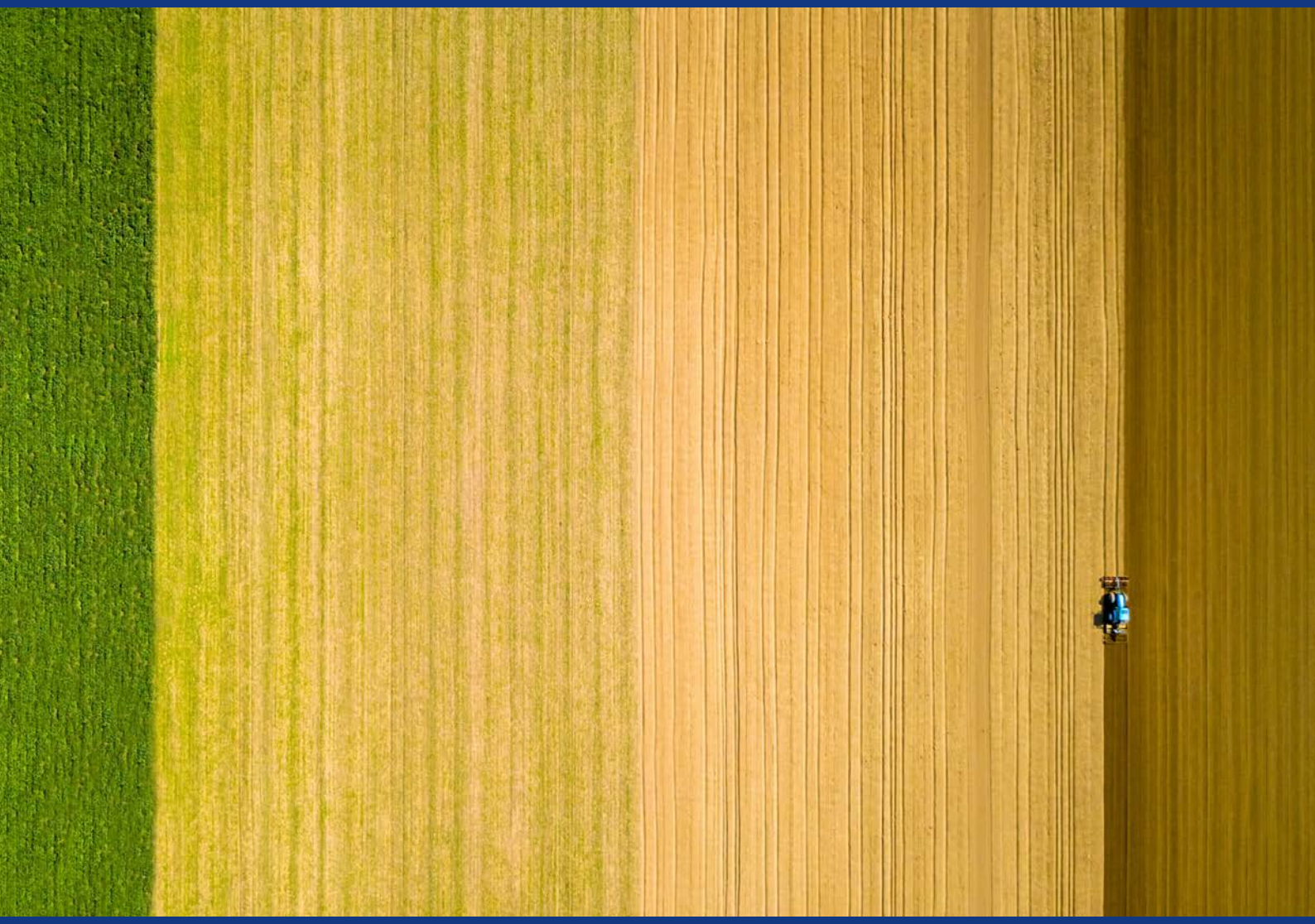
Department of Primary Industries
Department of Regional NSW

Agriculture Annual Report

2022



March 2023

NSW GOVERNMENT

Acknowledgement of Country

The Department of Primary Industries acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, the knowledge and wisdom they hold in managing the landscape, and we show our respect for Elders past and present.

Our annual report

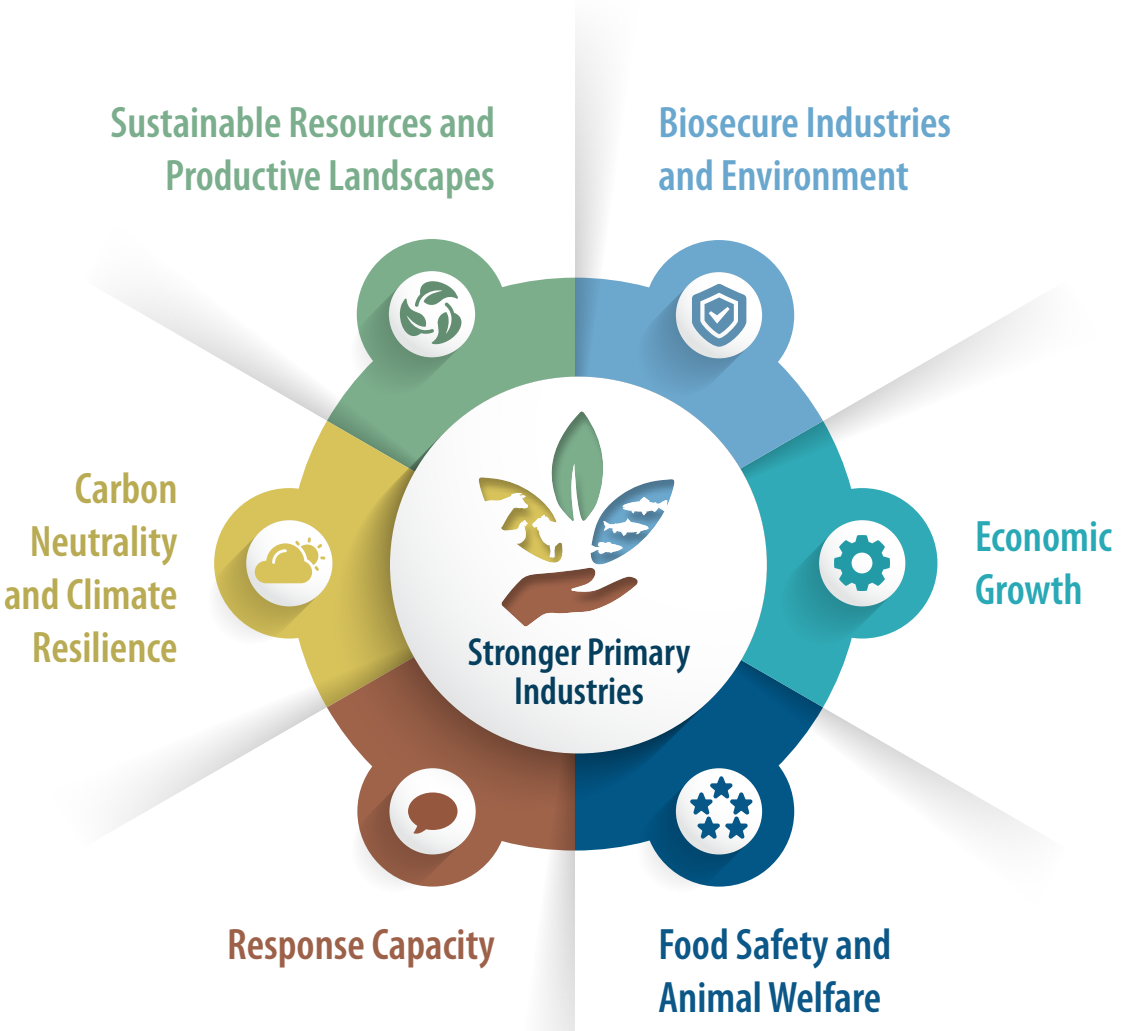
This annual report provides a summary of our activities and performance for the calendar year of 2022.

Our purpose

To maximise outcomes for NSW primary industries, the communities they support and the resources they rely on, both today and for the future.

NSW DPI

We are Australia's largest provider of rural research and development. DPI Agriculture is a division with NSW DPI. At DPI Agriculture, we use 130 years of research and development know-how to inform contemporary policy and legislation, and build stronger primary industries in NSW.



Contents

NSW GOVERNMENT

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Foreword

NSW Department of Primary Industries (NSW DPI) Agriculture branch aims to increase the productivity, sustainability and resilience of the agricultural sector in the state.

Our purpose is to maximise outcomes for NSW primary industries, the communities they support and the resources they rely on, both today and for the future.

We are working on key issues and opportunities surrounding the production of food and fibre in NSW.

NSW DPI Agriculture, a recognised world leader in primary industries research and development (R&D), specialises in applied and blue-sky research to:

- Improve the productivity, profitability and sustainability of primary industries
- Manage environmental and on-farm risks such as climate change, pests, disease, animal welfare and food safety.

In doing so, we support the delivery of high quality, affordable and healthy food and fibre, to an expanding world population, in a productive and sustainable manner.

Working with a multi-million dollar annual budget, NSW DPI Agriculture, employs approximately 650 people and works from 21 research institutes in the various agro-ecological regions across the state – making it the largest provider of rural R&D in Australia.

The key advantage of research institutes are that they allow R&D to be conducted under commercial scaled conditions but without normal farming operation constraints.

NSW DPI Agriculture invests in and also delivers specialised training to rural

industries through Tocal College, and provide strategic policy and legislative advice to the NSW Government.

The key R&D competitive advantage of our organisation is its large and diverse resource capability and capacity across the various farming production systems in NSW, along with its long history of working with producers, commercial companies, R&D corporations and other research institutions.

NSW DPI is one of the few organisations in Australia that can rapidly have its research applied and adopted through its own targeted industry development and education programs, meaning a stronger return on investment for government and industry.

Kate Lorimer-Ward
Deputy Director General,
NSW DPI Agriculture

What we do

Climate

Education

Livestock Systems

Plant Systems

Soil & Water

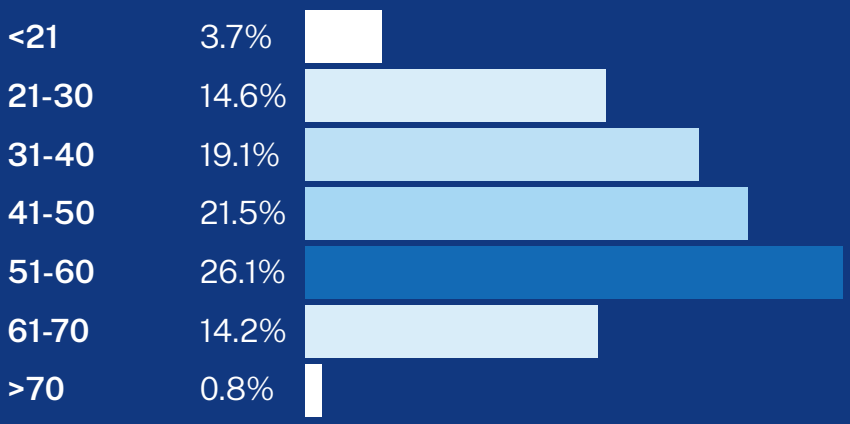
Strategic Initiatives

Who are we?

Female
52%

Other
1%

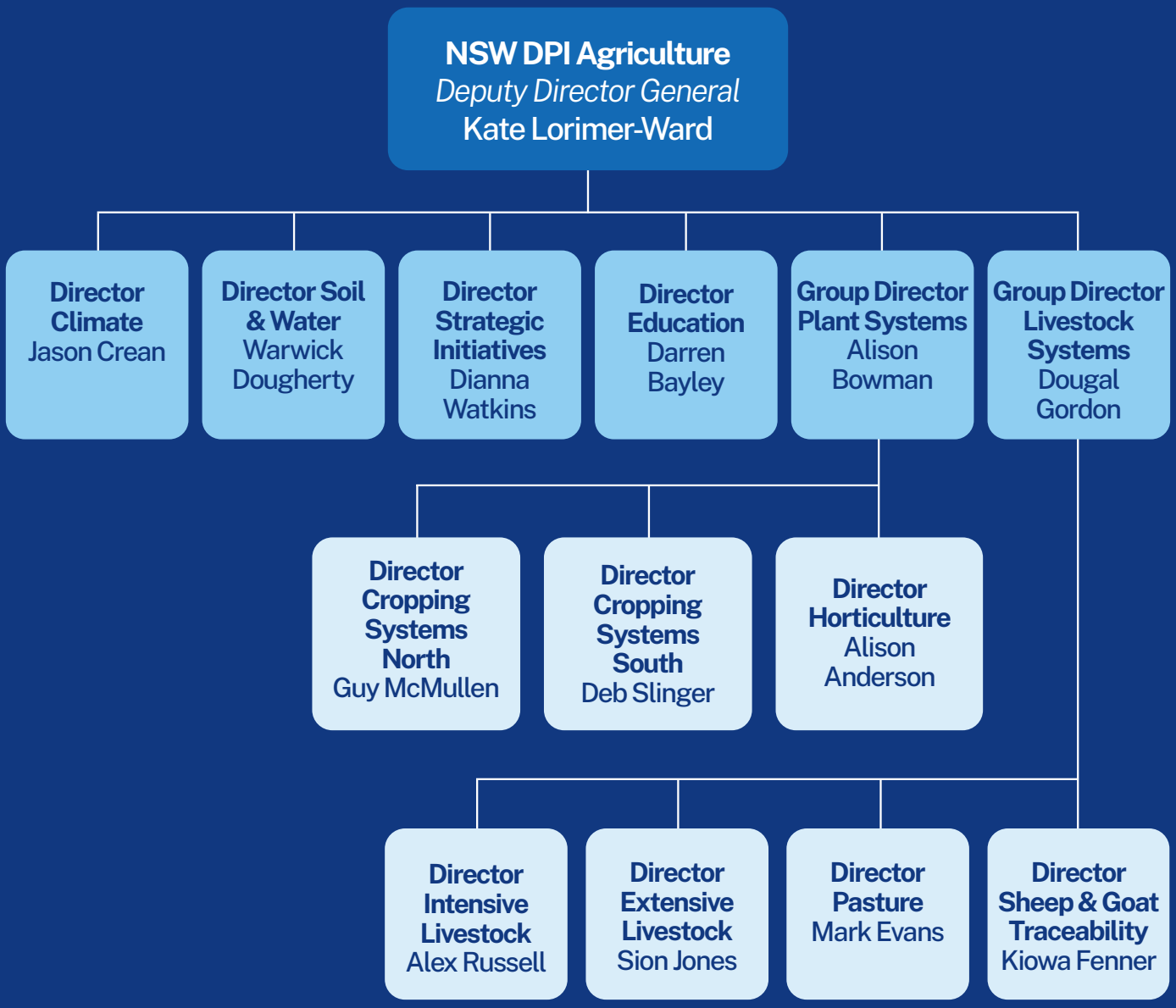
Male
48%



95.8%
Regional

4.2%
Metro

Ag senior leadership team



Team purpose

The NSW DPI Agriculture Senior Leadership Team works together to enhance collaboration, enable opportunities and lead a capable and engaged workforce to deliver against the NSW DPI strategic plan, to the benefit of our primary industries.

We enhance the effectiveness and reputation of the NSW DPI by identifying and creating linkages across work streams, representing the branch to ministers and industry, undertaking research, informing policy decisions, and by providing our colleagues with first class specialist advice.

NSW GOVERNMENT


1%
NSW DPI is globally recognised as a top 1% Ag research organisation
13,000ha of trial sites
NSW DPI is the largest rural research provider in Australia
600+ scientific and technical staff
Trangie
Agricultural Research Centre
Condobolin
Agricultural Research and Advisory Station
Forbes
Dareton
Primary Industries Institute
Griffith
Citris Centre of Excellence
Yanco
Agricultural Institute
Narrandera
Fisheries Centre
Wagga Wagga
Agricultural Institute
Deniliquin

NSW GOVERNMENT

Industry Snapshot 2021-2022

Sourced from NSW DPI Performance Data & Insights publication, which can be viewed in full at www.dpi.nsw.gov.au/pdi

VALUE OF AGRICULTURE

$22.4b
RECORD GVP FOR 2021-2022, UP 24% YEAR-ON-YEAR

$11.9b
2ND CONSECUTIVE RECORD GVP FOR BROADACRE CROPS

$7.9b
RECORD LIVESTOCK & LIVESTOCK PRODUCTS GVP FOR 2021-2022

$2.6b
HORTICULTURE GVP FOR 2021-2022

- This record GVP was partially driven by very strong global food commodity prices, fuelled by a range of global supply issues, post-pandemic economic recovery and generally favourable weather conditions.
- Labour shortages, particularly for horticultural seasonal workers continued to impact the sector.
- International bulk and container shipping costs soared due to supply chain disruptions, regional COVID lockdowns and the post pandemic economic recovery. This increased costs for exporters and the price of key imports including chemicals.

AGRICULTURAL EXPORTS

$9315.4b
TOTAL VALUE OF NSW AGRICULTURAL EXPORTS (INCLUDING WINE)

- Record value of broadacre crop exports of $5,893 million, driven by higher volumes and prices.
- Record value of livestock and livestock product exports of $4,642 million, driven by higher prices.
- Value of horticultural exports (incl wine) of $767 million.

COTTON: UP **249%** YEAR ON YEAR
WHEAT: UP **109%** YEAR ON YEAR
CATTLE: UP **22%** YEAR ON YEAR
CANOLA: UP **125%** YEAR ON YEAR
SHEEP: UP **29%** YEAR ON YEAR
WOOL: UP **53%** YEAR ON YEAR

- 2021-22 was the first year that both of NSW's major export sectors, livestock and broadacre crops grew in value at the same time.
- Wheat exports were NSW's largest export by value, surpassing beef for the first time since 2013.
- Cotton and barley exports continued to be affected by unofficial Chinese trade boycotts.

SUMMER CROP

- Significantly improved water allocations boosted summer crop production, notably for cotton in the northern basin and rice in the south.
- NSW cotton production reached peak levels and was one of the largest drivers behind broadacre cropping GVP growth, with production up across all valleys, particularly in Southern NSW and the Gwydir valley.
- Sorghum production was the largest in 14 years.

LIVESTOCK & LIVESTOCK PRODUCTS

- Beef cattle was the main contributor to the record GVP result, driven by robust demand for protein and strong restocker demand.
- Generally favourable seasonal conditions helped support the continued rebuilding of cattle herds and sheep flocks
- Farmgate prices for livestock and livestock products rose 11% on average.
- Intensive poultry and pig meat industries were challenged by higher feed grain prices and supply chain disruptions.
- Wool grew 24% and achieved a GVP of over $1 billion for the first time since 2019.

HORTICULTURE

- Horticultural GVP was estimated to be $2,397 million.
- Exports of horticultural products totalled $297.4 million, a 3.2% increase year-on-year.
- Major export markets for NSW horticultural products include China valued at $54.6 million, Hong Kong at $27.1 million, Japan ($30.9 million), New Zealand ($26.8 million) and Singapore ($25.8 million).

NSW GOVERNMENT

Economic Growth

Primary Industries benefit the wider community through food as medicine, zero waste, food and fibre supply chain security, while underpinning growth and resilience in regional communities, and seeking opportunities to contribute to closing the gap for indigenous peoples

NSW DPI Tamworth Agricultural Institute

Tropical perennial grasses

Increasing livestock production by integrating tropical pastures into farming systems

Climate modelling has predicted increased temperatures and reduced winter-spring rainfall in southern Australia by 2050.

Thus, grazing systems that are based on temperate species will have a shortened growing season, leading to a prolonged summer-autumn feed gap, costing the Australian red meat industry $1.13 billion per year.

To address this challenge, a $7.6 million project was launched with the aim to increase livestock production by integrating tropical pastures into farming systems. Tropical perennial grasses are summer growing, drought tolerant, responsive to summer rainfall, and offer the potential to contribute to summer and autumn forage in current and future climate scenarios.

The results of this project will enable the creation of agronomy packages and resources specific to different regions in order to maximise the efficiency of using tropical pastures across different farming systems.

This multidisciplinary state-wide project commenced in 2017 as part of the Livestock Productivity Partnership between NSW DPI, Meat and Livestock Australia Donor Company and a number of other research organisations.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Winter cropping guide

Helping grain farmers make better winter cropping decisions

With such a variable climate, Australia is one of the harshest environments in which to crop in the world.

Having access to accurate advice on new crop varieties and better management practices is important to improve the profitability and sustainability of the industry.

For more than 25 years, NSW DPI has published the Winter crop variety sowing guide, to provide advice for grain growers and their advisers to make better cropping decisions and lock in higher profits from winter crops

The 2022 edition of this valuable resource includes the latest grain yield and disease ratings for new crop varieties released over the last few seasons for wheat, barley, oat, canola, chickpea, field pea, faba bean and lupin. Lentil is included in this year's edition because of its growing potential in the state.

This edition includes the results of National Variety Trials conducted throughout NSW, including 38 trial sites undertaken by NSW DPI for the Grains Research Development Corporation.

This information will allow farmers to assess how a variety performs across sites and years.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Macadamia plant protection

Helping macadamia growers protect orchards from pests and disease

Macadamia production is one of the Northern Rivers and Mid-North Coast's most vibrant horticultural industries and makes a major contribution to the local economies.

NSW DPI supports the NSW macadamia industry and growers with industry development, grants and expert advice to help ensure long-term quality and sustainable nut production.

Now in its eighth edition, the Macadamia plant protection guide is an easy-to-use support tool for growers, with information on how to protect orchards from pests and diseases including regular monitoring, cultural and biological management, in tandem with responsible targeted pesticide use.

It also highlights the outcomes of NSW DPI's five-year Integrated Pest Management (IPM) project, with growers now able to use a management system specific to their farm and location.

The guide is free to macadamia growers and is distributed to all macadamia processors within Australia.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Data to support cattle enterprises

Investing in the future of Australia's beef industry

There has been a long history of genetic evaluation based on single breeds of beef cattle, allowing stud breeders to achieve efficient and productive animals.

However, commercial cattle producers often find it difficult to make selection decisions across breeds or to design effective crossbreeding programs.

That's where the Southern Multi Breed project comes in.

Now in its third year, this multi million-dollar project continues to build up a large reference dataset of animal performance and DNA test records from six key breeds of beef cattle that include Angus, Shorthorn, Hereford, Charolais, Wagyu, and Brahman.

This information will not only enable direct comparisons across the different breeds, which has never been achieved before, but it can be used to strengthen national genetic evaluations through BREEDPLAN, thereby increasing the rate of genetic improvement in beef cattle.

This will be achieved by developing across breed head-to-head comparisons to support a National multi-breed genetic evaluation which will allow up to 8,000 Angus, Hereford, Shorthorn, Charolais, Wagyu and Brahman to be directly benchmarked and compared by the commercial sector.

In addition, this project will significantly increase the number of hard to measure phenotypes and genotypes recorded for Angus, Hereford, Shorthorn, Charolais, Wagyu and Brahman in southern Australia, increasing the accuracy of the genomic predictions within current breed specific BREEDPLAN analyses.

The Southern Multi Breed project will have its biggest impact on the Australian beef industry through major productivity improvements across female reproduction, weaning rates, carcass meeting top market specifications, and improvement in feed efficiency, resulting in a projected increase in profitability across the industry.

This project is jointly funded by the NSW DPI, University of New England, and the Commonwealth Government via the Meat and Livestock Australia Donor Company.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Chickpea Breeding Australia

Finger on the pulse for better chickpea production in NSW

Australia is one of the world's top chickpea exporters, and with emerging new markets for plant-based protein, this humble pulse is the crop of the future.

Chickpea Breeding Australia (CBA), a five-year program funded by the Grains Research and Development Corporation (GRDC) and NSW DPI, is helping Australian farmers tap into new opportunities and build a sustainable future.

With $30 million invested in breeding better chickpea varieties faster, CBA is working on better disease resistance, tolerance to particular soil constraints, broader environmental adaptation, and delivering better agronomic packages for chickpeas.

Promising results in trials of CBA Captain, a new Desi chickpea variety, should see the popularity of this pulse increase among growers in the coming seasons.

CBA works with ten organisations across the country to conduct field evaluation trials, biometrics support and use genomic technologies and also partners with regional seed partners to distribute seed.

Strategic priority: *Support high value, new and emerging industries and new product development.*

Citrus Centre of Excellence

World-leading research to boost the state's citrus industry

Citrus is one of most important horticultural industries in NSW producing around 250,000 tonnes of citrus annually, around 40% of Australia's production and 36% of citrus exports.

To ensure NSW's citrus industry continues to flourish, NSW DPI's $300,000 Citrus Centre of Excellence opened in Griffith last year to build knowledge on sustainable methods and practices.

Home to a world-leading research centre and the latest in technology, it will ensure citrus growing is sustainable and profitable in a rapidly changing environment as well as provide an economic boost to the city.

Research undertaken by the centre will protect the already thriving industry and help citrus and grape growers adapt to changing climatic conditions, improve production practices for the best yield and quality, and support future growth.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Remote sensing for the rice industry

Improving water management for better rice farming

The Australian rice industry is one of the most efficient users of water in the world but with increasing pressure on water availability, a new project using remote sensing will help local farmers further improve water usage to ensure climate change resilience.

NSW DPI researchers are working with rice growers to provide real-time monitoring of crops to support decision making on the timing of crop management including grain moisture content and harvest readiness.

By bringing together real-time remote sensing, weather and field observations and machine-learning techniques to provide 'live' information to growers, this project will help

growers become more sustainable.

The three-year project is a collaboration between AgriFutures Australia, NSW DPI, SunRice, and the University of New England's Applied Agricultural Remote Sensing Centre.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

NSW Dairy Industry Action Plan

Supporting the delivery of the NSW Dairy Industry Action Plan

The NSW Dairy Industry Action Plan was initiated following a series of extremely challenging years for the sector.

NSW DPI continued to support the dairy industry (with milk outputs valued at $670 million in the 2021-2022 year) through the delivery of the NSW Dairy Industry Action Plan.

The purpose of the Dairy Industry Action Plan is to set the foundation of a successful and profitable future for the NSW dairy industry. The Dairy Action Plan Implementation Panel was established in 2022, and consists of a mix of industry stakeholders that have responsibility for overseeing implementation of the Plan.

Mr Rob Cooper was appointed as Chair of the DAPIP, with Mr Phil Ryan as Deputy Chair.

The Panel will work with industry groups and government agencies to drive delivery of the actions outlined in the plan, while monitoring and reporting on implementation.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

National Soybean Breeding Program

New soybean variety sows the seeds for better crop security

A new variety of soybean developed in NSW will significantly boost productivity and profitability for growers across the state, locking in crop security and helping to meet the projected global demand for diverse protein supplies.

Bred as part of the ongoing Australian National Soybean Breeding Program, a collaboration between NSW DPI, CSIRO and Grains Research and Development Corporation, Gwydir is the first variety in NSW that is resistant to soybean leaf rust (Phakopsora pachyrhizi).

An airborne fungal disease spread by tiny spores, soybean leaf rust thrives in wet conditions and rapidly progresses towards the canopy of the plant where it destroys the green leaves and prevents the grain from filling the pods, resulting in substantially reduced yield and crop quality.

A 2019 analysis, based on an edible grain price of $700 per tonne with severe soybean leaf rust occurring every four seasons, estimated the resulting income benefit for soybean producers sowing and harvesting a rust resistant variety was around $2,500 per hectare.

The higher-yielding and early-maturing variety is well suited to different climates, particularly to an early sowing window on the northern NSW production regions including the North Coast, Northern Tablelands, Northern Slopes and Liverpool Plains.

Gwydir's improved weather tolerance will help growers to maintain edible market quality and price in environments that experience heavy rainfall at harvest time.

Its narrow leaf allows better spray penetration and more light deep into the canopy, where it can stimulate pod-set after flowering.

With its high protein content, Gwydir is suitable for high-value edible markets for export and domestic consumption, meeting the growing demand for plant-based foods.

Strategic priority: *Partner for productive, efficient and resilient food and fibre supply.*

Grains Agronomy and Pathology Partnership

Driving sustainability and profitability for NSW grain growers

Winter grain crop diseases such as Fusarium crown rot are a major constraint to the $8 billion NSW grains industry, with an estimated cost to growers of $350 million each year. Now, NSW grain growers will benefit from two new projects focused on crop protection and biosecurity in the grains sector.

Working in partnership with the Grains Research Development Corporation (GRDC), NSW DPI will lead a $2.47 million, three-year project to improve central and southern NSW growers' understanding and management of Fusarium crown rot.

Fusarium crown rot is the largest soil borne biotic threat to winter cereals, particularly wheat, and yet many growers don't recognise that the disease can result in 5 to 20% yield loss.

By 2025, growers will have the knowledge to make on-farm decisions that reduce the risk of economic losses to Fusarium crown rot.

GRDC has also committed $1.5 million to NSW DPI's successful real-time disease surveillance and diagnostics service direct to growers.

Both projects will benefit growers and contribute to ongoing research and development to reduce the effects of winter crop diseases.

This investment follows on from the successful $64.6 Grains Agronomy and Pathology Partnership, which has delivered 58 research projects to help improve profitability and sustainability in the grains industry.

Completed in June 2022, the five-year collaboration between NSW DPI and GRDC has delivered immense benefits for growers and the Australian grains industry, boosting business productivity and long-term savings and returns .

Projects like NSW DPI's research-based plant diagnostic service, which enables growers to identify and manage diseases early, and will return $20 million to the industry over the next 10 years.

And innovative phenology research to create optimal flowering period targets by area to pinpoint the best cereal sowing and flowering times, which will return $23 million to industry once adopted.

These research wins were celebrated in June 2022 to showcase the hard work and effort of researchers, reviewing what has been delivered for growers and exploring emerging issues and future opportunities.

Ongoing research will ensure NSW growers have the right advice to increase farm efficiency and boost profitability through improved on-farm cropping practices.

Future projects to address the challenges facing grain growers will include investments in national biosecurity and crop protection diagnostics and surveillance and a soils, agronomy and farming systems initiative.

Skills and labour focus

Supporting workforce needs for primary industries

Primary industries have struggled to find enough hands to help with harvest and other activities such as pruning and shearing.

NSW DPI has assisted in that space through the delivery of AgSkilled 2.0, which is a $15 million NSW Government-funded industry-led workforce development strategy.

AgSkilled 2.0 seeks to upskill NSW's cotton, grains, production horticulture, viticulture and rice growing industries to manage the challenges of the future.

The program demonstrates an effective partnership between industry and government to provide skills training that is current, relevant and flexible.

65% of this training has been completed at Tocal College. The program includes free training for short courses and part qualifications / skill sets.

Incentives are also available for employers and trainees to take up traineeships in agriculture. NSW DPI's Tocal College is a leader in full-time and part-time agricultural courses, short courses and distance education.

Tocal is a registered training organization (RTO) that provides training for new industry entrants from both urban and rural backgrounds.

NSW DPI's registered training organisation Tocal College produced 220 graduates in 2021 and had more than 4,000 participants in skills training across 115 locations in NSW. Tocal College courses have a successful completion rate with it being 42% higher than national average.

The College is recognised as a high performing provider by Training Services NSW.

Understanding the workforce shortage

A major gap in addressing the labour shortage within the primary industries sector is data –understanding where workforce is needed and when. NSW DPI in collaboration with industry launched a survey about primary producers' labour needs.

The survey aimed to establish a much-needed baseline of seasonal workforce demand in the agriculture, forestry, and fisheries sectors across NSW.

The resulting data will inform potential interventions to address the significant workforce shortage in the agriculture sector.

NSW DPI participates in the national Pacific Australia Labour Mobility Scheme working group, providing advice to the Commonwealth on the strategic and policy settings of the scheme.

Strategic priority: *Improve access to a capable workforce.*

Genetic improvement for honey bees

Plan Bee – Australian honey bee genetic improvement program

NSW DPI is part of project Plan Bee which is a national, collaborative research, development and extension program to develop a genetic improvement program for honey bees.

Plan Bee aims to foster a sustainable national genetic improvement program using innovative breeding technologies to transform the performance of honey bees in Australia. It will focus on traits of importance to beekeepers, and horticulture and broadacre industries dependent on honey bee pollination. The strength of this project lies in its ability to leverage benefits across multiple industries by creating a more profitable and sustainable beekeeping industry, improving crop pollination efficiency, and enabling industry expansion through enhanced pollination security.

NSW DPI is part of a team with Agrifutures, Sydney University, University of New England Animal Genetics and Breeding Unit, Better Bees WA Inc and Wheen Bee Foundation. Contributions to the project have also been made by those that work in pollination dependent industries.

A research apiary was established at NSW DPI's Tocal College including a honey extracting facility and dedicated honey bee industry training centre. From December 2022 hives were built into a 250-hive strong apiary made up of 200 full strength hives and another 50 nucelus hives from donated or purchase honey bee stock.

In January 2022, over 14 tonnes of Eucalyptus tereticornis, Eucalyptus paniculata and Trifolium repens (white clover) honey was extracted from research hives, with phenotype traits identified.

In October 2022 a number of queens were distributed to registered beekeepers with primary production businesses, those that produce queens for sale or those that will provide data or allow Tocal to collect further data on this stock.

Due to the incursion of Varroa mite in NSW, and the subsequent emergency response, the honey bee stock at Tocal was euthanised, with a number of queen bees from the project temporarily moved further north to preserve the genetics that have been developed since the project commenced.

Plan Bee continues to empower bee breeders to use improved animal breeding techniques based on their own breeding objectives that will enable faster selection for traits and greater surety for beekeepers that they are getting quality stock.

Strategic priority: *Support high value, new and emerging industries and new product development.*

Carbon Neutrality and Climate Resilience

Primary industries are contributing to net zero by 2050 and adapting to climate change while maintaining productivity growth

How to lower methane emissions from sheep and cattle?

A collaboration to examine the genetics of methane emissions in beef cattle

The livestock sector currently contributes around 80% of Australian agriculture emissions – largely driven by cattle and sheep.

Working in collaboration with Meat & Livestock Australia, the University of New England and Angus Australia, NSW DPI is developing Estimated Breeding Values for cattle and Australian Sheep Breeding Values that will enable cattle and sheep producers to select and breed animals that produce less methane

Once animals and their genomic sequences are identified, producers

and breeders can begin to select for reduced methane without sacrificing other production, health, and reproduction traits, thereby increasing industry efficiency and profit.

Strategic priority: *Expand options for cost effective emissions reductions or avoidance.*

Reducing soil acidity in NSW

Future proofing our soils for on-farm sustainability and productivity

More than half of the agricultural soil in southern and central NSW is affected by acidity and declining organic carbon levels, which threatens Australia's agricultural production and food security future.

Until now, soil management practices have been based on outdated models that have failed to prevent widespread subsurface acidity.

That's about to change with the

FutureSOILS project. The project will use machine learning to develop, trial and implement an accurate soil acidification model to monitor soil acidity and organic carbon levels.

That data will be used to develop a free online decision-support tool to help farmers sustainably manage and protect their land against changing climatic conditions, resulting in more productive, healthy and resilient soil.

Growers will be able to input paddock locations, target pH, soil parameters and sample depths, as well as farming systems and management actions, and receive customised liming and soil management recommendations.

Strategic priority: *Increase carbon storage and sequestration.*

Farms of the Future

Helping farmers to invest in Agtech to boost climate change resilience

Digital technology in agriculture is a growing opportunity for farmers in regional NSW to increase productivity, profitability, and become better prepared for the impacts of climate change.

The $48 million Farms of the Future program will help farmers in five target regions in 11 local government areas – Carrathool, Griffith and Leeton, Armidale, Moree Plains and Narrabri, Orange and Cabonne, and Ballina, Byron and Lismore – improve their understanding and adoption of Agtech for their enterprise.

Face-to-face and online training courses will explain the benefits of Agtech, how connectivity works on a farm, and how to invest in the right Agtech.

Farmers from the target regions will be able to apply for grants for approved on-farm connectivity solutions and digital Agtech devices to help make better decisions, prepare for climate variabilities and improve resource use.

The Farms of the Future project is delivered by NSW DPI, and is part of the Regional Digital Connectivity program, and funded by the $4.2 billion Snowy Hydro Legacy Fund.

Strategic priority: *Quantify vulnerability and opportunities to climate changes and support adaptation.*

Monitoring NSW seasonal conditions

NSW DPI climate research focusses on maintaining productivity growth through a changing climate

The department's Enhanced Drought Information System (EDIS), originally developed in 2016, provides data on drought conditions to improve the awareness, monitoring and forecasting of seasonal conditions across NSW.

EDIS has been continually monitoring seasonal conditions, including the major drought event from 2017-2020 supplying regional level information to a peak of 40,000 users.

From October 2022, EDIS was upgraded to provide higher resolution data at not only a regional but farm level and uses improved drought science to deliver more accurate monitoring information.

In late 2022, the NSW DPI team behind EDIS sought feedback from nearly 400 stakeholders on the improvements they'd like to see in an expansion of the program.

EDIS contributes data to a number of NSW DPI tools that support farmers and the community prepare for and manage variability in seasonal conditions and drought.

The monthly State Seasonal Update, distributed widely, provides information on drought, rainfall and temperature over the last month and an outlook for the coming three months.

The Combined Drought Indicator is an interactive tool that provides a snapshot of current seasonal conditions for NSW, factoring in rainfall, soil moisture and pasture/crop growth indices.

The Farm Tracker mobile app is a tool farmers can use to record seasonal conditions, including completing a simple crop, pasture or animal survey; keeping and managing a photo diary of a farm; monitoring the same paddock over a number of years.

Strategic priority: *Quantify vulnerability and opportunities, and support adaptation.*

Producers getting smart about climate

Getting smart about adapting to climate change

Across NSW, farmers are adopting new techniques and practices to tackle the challenges of climate variability.

Under the $6.7 million Climate Smart Pilots Project, NSW DPI specialists from across the fisheries, horticulture, cropping and livestock sectors are working with farmers to co-design and test how new technologies can improve management decisions and build resilience in rural communities and primary industry sectors.

Led by digital technology specialist Dr Allen Benter, the project is exploring how digital technology can help in responding and adapting to climate change. It is also looking at how digital technology-use and adaptation strategies can help farmers better manage short-term climate variability including extreme weather events or water resources.

In partnership with farmers, the team is developing new digital sensor technologies and trialling Agtech and IoT (Internet of Things) devices on farms to showcase how these emerging technologies can monitor resources and climate.

For instance, weather stations and trough sensors are being used in livestock systems across the Central West to monitor livestock health and make better decisions.

On an apple orchard in Orange, soil moisture and weather data is being used to improve water use efficiency.

And measuring and reporting on water salinity and temperatures in the Clyde River is helping the estuary's oyster farmers better understand local climate, prepare the industry for current and future climate events and improve yield.

As temperatures warm, rainfall regimes change and seasons shift, agriculture technologies will allow earlier warnings, better input control, and provide new ways to manage farming systems.

There are many farmers across the state who are already on the frontline of innovation, making use of new technologies and farming systems to maintain viable and resilient businesses.

The Climate Smart Pilots adaptation program supports these farmers and their impressive approaches to managing climate change.

Their stories show how it is possible to learn about and implement new strategies to create a more resilient business as climatic conditions shift across NSW.

The project created video stories of farmer experiences in adapting land, farming and business systems to a changing climate.

The stories demonstrate for the benefit of the wider industry, how positive steps can be taken on farms to proper as climatic conditions shift across NSW.

Climate change research strategy

Empowering farmers to build resilience and adapt to climate change

NSW's $23.1 billion primary industries sector operates in one of the most variable climates in the world.

Australian farmers are resilient and adaptable – they are innovators on the frontline in the battle against climate change – but as the rate and severity of climate change is predicted to intensify, the challenges of droughts and floods, storms and bushfires, and pests and diseases will increase.

Climate projections indicate that areas of NSW will face decreasing winter and spring rainfall, increased intensity of extreme rainfall events, increasing day and night temperatures, fewer frosts, and harsher fire weather.

As well as the challenges of a changing climate, energy security and energy affordability is also a concern for the sector.

Whether it's pumping water for irrigation, fuelling tractors and boats, or refrigerating packing sheds, energy is one of the biggest costs for many producers.

But there are also opportunities for the sector. A changing climate can provide untapped opportunities for new industries and for existing industries to expand into new areas of NSW.

NSW DPI's Climate Change Research Strategy is supporting farmers and growers as they navigate these challenges and opportunities.

The strategy will ensure that an investment of more than $29.2 million in research and innovation will identify energy supply and demand solutions, carbon market and emission reduction opportunities, and climate resilience building programs, to help build resilience in the sector.

As part of the strategy, NSW DPI is conducting seven pilot projects in energy-intensive industries including dairy, horticulture and feedlots to show how innovative technologies and practices can improve on-farm energy efficiency, energy security and productivity, and reduce on-farm energy use, costs and emissions.

The technologies include: solar thermal chilled water storage and control systems for milk cooling; electrification of irrigation pumps powered by an above ground solar photovoltaic tracking system to enable livestock grazing; solar photovoltaic and battery storage systems; electrification of LPG and diesel fuelled equipment; and peer-to-peer energy trading.

Research results will help farmers better understand, manage and adapt to climate change.

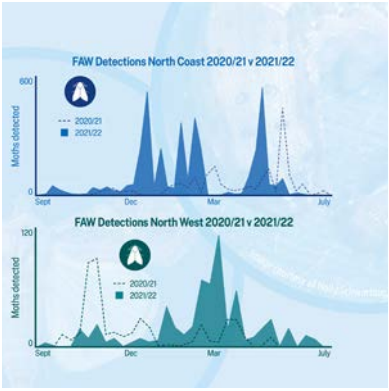
NSW DPI will use the results to develop future policies and programs for the long-term sustainability of the sector.

Strategic priority: *Expand options for cost effective emissions reductions or avoidance.*

Biosecure Industries and Environment

Primary industries, environment and the community are protected from the increasing threat and impact of pests, weeds, disease and other biological incursions

DPI Wagga Wagga Agricultural Institute



Sustainable insect management

Insect resistance research slowing the march of fall armyworm

Fall armyworm (Spodoptera frugiperda) is a highly invasive insect pest that is regularly detected in NSW. Its growing resistance to a number of insecticides makes it a major threat to Australia's agricultural industries.

Now, an innovative surveillance and monitoring program combined with the use of resistance management practices, is beginning to make inroads to controlling the pest in Australia.

NSW DPI and North Coast Local Land Services are urging growers to monitor crops for fall armyworm damage to help better understand this highly invasive and voracious pest.

Because the pest is relatively new to Australia, building knowledge about its migratory behaviour and identifying the crops and plants it may target in local environments is helping growers to manage outbreaks quickly and efficiently.

Early detection is an important first step in management.

Moth surveillance alerts growers to the presence of local fall armyworm activity and should be followed up with regular in-crop monitoring for larvae and signs of damage.

By understanding its behaviour, NSW DPI researchers can provide growers with advice and management strategies to help manage outbreaks of fall armyworm and reduce further resistance development.

Research conducted by Senior Research Scientist, Dr Lisa Bird, has revealed resistance to some insecticides prompting NSW DPI to advise growers to consider a planned approach to insecticide selection and rotation.

If sprays are warranted, chemical rotation will reduce the risk of resistance development and help to lower the costs of applications.

Growers are advised to act fast with full-rates of insecticide to target small larvae before they establish in whorls of plants, when control is more difficult to achieve.

Growers are also advised to consider insecticides that conserve insects that are natural enemies of fall armyworm and to avoid synthetic pyrethroids to which fall armyworm have shown high levels of resistance.

NSW DPI will continue to work with growers to share observations, experiences and learnings about this pest to minimise control costs.

Strategic priority: *Rapidly and efficiently contain biosecurity threats.*

Grains industry crop protection

Investing in detecting and managing crop diseases in NSW

Winter grain crop diseases such as Fusarium crown rot are a major constraint to the $8 billion dollar NSW grains industry, with an estimated cost to growers of $350 million each year.

Fusarium crown rot is the largest soil borne biotic threat to winter cereals, particularly wheat, and can result in 5 to 20% yield loss, yet it largely remains unrecognised and undetected by many NSW growers.

Now, two new projects focused on improving crop protection and biosecurity capacity in the grains sector will help growers to make more informed cropping decisions to boost their profitability.

Both projects will contribute to ongoing research and development to better understand winter crop diseases, how they can be managed to reduce impact on yield, and to promote useful and appropriate management strategies to growers.

In partnership with the Grains Research and Development Corporation (GRDC), NSW DPI will lead a $2.47 million, three-year project to improve NSW growers' understanding and management of Fusarium crown rot.

The project will help growers understand the risks of Fusarium crown rot and provide best practice management tactics to reduce the risk of economic losses on-farm.

GRDC has committed a further $1.5 million to the successful real-time disease surveillance and diagnostics service available to growers.

By implementing validation trials, working directly with growers and advisors on education, and surveying wheat crops on a commercial paddock scale, this project will build on knowledge of fusarium crown rot across both southern and northern NSW.

Working with growers to collect information in real time means that management advice is tailored to a grower's area and climatic conditions.

NSW DPI's experienced and trusted plant pathologists will continue to provide advice and diagnostics directly to growers to reduce the impact of disease on winter crops.

GRDC and NSW DPI have a very successful history of partnering to deliver practical information for grain growers and these new projects will build on that valuable work.

The $64-million-dollar partnership, known as the Grains Agronomy and Pathology Partnership, began in 2017 and has delivered more than 58 projects focused on increased productivity and innovation in the industry.

Strategic priority: *Coordinate timely and risk proportionate responses.*

Enhancing traceability of sheep and goats

Sheep and goat electronic Identification

In September 2022, all agricultural ministers in Australia agreed to work towards mandatory implementation of sheep and goat electronic identification (eID) nation-wide, similar to what occurs for cattle.

The sheep and goat industries and NSW DPI are working together to transition to an eID system from June 2024 through to January 2027.

NSW DPI chairs a NSW Sheep and Goat Traceability Reference Group, which has representatives from every sector of the industry (producers, saleyards, agents, processors, transporters and advisors). This group provides input and advice into the implementation process at every decision-making step.

An eID is an electronic identification device that contains a microchip, which is applied to individual sheep or goats -generally in the form of an ear tag.

The eID device can be scanned and that data inputted into the National Livestock Identification System (NLIS) database, which is Australia's system for the identification and traceability of cattle, pigs, sheep and goats.

The introduction of eID for sheep and goats nationally is an enhancement to the current traceability system making an animal emergency disease response more efficient and timely, with reduced impact on animals, people and consumers.

Sheep and goat eID will support long-term market access and productivity, ensuring opportunities for best practice husbandry and business operations.

NSW DPI is implementing an eID system for sheep and goats that takes a considered approach of the time taken to manage the challenges posed by cultural and skill set changes across all sectors.

In December 2022, grants of $5,000 to $15,000 were made available to all saleyards and processors in NSW to commence planning for essential modifications and critical infrastructure required to meet eID requirements.

NSW DPI will continue to support those across all sectors of the sheep and goat industry to make the change to eID through a wealth of education and training opportunities, opportunities to talk directly to staff through their unique situation and learn more through case studies of those who are making or have already made the switch to eID.

Strategic priority: *Rapidly and efficiently contain biosecurity threats.*

Food Safety and Animal Welfare

Markets and consumers are confident that industries and business meet high standards of food safety and animal welfare

DPI Cowra Agricultural Research and Advisory Station

TVB-N Indicator of meat freshness

Research supporting standards within the red meat market

Chinese consumers continue to demand products that reflect product safety, quality, as well as greater traceability, especially in the red meat market.

As such, total volatile basic nitrogen (TVB-N) is used to indicate meat freshness in China with other countries expected to adopt the same practice. However, this method has not been standardised, thus thresholds for freshness are inconsistent, leaving the Australian red meat sector vulnerable to terms that could constrict export access and market share.

To address this concern, the Total Volatile Basic Nitrogen (TVB-N) Indicator of Meat Freshness project filled multiple knowledge gaps and provided a science-based position that will affirm the economic security of the industry.

Findings from this project have already provided forewarning of TVB-N disparities in terms of its association with Australian standard measures for beef freshness and the concentrations defined by key export markets as limits for acceptance.

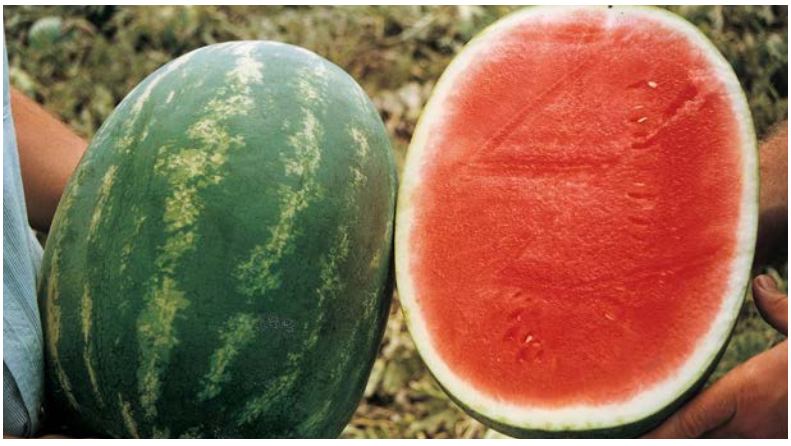
Strategic priority: *Prepare for and prevent the occurrence of food safety risks.*

Safe Melons project restoring consumer confidence

Managing future food safety threats in the melon industry

When an outbreak of listeria rocked the Australian rockmelon industry in 2018, the industry suffered a major downturn.

To rebuild consumer confidence and support growers, NSW DPI led 'Safe Melons', a national program to strengthen the safe production and handling of melons to prevent food borne illness.



Safe Melons is credited with restoring consumer confidence and improving productivity and profitability for melon growers through better prediction and early detection of risks across the supply chain.

With continuing wet weather conditions, skyrocketing fertiliser prices, disease and pests, and increasing labour, fuel and freight costs again putting pressure on the industry, growers are being urged to continue to follow the program's best practice guidelines to supply safe fruit to consumers.

In particular, growers are advised not to apply raw animal manure in melon production fields as this could pose a food safety risk.

Strategic priority: *Prepare for and prevent the occurrence of food safety risks.*

Paddock to supermarket traceability

Digital solutions helping to trace food from paddock to plate

As consumers demand more transparency around what they are eating, NSW DPI is encouraging fresh food producers to use technology to track and trace a product's journey from paddock to plate.

Biosecurity incursions, food safety recalls or emergencies such as floods or bushfires need rapid responses to protect the supply chain and consumers but gathering this information takes time.

Until now, that is. A pilot study using GS1 data standards and a GS1 Digital Link QR code to create a digital map of products in the NSW cherry and potato industries has the potential to change that.

Study results showed that using an integrated digital traceability system can improve industry competitiveness, buyer confidence and market access for horticultural products produced in NSW.

In a new era of food security challenges, traceability provides transparency of a product's provenance and where it is in the supply chain, providing consumers with confidence in a high-quality Australian product.

By working with growers, the study improved understanding of what is required on-farm to enable traceability and what the benefits would be to others along the supply chain.

As part of the study, unique serialised QR codes with a GS1 Digital Link label were applied to Woolworths-branded brushed potatoes and organic cherries bags and punnets. The GS1 Digital Link was encrypted with location data and a scannable QR code, which led to an interactive consumer application that could be viewed on a smartphone.

The GS1 Digital Link enabled the product to be traced in real-time, from property to store. It also provided information about how the product moved along the supply chain, the time spent at each location and allowed for real-time feedback from consumers.

Capturing and sharing data at every point in the supply chain — growers, carriers, retailers and the government — can enable full trace-back and trace-forward visibility in real-time.

The pilot study was conducted in partnership with Woolworths, Food Agility CRC, Freshchain Systems, GS1 Australia, Mitolo Family Farms, Cantrill Organics and Cherry Growers Australia.

Strategic priority: *Rapidly and efficiently contain biosecurity threats.*

Responding quickly to ensure food safety

Rapidly responding to food safety threats to minimise economic and health costs

Every day, Australians rely on the country's strong food safety systems to prevent and prepare for food recalls and food borne illness outbreaks. A nationwide recall of fresh baby spinach in 2022 showed how well these food safety processes work.

NSW DPI played a lead role in containing the outbreak by quickly identifying the toxic weed thornapple (Datura stramonium) in spinach samples and providing advice on managing the threat of toxic weeds in leafy vegetables.

With more than 190 people affected by the outbreak, many hospitalised with serious health effects, the rapid emergency response helped to reduce the impact on the economy, environment, and the community.

Strategic priority: *Prepare for and prevent the occurrence of food safety risks.*

Response Capacity

The impact of adverse events is minimised and rapid recovery is supported, with increasing resilience over time

Tocal training targeting emergencies

Delivering training to respond to biosecurity emergencies

In a world where biosecurity threats pose an ever-increasing risk, effective biosecurity is essential to safeguard Australia's economy, environment and community.

Biosecurity Emergency Response Training Australia (BERTA) was introduced to strengthen Australia's biosecurity system and provide a consistent, rapid and efficient response to biosecurity emergencies.

BERTA is a crucial tool in ensuring the country's preparedness and capacity to respond to incursions of animal and plant diseases and pests. Providing consistent, quality and targeted training to biosecurity personnel ensures a coordinated and effective response.

Tocal College maintains the training materials and helps to deliver the accredited training Australia-wide through a partnership with Animal Health Australia and Plant Health Australia.

Updating and refining the training modules will ensure BERTA continues to play a critical role in supporting a sustainable and profitable agricultural industry and protecting Australia's unique ecosystem.

Strategic priority: *Anticipate and prepare for adverse events.*

A resilient berry industry

A berry good outlook for NSW growers

It's been a challenging few years for the NSW berry industry with extreme weather conditions disrupting harvests.

Now, the Hort360 for a Sustainable and Resilient Berry Industry project is helping growers recover and better prepare for future flood and catastrophic weather events.

The $1 million project is part of the Australian and NSW governments Recovery and Resilience Grants program, which is providing more than $29 million to support recovery and build resilience in nine primary industry sectors affected by the 2021 storm and flood events.

The project, led by Berries Australia and delivered in partnership with NSW DPI, will provide growers with the tools to better identify on-farm risks and build capacity and knowledge to deal with future events.

Growers will have the chance to undertake an on-farm assessment using the Hort360 tool to identify areas of their business that could be improved including water use efficiency and run-off management, energy efficiency and soil and nutrient management.

Strategic priority: *Deliver rapid assistance and support sustained recovery.*

Coordinated emergency response

Supporting our primary industries in emergencies

The 2022 year saw a number of emergency responses to natural or biosecurity events.

NSW DPI Agriculture staff across the state have strong connections with primary industries, and so it's important that staff help in the hard times as well as the good times.

NSW DPI supported primary producers and communities through multiple flood events with the State Coordination Centre at Orange and the Agricultural Animal Services Functional Area (AASFA) being activated for each major event.

In terms of biosecurity risks, NSW DPI responded to over 1,984 notifications and conducted over 1,000 investigations of priority pests, diseases and weeds.

In June 2022, Varroa mite (Varroa destructor) was detected in two of six sentinel (surveillance) hives at the Port of Newcastle. Varroa mite is the number one biosecurity threat to the honey bee industry worldwide.

Since detection, an intensive response and eradication program has taken place with the establishment of emergency zones and then significant human effort to detect, sample, analyse and protect honey bee hives and dependent industries across the affected areas of the state.

NSW DPI worked closely with the apiary industry, Local Land Services, NSW Police, NSW Rural Fire Service and the community.

Within 60 days of initial response, NSW DPI had developed a pathway for pollinators to move bees for almond pollination.

The pollination season involved 90 beekeepers moving 80,000 hives, which each year is the largest movement of livestock at one time in NSW.

This was significant for industry, thanks to rigorous testing, contact tracing of hive movements and co-operation from the apiarists.

By the end of 2022, the Varroa mite emergency response surpassed 100 days and saw strong contact tracing work and comprehensive surveillance in which the NSW DPI response sampled more than 28,850 hives across the state.

Strategic priority: *Timely and proportionate response.*

Jaimys Arnott

Team Leader (Coorindation) and Lab Manager. Typically Business Support Officer

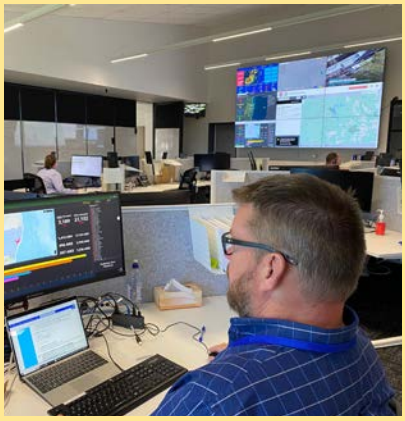
The team members I led were dedicated and enthusiastic. The most gratifying part of the work came from building relationships where we knew we could rely on one another to overcome the challenges faced each day. The work was often exhausting, but the comradery and good humour pushed me through.

Megan Dunford

Logistics support. Typically Schools Program Officer.

From a logistics point of view I was working out how to pull staff from across NSW to help out with surveillance, pollination and all the way to destruction phase

It's been interesting to connect with staff and other volunteers, and all working towards the one purpose

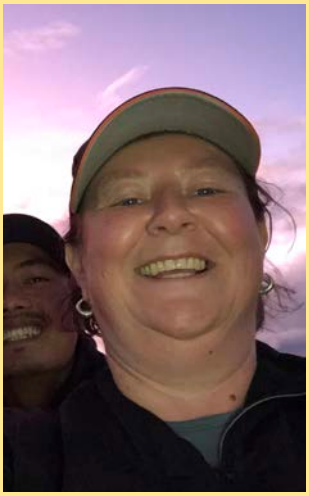


Sion Jones

Deputy Incident Controller, State Control Centre. Typically Director Extensive Livestock Systems.

Rachael Young

Field Crew Stores. Typically Coordinator, Climate Change Research Strategy.



I enjoyed working on the response as I got to meet people from across DPI, LLS, RFS and other agencies that I'd have never met. I enjoyed the challenge of taking on stores work which I've never done before all for the great cause of protecting our honey and bee industry in Australia.

Elizabeth Warden

Public Information Officer, State Control Centre. Typically Manager Communications, Agriculture.

I felt grateful that I could play a part in helping people involved in the apiary industry (and industries that require pollination as well) battle with Varroa. It was hard, tiring but very much worthwhile.

Getting to the core of apple recovery

Helping the horticulture industry prepare for and bounce back from bushfires

The apple industry is vulnerable to adverse events such as bushfires, drought and biosecurity outbreaks.

When the devastating bushfires of 2019-20 almost decimated apple orchards in parts of New South Wales and South Australia, NSW DPI in conjunction with South Australian Research and Development Institute and Hort Innovation, launched a five-year research program to help growers better respond to future fires.

Research and demonstration sites were established in Batlow, Bilpin and the Adelaide Hills to assess the impact of the fires on the trees, soil and the ecosystem.

By investigating how fruit and trees respond to fires, growers will be able to minimise the effects of bushfires, make better decisions about fruit marketability and tree recovery including whether to retain, renovate or replant trees.

Most of the orchard tree damage was from blow-torch fires, or direct flame or scorching caused by wind-driven heat. Initial results show that trees in blow-torch sites are gradually recovering from fire damage while trees in the slow-cooker (or smouldering) sites are struggling to recover.

At the end of the project, NSW DPI will develop guidelines to help growers get back on their feet quickly to meet full production levels and quality standards as soon as possible after a bushfire.

The findings from these studies will also be used to develop management strategies for other horticultural crops.

Strategic priority: *Deliver rapid assistance and support sustained recovery.*

Sustainable Resources and Productive Landscapes

Natural resources are managed to improve the environmental value and productive performance, for present and future generations

NSW DPI Grafton Primary Industries Institute

Clean Coastal Catchments project

Working with farmers to support sustainable agriculture and clean waterways

Farmers have an important role to play in protecting the health of our waterways now and in the future.

The Clean Coastal Catchments project is providing advice to farmers on how to keep sediment and nutrients on farm and out of coastal waterways and support profitable and sustainable agriculture.

NSW DPI is working with growers and peak industry bodies in key coastal areas to improve fertiliser knowledge and management for coastal agriculture and identify farm practices that will reduce losses of

nutrients and sediment from farms.

Better management of fertiliser and water on farm will help farmers be more productive, profitable and environmentally sustainable, while reducing negative impacts on coastal creeks and rivers and sensitive marine areas.

Updates on best practice management of fertiliser nutrients and erosion from key coastal demonstration sites is shared with farmers through regular webinars and workshops.

The project is funded through the NSW Government's $180 million 10-year Marine Estate Management Strategy to improve water quality for our ocean, estuaries, and coastal wetlands.

Strategic priority: *Improve the quality of the natural resource base.*

Dual-purpose perennial cereals

Exploring how dual purpose perennial crops can improve sustainability

Dual-purpose perennial crops are showing promising potential as a way for farmers to better manage climate variability, improve sustainability and on-farm profitability.

That's the finding of research being conducted by NSW DPI on perennial wheat that can provide fodder and harvestable grain without the annual costs.

Since 2008, researchers have been sourcing seeds from across the globe to develop perennial wheats suitable for Australian conditions.

Unlike annual crops which have to be planted every year, perennial crops can survive for up to four years, which takes a lot of pressure off farming systems – reducing the need for cultivating soil, resowing, and reducing other inputs such as fertilisers.

Reducing the frequency of soil disturbance and maintaining plant cover can also increase carbon sequestration and improve soil health and quality.

Perennial crops can also take advantage of out-of-season rain, which helps increase water-use efficiency, reduce soil acidification, salinisation and erosion.

Strategic priority: *Improve the quality of the natural resource base.*

Recognising cultural burning

Building and sharing traditional burning and land management knowledge

Cultural burns have been used by Aboriginal people for more than 60,000 years to care for Country, and maintain healthy, ecologically diverse and productive landscapes.

Now there is growing recognition of the value of cultural burning, including as a way to reduce the intensity and damage of bushfires on the rise because of climate change.

To continue to build knowledge and share understanding of cultural burning practices — also known as fire-stick farming or cool burning — NSW DPI's Tocal College offers a Certificate III in Conservation and Ecosystem Management, which specialises in Indigenous land management with a focus on using fire to improve ecosystem health.

The training program was delivered in partnership with Hunter Local Land Services and Firesticks Alliance, an Indigenous-led network that runs programs to build recognition of cultural fire management and to reintroduce it on lands owned and run by Aboriginal people.

The first program of its kind to be conducted in NSW, the course focuses on traditional fire management practices and techniques to train the fire practitioners of the future.

Students involved in the cultural burns are embracing the opportunity to connect to Country and learn traditional practices on caring for Country.

As part of the program, cultural burns have been conducted in the Hunter region in different vegetation and ecosystems from coastal heath to box-gum grassy woodlands and open grassy woodlands, teaching students how to use the correct fire knowledge to different types of vegetation to achieve the best outcomes for the landscape.

For instance, in Paynes Crossing, Indigenous fire practitioner Victor Steffensen worked with Aboriginal community members to share cultural burning knowledge and practices to provide a fire break for the Wonnarua Nation Aboriginal Corporation property which will increase and protect native endemic vegetation and protect cultural heritage values.

Traditional burning is not just about fuel reduction, but also about caring for Country, maintaining healthy, ecologically diverse and productive landscapes, and practicing cultural traditions.

The program will help share understanding of traditional burning and land management practices, which reduce weed infestations, improve the health of native vegetation, protect habitat for native animals and reduce the risks of bushfires.

Strategic priority: *Improve the quality of the natural resource base.*

Soil indicators for biodiversity

Measuring soil biology to improve farm profitability and sustainability

Maintaining healthy soil is one of the keys to a sustainable and profitable agriculture industry in NSW.

But our changing climate, the pressure to produce more food and fibre, and our increasing population are major challenges to successfully managing healthy soils.

New research by NSW DPI to measure soil biology is giving farmers more confidence in crop choice, sowing and herbicide management.

Each soil type has its own characteristics that influence land use and management. So, unearthing soil biodiversity — the millions of living organisms in the soil including bacteria, fungi, earthworms and termites — can improve sustainability through improved soil structure, water movement, nutrients and the suppression of pests and diseases.

In fact, one teaspoon of healthy soil can contain up to six billion microorganisms.

Protecting soil biodiversity will help to make our food system more resilient and more adaptable to changes in climate.

Strategic priority: *Assess and monitor natural resource health for sustainability.*

Supporting the NSW Agriculture Commissioner

Mr Daryl Quinlivan was appointed as the NSW Agriculture Commissioner in August 2020 to work with government and industry to resolve issues impacting the agriculture sector, especially in relation to land use conflict.

The commissioner undertook two reviews that involved:

- reviewing how agriculture can be better catered for in the planning system to reduce and manage land use conflict; and
- then reviewing the policy settings around the development of renewable energy facilities and associated infrastructure to ease the growing friction between these developments and agricultural production.

In July 2020, the Commissioner made 13 recommendations to better cater for agriculture in the planning framework, make it easier to do business and reduce land use conflict in his first report, titled Improving the Prospects for Agriculture and Regional Australia in the NSW Planning System.

NSW DPI has delivered on a number of the Commissioner's recommendations, including

- consulting on a draft State Significant Agricultural Land map to better identify this valuable land
- establishing a Paddock to Planning forum to share experiences and ideas about how to manage land use conflict.

In April 2022, the Commissioner released an issues paper Renewable Energy & Agriculture in NSW which invited interested parties to have their say on the renewable energy sector.

A total of 130 written submissions were received from a range of stakeholders.

The Commissioner also met with many individuals, businesses and representative groups, with these contributions and submissions were essential to informing this review and reflected the range of perspectives that were evident and consistent throughout this review.

In November 2022, the Commissioner made 29 recommendations to improve the policy framework to manage issues arising alongside the growth in the renewable energy and agriculture sectors in his second report, titled Renewable energy generation and agriculture in NSW's rural landscape and economy – growth sectors on a complementary path.

Strategic priority: *Govern natural resource use through modern policy and frameworks.*

Science & agricultural excellence

Duy Le, Cotton Pathologist, Australian Cotton Research Institute Narrabri

Industry recognition

JESSICA FEARNLEY

Development Officer Temperate Fruits

2022 RM Williams Royal Agricultural Society Rural Achiever

Always confident and willing to take the lead, Jessica is driven by her interest in research and development for the agricultural industry, wanting to see Australian farmers succeed with sustainable and global practices.

Not only is she aware of the pressing environmental impacts on the industry, but Jessica is also actively seeking ways in which to ensure the industry can attract and retain the next generation and safeguard their mental and fiscal health. With a Bachelor of Rural Science and partway through her Masters of Global Development, Jessica is one to lead by example and is well placed to help shape the future of farming and agricultural policies, and to engage others to work with her vision.

DARREN FAHEY

Development Officer Viticulture

Wine Science and Technology Award from the Australian Society of Viticulture and Oneology

This award honours an outstanding individual who demonstrates a broad positive contribution to the Australian wine industry and/or community, improvement from standard practice in their field through adoption of innovative practices, technologies or standards and contributes positively to the culture of their organisation and the broader wine industry.

Darren has been well and truly ticking these achievements off in his time with NSW DPI, working across the 16 wine regions of NSW/ACT, delivering the NSW Government-funded Viticulture Skills Development Program and the Wine Australia Regional Program in Greater NSW/Act on behalf of the NSW Wine Industry Association.

Darren and the team's work is published in the NSW DPI Grapevine Management Guide.

TONI PETRONAITIS

Research Officer

Grains Research Development Corporation Emerging Leader Award

Since starting with the NSW DPI, Ms Petronaitis has quickly adopted a leading role in understanding winter cereal pathogens and their activity, particularly looking at stubble-borne pathogens.

The work of Toni and her colleagues has shifted northern winter cereal disease research beyond the growing season and aims to understand pathogen trends after harvest and whether they're making it harder to control prominent diseases like crown rot, common root rot and yellow spot.

Industry recognition

DR LUKAS VAN ZWIETEN

Research Officer

Inaugural inductees to the Biochar Hall of Fame when the Australian New Zealand Biochar Industry Group

The award was in recognition of their contribution to the biochar industry in Australia, with over 20 years of biochar research and over 100 research papers published.

DR ANNETTE COWIE

Technical Specialist

Inaugural inductees to the Biochar Hall of Fame when the Australian New Zealand Biochar Industry Group

The award was in recognition of their contribution to the biochar industry in Australia, with over 20 years of biochar research and over 100 research papers published.

DR SP SINGH

Research Horticulturalist

Nominated for the HortConnections Conference National Awards of Excellence in Horticulture in the Researcher of the Year Award category. This awards recognise the outstanding contributions of a researcher to science, industry and profession.

Publications

NSW DPI Agriculture

- Berry plant protection guide
- Best practice in fresh produce traceability
- Early planting grain sorghum in northern NSW
- Grapevine management guide
- Grapevine red blotch virus
- Hazelnut growers handbook
- Insect and mite control in field crops
- Macadamia plant protection guide
- Managing blueberry rust
- Managing perennial horticultural crops during drought
- Northern NSW cropping research results
- Orchard plant protection guide
- Quality of Australian canola
- Rice crop protection guide
- Southern NSW cropping research results
- Summer crop management guide
- Summer cropping options for northern and central NSW 2022 guide
- Winter crop variety sowing guide

Tocal College

- Motorbikes and their use on farms
- Cropping systems for sustainable wheat production AgGuide
- The Tocal land and its people before and after 1822

Ebooks

- A field guide to four-wheel driving 4th ed.
- Australian native bees 2nd ed.
- Cropping systems for sustainable wheat production 2nd ed.
- Motorbikes and their use on farms
- Products of the hive
- Property planning 4th ed.
- Side by sides a practical guide 2nd ed.

Reprints and updates in 2022

- A field guide to four wheel driving 4th ed.
- Australian native bees 2nd ed.
- Bee AgSkills
- Cropping systems for sustainable wheat production 2nd ed.
- Fencing AgSkills
- Grasses of Coastal NSW

Primary school resources

- Investigate: Varroa mite teacher resource and student workbook for Stages 2-4. Written and updated to provide teachers with the latest content on the 2022 NSW varroa mite outbreak.

Secondary school resources

- Stage 4 Drones in agriculture learning materials and teaching guide.
- Stage 5 Industry Insights series poster, student workbook and answer guide titles including: Pork production, Common weeds of NSW, Crops and Pastures, Plant structure and function.

Women in Science

JESSICA FEARNLEY
Development Officer (Temperate Fruits)

I like working in science because of the ability to help solve problems that directly relate to farmers and help them to continue to produce quality produce.

LIZ FROST
Technical Specialist Bees

My dream job as Technical Specialist Bees allows me to enact real change for bee farmers, growers and ecosystem services through science and for my favourite organisms; insects!

JUSTINE COX
Leader Soil South

I love working out the best options for farmers to protect their soil and improve their fertility. In applied science research, we can compare a number of different methods or inputs on commercial farms, and evaluate them in real world conditions.

Justine has worked as a NSW DPI soil science researcher for 20 years, based in the far north coast of NSW. She has led and collaborated on projects assessing soil amendments and mulches, soil erosion control methods, soil biological indicators, and techniques to evaluate soil health, mostly in the horticultural industries.

Justine completed a Masters in Soil Science at the University of Hawaii in 2020, evaluating compost and biochar to retain nutrients and water in infertile, tropical soil. She helped develop a range of extension materials and workshops to upskill farmers in understanding the soil microbes and fauna in their soils, and contributed to the Northern Rivers Soil Health Card.


Jessica Rigg


Natalie Moore

Justine has experience in leading R&D teams in Soil, Water and Horticulture units within NSW DPI. Justine is the federal secretary of Soil Science Australia, and also has experience in organising conferences, field days and events.

NATALIE MOORE
Research Agronomist

Agricultural science helps to improve grain yield and quality, understand and solve problems and provide reliable information.

ESTHER QINGGAOZI ZHU
Research Officer, Climate Applications and Digital Agriculture

I like working in science because it solves practical problems mathematically, and assists with decision making from present to future.

JENNIFER WURTZEL
Research Officer, Climate Applications and Digital Agriculture

I love working in science because I love the thrill of solving problems, like pieces in a jigsaw, all working towards a bigger picture.

SARAH SULLIVAN
Leader Water R&D South

I love working in science because it's

S – satisfying
C – challenging
I – interesting
E – engaging
N – nourishing
C – compelling
E – enthralling

...and you never stop learning something new.

JESSICA RIGG
Research Officer Soil Microbiology

Science allows me to satisfy my curiosity about how and why the world works.

Ensuring scientific excellence

Professional and scientific officers, research scientists and technical staff progress through their research career in line with the Crown Employees (Department of Industry) Professional Officers Award.

The progression criteria for all grades require consistent and sustained performance, and contribution to NSW DPI's strategic plan.

It also requires the development of scientific qualifications and skills, and to undertake programs which will maximise benefits to themselves, our stakeholders and the Department with support and guidance from their supervisors.

Assessment is influenced by how well the applicant can provide objective and measurable statements to demonstrate how he/she has met each of the criteria as part of the scientific progression process.

The NSW Public Sector Capability Framework applies to all NSW public sector employees including these research staff.

Senior Principal Research Scientists

Annette Cowie
Technical Specialist Climate Policy

Paul Arthur
Leader Genetics

Lukas Van Zwieten
Research Officer

Harsh Raman
Canola Molecular Marker

Principal Research Scientists

Cathleen Waters
Leader Climate Research

De Li Liu
Climate Research Officer

John Golding
Research Horticulturist

Guangdi Li
Research Officer

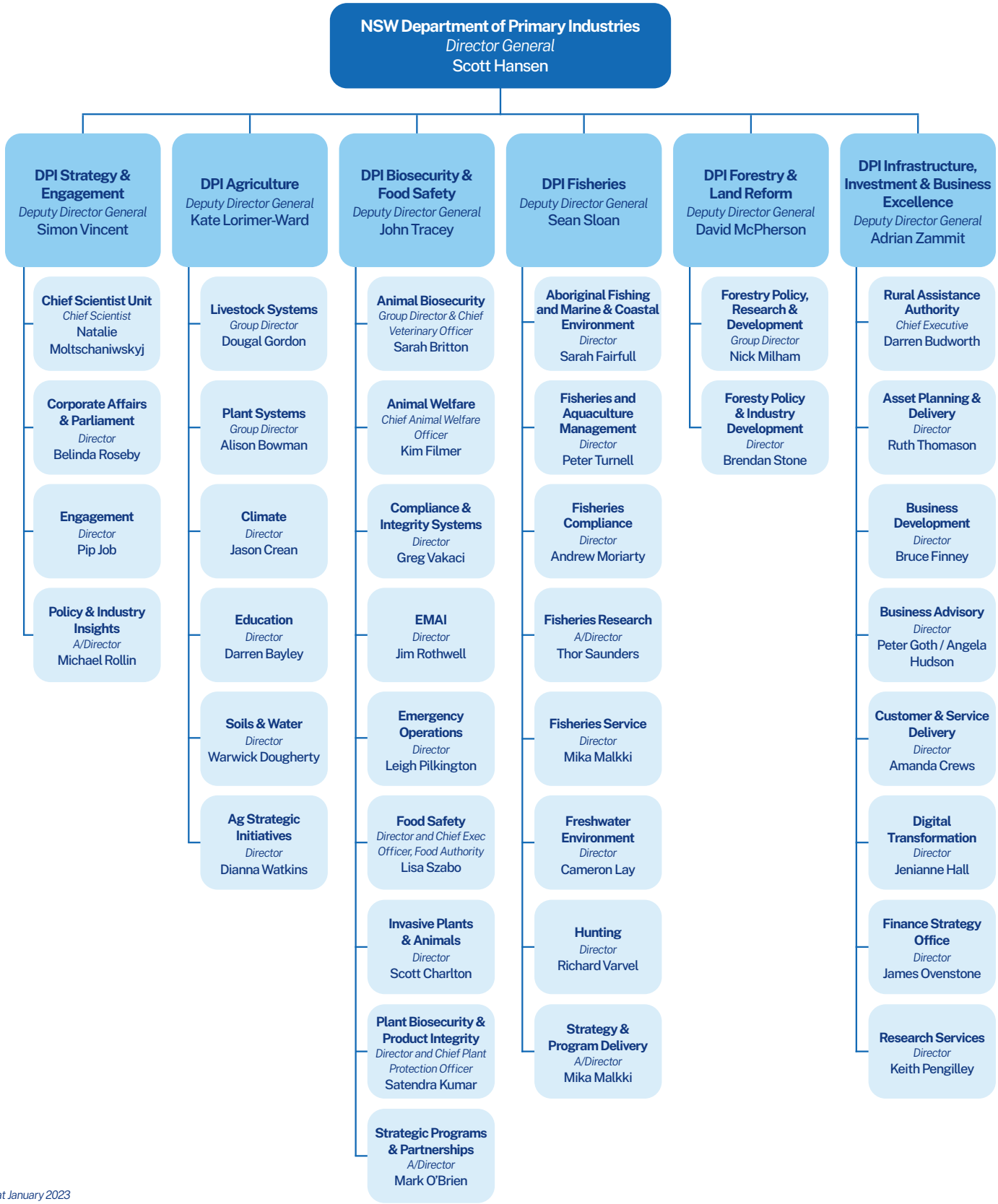
Michael Sissons
Cereal Chemist

Suzy Rogiers
Research Physiologist

Malcolm McPhee
Research Officer

Corporate governance

NSW DPI as an organisation



As at January 2023

Trusts

CB Alexander Foundation

The CB Alexander Foundation is constituted under the CB Alexander Foundation Incorporation Act No 61 1969.

The Foundation was created to promote and advance agricultural education through the Tocal college campus and other agricultural colleges or institutions in Australia, and maintain the upkeep of the Heritage Tocal Homestead Precinct.

Board members of the CB Foundation include:
Mr Scott Hansen
Director General NSW DPI (Chair)

Ms Kate Lorimer-Ward
Deputy Director General NSW DPI Agriculture (alternate Chair)

Dr Cameron Archer

Mr Simon Hugh Fraser

Ms Sarah Sivyer

Mr Gurmesh Singh MP
(Government representative)

Ms Susan Hunt (Ex-Officio)

Secretary:
Vicki Priest
Executive Officer Boards and Committees

Belgenny Farm Agricultural Heritage Centre Trust

The Trust aims to promote the heritage significance of the "Birthplace of Australian Agriculture" at Belgenny Farm through education, tourism and functions. Belgenny Farm is connected to the Macarthur family for dairy and merino sheep farming in the 1800's.

Trust Members:
Kate Lorimer-Ward, DDG NSW DPI Agriculture (Chair and sole Trustee whilst decisions are made on future planning of site).

Monthly Audit & Risk Committee meetings are being held with:
Darren Bayley, Director NSW DPI Education who is actively involved in decision making for site.

Vicki Priest, Secretary to the Trust, EO Boards & Committees NSW DPI and manages 3 x staff at site.
Lisa Southwood, Manager Strategic Finance NSW DPI Agriculture.

Farrer Memorial Trust

The Farrer Memorial Trust was established to perpetuate the memory of William James Farrer, Plant Breeder, and has a long-standing tradition since 1936 of providing encouragement and inspiration to those engaged in agricultural science in cropping fields. This is done through presentation of the annual Farrer Memorial Medal and student scholarships.

Trustees of the Farrer Memorial Trust:

Mr Scott Hansen
Director General, NSW DPI, and Chairman

Ms Kate Lorimer-Ward
Deputy Director General, NSW DPI Agriculture

Professor Alexander McBratney
Dean, Faculty of Agriculture and Environment, University of Sydney

Dr John C Radcliffe, *AM.*

Non-Official Trustees:
Geoffrey Mason, AM
Rohan Wilson
David Davidson

Secretary:
Vicki Priest
Executive Officer Boards and Committees

Helen Newton Turner Trust

The Helen Newton Turner Trust was established in 1993 following an anonymous donation to the Animal Genetics and Breeding Unit to perpetuate the memory of Helen Newton Turner and to encourage and inspire those engaged in animal genetics. The Trust provides two awards every two years that are named in honour of Dr Helen Newton Turner.

The first award is the prestigious Helen Newton Turner Medal to recognise significant achievement and outstanding contribution to advances in animal genetics in Australia.

The second, a new award established in 2021, the Helen Newton Turner Bright Futures Award, recognises the achievements of an up-and-coming individual who is showing evidence of establishing a reputation for excellence in the field of animal genetics within Australia.

Trustees of the Helen Newton Turner Trust:

Ms Kate Lorimer-Ward
Chair, NSW DPI Agriculture

Prof. Brian Kinghorn
Member, University of New England (UNE)

Dr Robert Banks
Member, Animal Genetics and Breeding Unit (AGBU) UNE

Prof. James Rowe
Member, National Farmers Federation (NFF)

Mr Ian Locke
Member, Association for the Advancement of Animal Breeding and Genetics (AAABG)

Secretary:
Vicki Priest
Executive Officer Boards and Committees

Rice Marketing Board for the State of NSW

The Rice Marketing Board for the State of New South Wales was the first commodity marketing board established in New South Wales under the Marketing of Primary Products Act, 1927, and was officially constituted by Proclamation on 9 November 1928.

The Board's primary function is to obtain the best possible monetary return to rice growers and operates under the authority of and in accordance with the Rice Marketing Act 1983.

Ms Victoria Taylor
GIA(Cert), GAICD–Chair

Ms Barbara Clark
BFA CA FAICD-Deputy Chair

Mr John Bradford
MAICD

Mr Ian Mason
MAICD

Ms Melissa De Bortoli
B.Bus(Acc). M.Prop. GAICD

Ms Donna Rygate
B EC (Hons), M Plan, GAICD, MPIA, FIPAA

Mr Rowan McMonnies
B Laws (Hons), M Comm, GAICD

Wine Grapes Marketing Board
(trading as Riverina Winegrape Growers)

Riverina Winegrape Growers represent the interests of winegrape growers within what is now the City of Griffith and the Shires of Leeton, Carrathool and Murrumbidgee.

Grower Elected Board Members:

Bruno Brombal *Chairman*

Robert Bellato *Deputy Chair*

Tony Baggio

Frank Alampi

Bruno Altin

Members appointed by the elected board:

Steven Barbon
Winegrape Grower

Domenic Schirrpa
Winegrape Grower

Chief Executive Officer:

The Board employs a full time Chief Executive Officer to undertake duties as instructed by the Board and to ensure compliance of the Board in accordance with Statutory Obligations. The Chief Executive Officer of the Board is Jeremy Cass.

Enablers for our business

NSW DPI AGRICULTURE'S ADOPTION FRAMEWORK

It has been estimated that two thirds of productivity increases in the agriculture sector arises directly from investment in research and development, and extension. NSW DPI Agriculture's Adoption Framework focusses on turning that research generated knowledge and invested into value for our agricultural stakeholders.

This value is typically found through an adoption in change of practice of behaviour that achieves economic growth or environmental or social benefits.

The Adoption Framework provides our program leaders, researchers and industry development staff a sound basis for planning, implementing and measuring practice change.

The framework delivers a consistent and rigorous approach to help achieve improved practices, accurate measures of impact and ensure greatest return on investment from research and development spend.

STRATEGIC INITIATIVES

NSW DPI Agriculture communications team work closely with our experts and stakeholder groups to deliver information at the right times of year, when our stakeholders are living and breathing it.

50 MEDIA RELEASES

120 SOCIAL POSTS

62K STAKEHOLDERS REACHED ON SOCIAL MEDIA

The NSW DPI Agriculture economics and biometrics team analyse and interpret data to understand the economic impact of our projects.

2 ECONOMISTS

2 BIOMETRICIANS

The NSW DPI Agriculture evaluation team demonstrates the impact of our projects, but building in evaluation from the start.

10 TIER ONE PROJECTS EVALUATED

The value and impact of NSW DPI Agriculture's investment informs a strong evidence-base for policy positions and decision-making for agriculture in NSW. NSW DPI Agriculture's policy team provide the appropriate policy and legislative settings to support industry.

134 CABINET SUBMISSIONS REVIEWED

57 CROSS-GOVERNMENT REQUESTS

Partnerships

NSW DPI Agriculture's strength is in the solid collaborations, networks and engagement with our partners.

We work closely with industry to solve problems. During the COVID-19 pandemic, NSW DPI was a champion for the needs of our primary industries, which included:

- Advocating for changes to Public Health Orders to address key primary industry issues (for example relaxation of isolation requirements for the food supply chain) and to support workforce
- Provided legal interpretation of Public Health Orders to industry
- Conducted regular formal and informal engagement with industry to understand their issues, concerns and recommendations to address challenges
- Provided regular communication with industry regarding changes to rules and requirements both in NSW and interstate
- Worked with COVID-19 affected businesses and NSW Health to help manage business continuity
- Set up a concierge service to manage COVID-19 queries and concerns
- Established a COVID-19 hub on its website. The hub includes FAQ's, border restriction information as well as links to other resources and information
- Reviewed relevant border application requests
- Assisted in the resolution of COVID-19 related industry issues such as border restrictions, auction bans and shearer shortages
- Worked with industry and the Commonwealth Government regarding contingency planning on matters such as potential destruction and disposal of animals.

Appendices

Appendix 1 - NSW DPI Agriculture Projects

A snapshot of projects within the NSW DPI Agriculture research and development portfolio

2016-17 multiparty process subsoil app
4.2.00 Mechanistic understanding
77LG303 - Grad 2 Build Research Capacity
Accelerating the development of tools
Addressing & reducing the impacts
Addressing hostile calcareous soils
Adult Education Delivery
Advanced phenotyping technologies
AFREN 2
A Genetic to Reduce Methane emissions
AGF Composition of Aust Honey PRJ-012227
AGF Hazelnut Productivity & Anal 2018-22
AGF Honey Bee Genetic Improvement Prog
AGF Professional Development Beekeepers
Ag Land Use Planning Education Program
Agro-Essence Spinosad 120 insecticide
AgSkilled
Alternative growing media
Amelioration of subsoil
A nationally consistent soil hydrology
Animal Genetics and Breeding Unit (AGBU)
An integrated pest mgt - Almonds
An integrated systems-based
An integrated systems-based approach
APAL Future Orchards 2021-2024
A property identification & phytosanitar
ARC Industrial Transformation Training
Aust. Pome Fruit Improvement Program
Australian Grains Genebank 2022-2023
Australian Honey Bush Fire Recovery
Australian Soil Network (ASN)
Authentication of Australian Tea TreeOil
Automatic Milking Systems
Autonomous robot for eradicating weeds
AWCC Quarantine Processing
AWI Merino Lifetime Productivity Project
BASF Provision of rhizobial services
Belgenny Farm
Benchmarking genetic gain in chickpea
Benchmarking in cotton industry sites
Benchmarking water productivity - cotton
BERTA Biosecurity emergency resp. training
Better Prep Low Risk Res Dairy
Better resp short term recov Dairy
Bio-refining to facilitate zero waste
Biodegradable mulches
BLG111 - Chickpea Increase&Stabilise Yld
BLG115 - Optimise Flowering Time & Yield
BLG116 - Pilot: Establishing GPII
BLG118 - Optimising Pulse
BLG119 Stability of early sown wheat
BLG120 Nitrogen use eff in Canola
BLG124 Quantifying wheat leaves to yield
BLG126 Value of companion cropping
BLG127 Safflower Agronomy & Pathology
BLG200 - Winter Crop Pathology
BLG206 - IDM 4 Broadleaf Crops Sth/Cnt
BLG207 - SNSW Winter Cereals IDM
BLG208 - Mgmt of Winter Cereal Diseases
BLG209 - Pulse IDM - Northern NSW/QLD
BLG215 - Implementation of PRR
BLG216 - Role of Pasture Legumes
BLG217 - Sclerotinia Stem Rot
BLG219 Oats to manage Fusarium crown rot
BLG310 - Maintaining Pulse Pathology
BLG311 - Graduate Training Program
Blueberry rust resistance screening - 1
Boards and Committees
Boosting profit and reducing risk
Buffer Guideline
Bushfire Recovery Public Land Audit
CADA Leadership & Team Management
CADA project development
Canola WUE and NUE
Centre for Organics Extension
Certificate 3 - CEM Indigenous training
Characteristics of disease sup
Chemical consultancies
Chickpea Breeding program - agreement
Citrus Food Safety
Citrus Industry IPDM extension program
Clean Technology - tropical legume
Climate App & Digital Agriculture
Climate Change Research Strategy DPI Climate Change Strategy
Climate Change Research Strategy Project 1: Clean Energy Solutions
Climate Change Research Strategy Project 2: Energy Efficiency Solution
Climate Change Research Strategy Project 4: Emission Reduction Pathway
Climate Change Research Strategy Project 5: Accessing Carbon Markets
Climate Change Research Strategy Project 6: Vulnerability Assessment
Climate Change Research Strategy Project 7: Smart Pilots
Climate Change Research Strategy Project 8: DPI Climate Change Strategy
Climate Impacts and Adaptation
Climate Leadership and Team Management
Climate modelling and Analysis
Climate modelling to predict animal dise
Climate Module Development Dairy
Climate Policy
Climate Preparedness and Biosecurity Inc
Climate Research
Climate Research
Climate Research, Leadership & Team
Climate Research, Project Development
Climate Risks for biosecurity priorities
Climate Vulnerability Assessment
Clover4Bees Pilot Project
Coastal Council Reference Group
Competitive Aust meat value chains
Consequences of ceasing red meat product
CottonInfo - Technical Lead Nutrition
CottonInfo Nutrition Water & Irrigation
CPCR Agar Plate Testing
CRC-P Growing Medicinal Cannabis
CRC HPS Management & Development
CRDC Evaluate Efficacy Novel Chemistries
CRDC Identifying the Trends & Drivers
CRDC Improved Management of Weeds
CRDC Min Yield - Max Yield Cotton Farm
CRDC Quantifying Potential Enviro Impact
CRDC Supporting Southern Cotton
CRDC Sustainable Insect Management
CSIRO (extension) Leveraging int'l
CSIRO New Viticulture Variety Project
Dairy Advocate procurement
Dairy Business for Future Climates
Decarbonisation Innovation Hub
Decision support for robotics in cotton

Deep sowing durum and bread wheat for cr
Delivering Integrated Management CN30
Designing New Forage Systems
DeSireBull: delivery to the beef industr
Develop and implement Codes of Practice in land use planning
Developing a mechanistic understanding
Development & validation of soil amelior
Devt of Profitable Grazing Learn Package
Diagnostic Residential 2022-Nematode T
Digital Delivery and Resources
Dispersive soil and soil structure
DPE Aboriginal Biodiversity Regional
DPI Schools Program
Drought Hub-building drought resilienc
Drought mgmnt of perennial Hort plants
DRSL HLN resilient pasture systems
EAP Desmanthus
EAP WWAI Methane Testing
Edible Shelter
Effective Fall armyworm pheromone blends
Enable adoption of a blockchain-based
Engineering novel amendments
Engineering the rhizosphere
Enhancing frost tolerance
Enhancing traceability in melon supply
Ensuring food safety in leafy vegetables
Evaluating the role of ecosys
Evaluation of bare earth herbicides
Evaluation of Canola Germplasm
Evaluation of new citrus varieties
Evaulation of GM wheat lines
Executive for NSW Agriculture Commissioner
Expanding crop protection options
Expansion of land management program
Expansion of Soybean in high rainfall
Extension & Communications Cherry Indust
Extension AU
extensionAUS Peri-Urban Bio Surveillance
Extension of Beef Shelf-Live
Faba Bean in Ethiopia
Faba Bean Pathology
Facilitating the development of the Aust
Fall armyworm resistance surveillance in
Farmer Options for Crops Saline Vietnam
Farming Forcaster validation
Farms of the Future 2
Farms of the Future Program
FCR inoculum production fee for service
Feeding strategies for sugar syrup
Field evaluation of new Syngenta
Field Study Rhizosheath
Field validation of lentil germplasm
Flood response and recovery options
Further development of Score 4 Sure
Future Proofing the soils of southern
Future Ready Regions EDIS Development
Generation of soil carbon dataset
Genetic technologies
Germplasm evaluation for flowering time
GHG Baseline & Mitigation
GHG baseline and mitigation options for
Goat Data Collection Phase 2
Grains Bilateral
Grazing Intelligence–smart grazing, hi
GRDC-Diagnostics and Surveliance
GRDC-Effect of Cereal Stubble Mgt
GRDC AGT Improve Phenotyping Crown Rot
GRDC Canola Pre-Breeding
GRDC Chickpea Collaboration Agreement
GRDC Common Seed Bulkup 2020-2024
GRDC Data Partnerships Initiative
GRDC DBAR
GRDC Improving Production-Canola Seed
GRDC Increasing Effectiveness Nitrogen
GRDC Integrating long coleoptile wheat
GRDC Maximising the Uptake of Phosphorus
GRDC National Variety Trials 2020-23
GRDC Northern Farming System (NFS)
GRDC NVT Pathology Services 2019-2023
GRDC Post Doctoral Fellowship
GRDC Resistance Surveillance
Greenhouse Gas Testing (Wollongbar)
Heat tolerance in Lentils
HIA Afourer Mandarin Bst Practice Canopy
HIA Citrus Postharvest Program
HIA Enhance Recovery Hort from Bushfires
HIA Evaluation New Citrus Varieties
HIA Evaluations of New Rootstocks
HIA Improving Citrus Quality
HIA Innovative Cold Plasma Hort Indust
HIA IPM Citrus Gall Wasp & Fuller's Rose
HIA Multi-scale Monitoring Tools
HIA National Tree Crop Intensification
HIA Novel Technologies
HIA Persimmon Varieties
HIA The IPM Program for Aus Macadmia Ind
High Performance pasture mix
Hort360 for a sustainable & resilient
Hybrid Evaluation for HSR Seeds
Identification, surveillance and advisor
Impact of root disease in pulse crops
Improved Australian apple and pear orcha
Improved drought resilience
Improved management Rutherglen Bug North
Improving canola heat tolerance
Improving Farming Systems Efficiency
Improving intake of supplements in EGS
Improving plant productivity through
Improving Soils in Perennial Horticultur
Improving the representation of soil
Improving the science water footprinting
Increasing lambing percentage preg scann
Industry Qualifications Diploma Programs
Innovative crop weed control
Insecticide resistance monitoring
Integrated management approaches
Integrated solutions for soil
Intensive Livestock-Alliances
LCTQMS
Leader Adoption
Lentil Breeding Program evaluation for N
Limited water decision support
LMA Project C-An improved model
Low methane Tropical legumes
Macadamia grower guide
Macadamia Regional Variety Trials S4
Management for serpentine leafminer
Management of cotton diseases
Managing Merino Weaners to Thrive
Managing Rangelands for drought resilien
Managing soil acidity for resilient GS
Mapping Yield Gap & Yield crops
Maximising the Omega-3 content
MC18002 Benchmarking the macadamia indus
MDC GrowPlan Development
MDC HRZ Legumes
MDC Inc Pasture Profit Inc Feed Efficie
MDC Increase Livestock Prod Tropic Past
MDC Low methane emission CN30
MDC Mixed Species Annual Fodders
MDC New Generation NIRS
MDC NLGC Southern Multibreed
MDC Novel Dual Purpose Perennial Cereals

MDC Reduce Methane Imp Productivity Beef
MDC SFIRP-Extensive Livestock
MDC Spectroscopic Verific Grassfed Beef
MDC Welfare Benchmarking Beef Cattle Ind
Melon Food Safety monitoring and support
MEMS Imp Water Quality&Reducing Litter
MerinoLink DNA
Methane mitigation MERiL
Methane supplements sheep MDC
Minimising impact of barley pathogens
MLA Soil Investment 4 Livestock Grazing
Monitoring loss of agricultural land
National Banana Development & Extension
National Hay Agronomy
National Lentil and Field Pea Breeding
National Phenology Initiative research
National rootstock evaluation and commer
National Soybean breeding program
NCR Central Agronomy Research
Neesh Foods Tritordeum Quality evaluatio
New Edge Microbials-Provision of rhizo
New tech anti-methanogenic pasture speci
North Chickpea Pre Breeding
Northwest Prograze
NSW dairy benchmarking project
NSW Dairy Farm Monitor Project
NSW DPI Winter Crop Management Guides
NSW DPI Winter Crop Management Guides
NSW Seasonal Conditions, Monitoring
Nutrients Testing -TAI
Nutritional value of cows
Objective real time assessment
On-farm carbon advice
On-shore cold treatment and mixed consig
Optimising genetic control of oat phenol
Optimising irrigation & nitrogen
Optimising pulse profitability
Optimising Sorghum
Optimising sorghum yield
Optimising yield-Project D
Overcome nutrient stratification in soil
P3-Economics of Intensive Systems
P9 Designer Milk-Unlocking Potential
Packaging and Spectroscopic ...Lamb
PCR Orchard Plant Protection Guide
PEQ Support-Aust Grains Genebank
Perennial and indigenous grains 2.0
Perennial Grains for Improved Agricultur
Phosphine resistance monitoring 2022
Plant based solutions
Predicting nitrogen cycling & losses
Preparedness & management of huánglóng
Profitable Viticulture Project
Property ID and traceability systems
Protecting Ethiopian Lentil Crops
Provision of Rhizobial services
Provision of Technical Advice-Grains
Provision Tech Advice-Oils and Pulses
Pulse & Oilseeds North Sandpit
Quantifying the benefits of breeding
Quantifying the potential environment
Quantifying yield loss from frost & heat
Radicle Seeds 2223 Sorghum Hybrids
Rangeland Living Skin
Rangelands producer network
Rangelands Rehydration
Re-sampling of CAMBI sites
Real Time Screening of Residues
Redox in the rhizosphere SPJA4.S.001
Reducing risks to canola establishment
Refining body condition score
Regional demo integrated weed management
Regional evaluation of new germsplasm
Regional Plan-Riverina 2017-22
Regional Program Riverina 2022-2023
Regional Soils Coordinator
Remote sensing-rice water productivity
Research collaboration for PhD students
Research Officer-Pulse Pathologist
Resistance monitoring for insect pests
Resistance surveillance for sustainable
Restoring biodiverse pastures resilient
Restoring perennial pastures for resilie
Review opportunities Avocado Production
Safflower agronomy
Sardi Wine Irrigation Riverina
Science & Innovation Awards
Sclerotinia in the farming systems
Screening Biopesticide for BASF
Screening biopesticides
Serradellas for new environments
SFIRP-Storm Flood Ind Recovery Package
SFIRP Understanding waterlogged soils
Skills Development Program
Smallstock Traceability Pilot Study
SMB Retail Beef Yield
Soil biological indicators
Soil monitoring program
Soil Science Challenge-Demystifying
Soil water storage
Spectroscopic technology for the rapid
State Significant Agricultural Land mapping
Stockplan Plus; drought preparedness
Strategies to increase Omega 3 in beef
Sub-tenancy agreement Deniliquin SPS
Sugarcane Coastal Drain Management
Supply of rhizobial strains
Sustainable pathways to CN30
The Business of Dairy Podcast
The Potential of Microbial Inoculants
Trace Minerals affects on heifer fert
Tracking on-farm greenhouse gas emission
Turning organic residues meat
Vitamins ADE to minimise difficult birth
Viticulture Pilot Track & Trace
Viticulture Sustainability Develop Offic
VM21001 Quality improvements
Vulnerability Assessment 2.0
Wild cicer chickpea chilling
Wine Aust. Regional Program GreaterNSW
Wine Australia Regional Program
Youth Bee training program
Youth Education Delivery
Youth Network-Pilot Program NSW

Department of Primary Industries
Department of Regional NSW

Agriculture Annual Report

2022

March 2023

NSW GOVERNMENT