AGRICULTURE, HORTICULTURE AND CONSERVATION AND LAND MANAGEMENT INDUSTRY SECTOR

IRC Skills Forecast and Proposed Schedule of Work

2018–2021

Prepared on behalf of the Agriculture and Production Horticulture Industry Reference Committee and the Amenity Horticulture, Landscaping, Conservation and Land Management Industry Reference Committee for the Australian Industry and Skills Committee (AISC).

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IRC SKILLS FORECAST AND PROPOSED SCHEDULE OF WORK 2018–2021

Purpose

This *IRC Skills Forecast* represents the latest industry intelligence and resulting schedule of work of the Agriculture and Production Horticulture Industry Reference Committee (IRC) and the Amenity Horticulture, Landscaping, Conservation and Land Management Industry Reference Committee. It was developed through research of national and industry data sources and ongoing input from IRC members and key stakeholders. The report is designed to provide industry intelligence to support the Australian Industry and Skills Committee's four-year rolling National Schedule of training product development and review work.

The industry intelligence component covers the following topics:

- **Sector overview:** examining the depth and breadth of the industry, and identifying the macro-environmental forces that currently challenge and/or provide opportunities.
- **Employment:** reviewing the employment projections by the Department of Employment, and outlining of the current workforce profile and supply for the industry.
- **Skills outlook:** identifying the key priority skills for the industry and how they can benefit from improvement or development of national skill standards
- **Training product review work plan:** establishing the scope and timeframe of proposed training package development in line with industry priority skills.

Administrative Information

Name of applicable Industry Reference Committees (IRC):	1. Agriculture and Production Horticulture 2. Amenity Horticulture, Landscaping, Conservation and Land Management
Name of applicable Skills Service Organisation (SSO):	Skills Impact Ltd

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A. Executive summary

This report provides an overview of workforce development and skills needs for the Australian agriculture, horticulture and conservation and land management industry sectors. The report was commissioned to support the Australian Industry and Skills Committee (AISC) in developing the four-year rolling National Schedule of training product development and review work. The report is structured, as per the AISC template, in four main sections: 'Sector overview', 'Employment', 'Skills outlook' and 'Training product review plan 2018–2020'. Methods of analysis included research of published national and industry data sources, and input from Industry Reference Committee (IRC) members and key stakeholders.

The report draws attention to the fact that exponential population growth – which will increase the needs for food, stockfeed, fibre and other products – provides the agriculture industry with the potential for growth and new business opportunities. These opportunities are also shaped by current government policies including free trade agreements. Furthermore, governmental initiatives such as building brand awareness for Australia aim to promote global recognition for the nation as a producer of safe, clean agricultural crops and fibre products, and a producer that integrates animal-welfare and on-farm and regional biosecurity measures. Precision agriculture, including digital technologies, analytics and emerging technologies, will help the industry to increase its productivity and profitability.

The report describes the industry sector's workforce – consistent with many other industry sectors – as reaching retirement age in high numbers. This is creating significant challenges for employers, particularly with respect to their ability to attract people to the industry, and to develop employees' skills through on-the-job learning and formal training.

Importantly, the report shows that employers in most workplaces will seek employees with high-level skills, both industry-specific and non-industry specific, to support more demanding job functions. The utilisation of more specialist skills is driven by growing technological developments, and by adoption of new technologies for use in agricultural production systems. Businesses are responding to these opportunities with growing investment in new technology; through strategies for better connectivity with, and service to, domestic and international markets; and through ongoing biosecurity strategies – for example, programs to control invasive species, amongst other innovations. In this context, the workforce needs job-specific skills to support higher efficiency targets, innovations and increasing automation and digitalisation.

The right mix of high-level skills will allow the agriculture, horticulture and conservation and land management industries to capture all the benefits offered by technology. Examples of high-level skills include a range of skills in the science technology engineering and mathematics (STEM) fields, and compliance and leadership areas.

Summary of key points in each section

Sector overview

- The agriculture, horticulture and conservation and land management industry can be described as having eight sectors: amenity horticulture, production horticulture, broadacre farming, livestock farming, mixed crop and livestock farming, agriculture support services, wholesaling, and conservation and land management. The industry can also be described in more detail through a range of sub-sectors.
- In 2016, the industry was represented by more than 168,917 businesses/organisations ?? across agriculture, horticulture, agricultural product wholesaling and parks and garden operations, and directly employed 273,947 people. Almost 70 per cent of these businesses are owner-operated, non-employing farms. Of the remaining businesses, most employ fewer than 20 people. This leaves only a small percentage of agribusinesses that employ more than 20 people.
- Total sales turnover of the agriculture sectors increased by 10.1 per cent (or $7.4 billion) from 73.4 billion in 2015 to $80.8 billion in 2016.
- The industry is represented at a national level by more than 206 peak organisations, including industry and industry sub-sector associations, and industry service bodies such as research and development corporations, professional associations, employee associations and regulatory bodies.
- Key regulations for the industry include, or are related to the following: regulation of genetically modified crops, environmental regulations, food regulations, grape-growing legislation, livestock management legislation, the Australian ruminant feed ban, biosecurity legislations, live-animal export legislation, conservation laws, industry codes of conduct, grain-trade standards and legislation, international regulations and access to markets, and industry certification programs.
- There are regulated occupations[1] that are specific to the industry sectors – for example, landscapers, who must be registered with the relevant state/territory building practitioners' board to carry out large-scale structural landscaping, and professional arborists, who need to meet several requirements stipulated by WorkCover and industry associations.
- Key macro forces that currently challenge and provide opportunities for the industry's sectors include:
    - the significance of global food security and higher food demand in expanding markets such as the Asia-Pacific region, which is being reflected in a number of government policies aimed at facilitating growth in the sector (e.g. free trade agreements)
    - national and state-/territory-based biosecurity policies and strategies could have a negative impact on production and access to markets
    - increasing international trade – the Australian agriculture industry is a competitive net-exports sector, with around two-thirds of total production being exported
    - climate change and its effects – many producers capitalise on technology innovations (e.g. biotechnology) aimed at supporting the development of more resilient crop varieties and large-scale farming systems

[1] Regulated occupations have legal (or industry) requirements or restrictions to perform the work. Regulated occupations require a licence from, or registration by, a professional association or occupational licensing authority.

- new global farming trends, including growth of new food sources (e.g. seaweed); improved pharmaceuticals (e.g. bugs on food and agricultural waste) and new sources of stockfeed and fertiliser
- the development of precision agriculture technologies – for example, drones and new chemical solutions – that help growers to increase productivity.

Employment

- The industry workforce is ageing. The proportion of employees in each age group category over 60 years increased by up to 3 per cent in 2016, when compared with 2006.
- Men constituted 68 per cent of all employees in the industry in 2016. The proportion of male and female participation did not change from 2006.
- The most common occupation in the industry is livestock farmers. Other popular occupations include crop farmers, mixed crop and livestock farmers, livestock farm workers and crop farm workers.
- A significant number of the industry's workforce occupy roles that are unique and specific to the relevant sub-sectors, such as livestock and crop farmers, farm workers, shearers, agricultural and horticultural plant operators, nurserypersons and other nursery workers, and gardeners. A significant proportion of the workforce is also employed to undertake more general roles, such as clerical and administrative work.
- The proportion of sales assistants, auctioneer and stock and station agents, salespersons, financial brokers, sales managers and farm managers (as a percentage of total employees per industry sector) increased in the industry from 2006 to 2016. The proportion of livestock farmers and mixed crop and livestock farmers decreased by more than 5 per cent each across the industry.
- Total employment in the industry is expected to remain relatively stable over the next five years.
- In 2016, there were 73,513 student enrolments in AHC qualifications and 556,680 in AHC units of competency.

Skills outlook

- Priority skills in the agriculture, horticulture and conservation and land management industry over the next four years, 2018–2021, are summarised in the following table

AMENITY HORTICULTURE, LANDSCAPING, CONSERVATION AND LAND MANAGEMENT IRC		
Priority skill	**Drivers**	**Training package solution**[2]
Conservation and land management	The IRC has identified that the current Conservation and Land Management Qualifications and Units of Competencies do not reflect modern industry practices in respect of land management, restoration projects and cultural inclusion.	• Review 6 qualifications • Review 150 units

[2] For a full list or relevant qualifications and units of competencies, refer to Attachment C.

Production nurseries skills in integrated pest management, growing media and environmental control	The current qualifications encourage an overreliance on chemicals to manage plant pests and diseases. Current development of new variants of agricultural chemicals and integrated pest management strategies are key skills areas that are needed in this industry. Industry and trainers have commented on the structure of the qualifications, indicating that the use of generic units of competency do not provide the necessary skill sets for pest management, soil management and efficient irrigation systems.	• Develop 1 new skill set and unit as identified during review • Review 2 qualifications • Review 34 units across production nursery
Landscape qualifications: pathways and ecology	The LNA Master Landscapers Association has highlighted that there are no clear pathways for landscape construction or landscape design roles. Industry workers are missing key skills in ecology, ecological sustainability and there is growing need for such skills during design and construction phases of work.	• Develop 5 new skill sets • Develop 20 new units as identified during review • Review 3 qualifications • Review 32 units
Sports turf skills update	Changes in turf management practices need to be addressed in the units of competency. These include: • increase use of technology in monitoring turf surface health and usability • increase use of growth regulators as an integral part of surface maintenance • machinery technology, use of GPS, hydraulics, hybrid/battery machines the unit *AHCTRF303 Implement a grassed area maintenance program* no longer meets industry requirements.	• Develop 4 new skill sets • Develop up to 5 new units as identified during review • Review 2 qualifications • Review 38 units
Rooftop and vertical gardening	Population growth in the cities is influencing government policies around sustainable living and urban greening within high-density living areas. There will be increasing demand for skills in developing rooftop gardens and green walls.	• Develop 1 new qualification • Develop 5 new skills sets • Develop up to 25 new units as identified in the review
	•	•

Carbon farming skill sets	Support from the National Farmers' Federation for farmers to access the Emissions Reduction Fund, and a growing interest from farmers to diversify farming activities and income, have increased awareness of carbon farming. Currently, there is no nationally-endorsed training available for farmers or managers to fill this growing skills gap.	• Develop up to 8 new skill sets and units as identified during review • Review 11 units
Permaculture review	The low number of RTOs that have permaculture qualifications on scope may be the cause of inherent issues within the qualifications. The IRC has identified that Certificates II, III and IV need to be reviewed.	• Review 3 qualifications

AGRICULTURE AND PRODUCTION HORTICULTURE IRC		
Priority skill	**Drivers**	**Training package solution**[3]
Protected horticulture	The Australian protected cropping industry is the fastest growing food producing sector in Australia. With farmgate value at $1.3 billion per year, this is equivalent to 20 per cent of the total value of vegetable and flower production. The industry employs 10,000 people and is expanding at a rate of 4–6 per cent per year. Current investment is conservatively valued at $975 million, with annual investment at $50 million per year.	• Develop 2 new qualifications at AQF 3 and 4 levels • Develop 5 new skill sets as identified during review • Develop 25 new units
Irrigation technology, design and processes	There is ongoing implementation of new processes and technologies in irrigation. The IRC identified that existing units need to be reviewed and updated to ensure that different types of irrigation (e.g. broadacre, gravity-fed, pressurised, domestic/urban irrigation) reflect these technological and process changes.	• Develop 5 new skills sets as identified during review • Develop 25 new units as identified during review • Review 4 qualifications • Review 48 units
Agricultural skills in data	With growing investment in integrated world-leading technology (such as robotics and digital and wireless technology to monitor farm operations and detect issues with crop	• Develop 3 new skill sets • Develop 10 new units as identified during review

[3] For a full list or relevant qualifications and units of competencies, refer to Attachment A.

AGRICULTURE AND PRODUCTION HORTICULTURE IRC		
Priority skill	**Drivers**	**Training package solution[3]**
capture and analysis	or livestock health) there is a need for skills in data capture and analysis.	• Review 4 qualifications • Review 7 units
Biosecurity skill sets	Current government policies support Australian agribusinesses to remain free from exotic pests and diseases, in addition to reducing infectious diseases within Australia.	• Develop up to 5 new skills sets • Develop up to 25 new units
Agribusiness innovation and farmgate value-adding	Australia is experiencing increasing market demands for innovation in product development, to ensure the viability of enterprises and to take advantage of opportunities in the new free trade agreement with Asian Pacific partners.	• Develop 1 new skill set • Develop new units as identified during review • Review 3 qualifications • Review 51 units
Compliance and regulation of medicinal crops	New legislation allowing for the production of medicinal cannabis and poppies has led to a growth in the medicinal crop industry. New skills will be emerging related to growing and harvesting the crops, security, understanding and implementing compliance and government regulation.	• Develop up to 4 new skill sets • Develop up to 25 new units as identified during review
Diploma of Viticulture review.	Industry has expressed concerns over the job outcomes of the Diploma of Viticulture and its role in the wine industry. It appears that industry does not recognise the Diploma of Viticulture, and that at this level, employers focus on skills in leadership and management, not specialist viticulture.	• Develop 1 new skill set • Develop units as identified during review • Review 1 qualification • Review 11 units

B. SECTOR OVERVIEW

Sector description

The agriculture, horticulture and conservation and land management industry sector is highly diverse, integrating all businesses that operate in the following sub-sectors:

Amenity horticulture

- Arboriculture
- Landscape services
- Gardening services
- Turf and sports turf management

Production horticulture

- Turf production (commercial)
- Nursery production
- Retail nursery
- Floriculture production
- Vegetable growing
- Fruit tree growing
- Nut tree growing

Broadacre farming

- Grain growing
- Fodder growing
- Sugar cane growing
- Cotton growing
- Seed production

Livestock farming

- Sheep farming
- Beef cattle farming
- Sheep-beef cattle farming
- Dairy cattle farming
- Poultry farming
- Other livestock farming

Mixed crop and livestock farming

- Grain-sheep or grain-beef cattle farming

Agriculture support services

- Shearing, cropping and agricultural support service
- Grain storage services

Agricultural product wholesaling

- Fruit and vegetable wholesaling
- Cereal grain wholesaling
- Wool wholesaling
- Fish and seafood wholesaling

Conservation

- National Parks
- Nature Reserves
- Council reserves
- Corridors (national, state and local)
- Farms
- Indigenous Protected lands and Seas
- Botanical gardens
- Landcare
- Coastcare
- Rivercare
- Private land

In 2016, the industry was represented by 168,917 businesses across agriculture, horticulture, agricultural product wholesaling and parks and gardens operations,[4] and directly employed 273,947 people. About 261,000 people were employed in the agriculture and wholesaling sectors and 12,947 in the parks and gardens operations sector.[5]

Seventy per cent of all agricultural businesses were non-employing farms and 29 per cent employed fewer than 20 people.

Around three-quarters of these businesses were sheep, beef cattle and grain farms, fruit and tree nut growers, agriculture support services and dairy cattle farmers.

In 2016, the agriculture contribution to the Australian economy consisted of: [6]

- a total sales turnover of $80.7 billion, which increased by 10.1 per cent (or $7.4 billion) from 2015
- an industry value-added of $26.2 billion, which increased by 3.3 per cent (or $845 million) from 2015.

Relevant training package qualifications

The training package for the agriculture, horticulture and conservation and land management industry sector is *AHC – Agriculture, Horticulture and Conservation and Land Management*. AHC comprises 97 qualifications, 46 skill sets and 882 units of competency.

AHC QUALIFICATIONS
Qualification Level: Certificate I
Certificate I in AgriFood Operations
Certificate I in Conservation and Land Management
Certificate I in Horticulture
Certificate I in Permaculture
Qualification Level: Certificate II
Certificate II in Agriculture
Certificate II in Arboriculture
Certificate II in Conservation and Land Management
Certificate II in Floriculture
Certificate II in Horticulture
Certificate II in Irrigation
Certificate II in Landscaping
Certificate II in Parks and Gardens
Certificate II in Permaculture
Certificate II in Production Horticulture
Certificate II in Production Nursery
Certificate II in Retail Nursery
Certificate II in Rural Operations
Certificate II in Shearing
Certificate II in Sports Turf Management
Certificate II in Wool Handling

[4] Australian Bureau of Statistics, 2017, 'Counts of Australian businesses, including entries and exits, June 2012 to June 2016', viewed April 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202012%20to%20Jun%202016?OpenDocument.
[5] Australian Bureau of Statistics, 2016 Census
[6] Australian Bureau of Statistics, 2014, *Australian Industry, 2013–14*, Cat No 8155.0.

AHC QUALIFICATIONS

Qualification Level: Certificate III

Certificate III in Aboriginal Sites Work
Certificate III in Advanced Wool Handling
Certificate III in Agriculture
Certificate III in Agriculture (Dairy Production)
Certificate III in Arboriculture
Certificate III in Beekeeping
Certificate III in Commercial Composting
Certificate III in Commercial Seed Processing
Certificate III in Conservation and Land Management
Certificate III in Conservation Earthworks
Certificate III in Feedlot Operations
Certificate III in Floriculture
Certificate III in Horticulture
Certificate III in Indigenous Land Management
Certificate III in Irrigation
Certificate III in Lands, Parks and Wildlife
Certificate III in Landscape Construction
Certificate III in Natural Area Restoration
Certificate III in Parks and Gardens
Certificate III in Permaculture
Certificate III in Pest Management
Certificate III in Pork Production
Certificate III in Poultry Production
Certificate III in Production Horticulture
Certificate III in Production Nursery
Certificate III in Retail Nursery
Certificate III in Rural Machinery Operations
Certificate III in Rural Merchandising
Certificate III in Rural Operations
Certificate III in Seed Production
Certificate III in Seed Testing
Certificate III in Shearing
Certificate III in Sports Turf Management
Certificate III in Wool Clip Preparation

Qualification Level: Certificate IV

Certificate IV in Agribusiness
Certificate IV in Agriculture
Certificate IV in Arboriculture
Certificate IV in Conservation and Land Management
Certificate IV in Horticulture
Certificate IV in Irrigation
Certificate IV in Landscape
Certificate IV in Organic Farming
Certificate IV in Parks and Gardens

AHC QUALIFICATIONS

Certificate IV in Permaculture
Certificate IV in Pest Management
Certificate IV in Production Horticulture
Certificate IV in Production Nursery
Certificate IV in Retail Nursery
Certificate IV in Seed Production
Certificate IV in Seed Testing
Certificate IV in Shearing Contracting
Certificate IV in Sports Turf Management
Certificate IV in Wool Classing

Qualification Level: Diploma

Diploma of Agribusiness Management
Diploma of Agriculture
Diploma of Arboriculture
Diploma of Community Coordination and Facilitation
Diploma of Conservation and Land Management
Diploma of Horticulture
Diploma of Irrigation Management
Diploma of Landscape Design
Diploma of Landscape Project Management
Diploma of Organic Farming
Diploma of Parks and Gardens Management
Diploma of Permaculture
Diploma of Pest Management
Diploma of Pork Production
Diploma of Production Horticulture
Diploma of Production Nursery Management
Diploma of Retail Nursery Management
Diploma of Sports Turf Management
Diploma of Viticulture

Qualification Level: Advanced Diploma

Advanced Diploma of Agribusiness Management
Advanced Diploma of Arboriculture
Advanced Diploma of Conservation and Land Management
Advanced Diploma of Horticulture

Qualification Level: Graduate Diploma

Graduate Diploma of Arboriculture

Sector analysis

Description of sub-sectors and analysis of businesses involved

Amenity horticulture

Sub-sector name	Arboriculture services
Scope of work	Businesses in this sector include practising arborists and consultants who conduct tree-care operations, or diverse specialist arboriculture services. Areas of operations include: • utility clearance – eliminating contact between vegetation and power lines and maintaining clearances from infrastructure • tree care – planting, pruning and tree removal in urban areas, in confined spaces surrounded by buildings and in open spaces such as parks • providing services such as tree-climbing, seed collection, ecological and habitat work, and canopy access for hardware installations such as lights or fauna monitoring.
Companies	Arboriculture practitioners are generally small operators, servicing local or regional communities.
Geographical location	Australian states with the largest number of arboriculture services businesses include NSW, QLD and VIC.
Automation and digitalisation	The sub-sector requires operations that involve working at height and with specialised equipment, including chainsaws and skid-steer machinery. Global information systems and mapping are also used to provide the location and specifics of trees or vegetation (or other features) to facilitate planning, management and risk mitigation.

Sub-sector name	Gardening services
Scope of work	Businesses in this sector are engaged in providing gardening services, including lawn-care service (e.g. fertilising, seeding, spraying), lawn mowing, and maintenance of plants and shrubs.
Companies	In June 2016, there were 11,051 gardening businesses in Australia.[7] More than half (65 per cent) are non-employing businesses. Many others (34 per cent) are small businesses, employing fewer than 20 people. The sub-sector also includes a number of large operators, which often operate as franchise businesses.

[7] Australian Bureau of Statistics, 2017, 'Counts of Australian businesses, including entries and exits, June 2012 to June 2016', viewed April 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202012%20to%20Jun%202016?OpenDocument.

Sub-sector name	Gardening services
Geographical location	Gardening services activities occur in all Australian states, yet NSW, VIC, QLD and WA combined host 89 per cent of all gardening businesses.
Automation and digitalisation	Technology used in this industry includes mobile communications, blowers, lawn edgers, line trimmers and chainsaws.

Sub-sector name	Landscape construction services
Scope of work	The sector comprises companies that construct landscapes, which may include planting, land forming, the provision of retaining walls and paths, and the installation of garden drainage control, garden watering systems and structural garden features. The sub-sector also includes businesses that provide landscape consultancy and design services.
Companies	In June 2016, there were 14,751 landscape businesses in Australia.[8] Just above half (56 per cent) are non-employing businesses that mainly service residential markets. Many others (42 per cent) are small businesses employing fewer than 20 people. The sector also includes a number of large operators, which dominate commercial work.
Geographical location	Landscape services activities occur in all Australian states, yet NSW, VIC and QLD together host 75 per cent of all landscape businesses.
Automation and digitalisation	Computer-aided design (CAD) technology is widely used by landscape architects and designers. CAD techniques are used by larger landscaping service contractors to more efficiently plan and allocate resources on a project.

Sub-sector name	Turf growing
Scope of work	This sector comprises companies that grow and harvest turf, including sports turf, grass and lawn. The turf product is sold to landscapers, households, governments, sport venues, revegetation contractors, and plant hire and garden service providers. The sector also includes companies that manage golf-course maintenance.
Producers	In June 2016, there were 481 operating turf growers in Australia.[9] Most turf growers operate on a small scale, employing fewer than 20 people or

[8] Australian Bureau of Statistics, 2017, 'Counts of Australian businesses, including entries and exits, June 2012 to June 2016', viewed April 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202012%20to%20Jun%202016?OpenDocument.
[9] Ibid.

Sub-sector name	Turf growing
	operating as sole traders. Industry indicates that data related to the turf growing industry are often underreported.
Geographical location	Turf growing activities occur in NSW, QLD, WA and VIC, with NSW and QLD having the largest share (71 per cent)[10] of turf growers.
Automation and digitalisation	This sub-sector, particularly larger processors, integrates automated processes and digital systems that provide computer-controlled watering and monitoring systems. Operators use tractors to seed, fertilise and maintain turf.

Production horticulture

Sub-sector name	Nursery production and retail
Scope of work	Businesses in this sub-sector are involved in growing trees, shrubs, ornamental plants and bulbs. These businesses sell to retailers or wholesalers, landscapers, local government and councils, and orchardists. Nursery production is organised into both under-cover and outdoor production systems.
Producers	The sector comprised 1,159 nursery producers in June 2016, consisting of 382 under-cover producers and 777 outdoor producers. The sector is dominated by small (40 per cent) or non-employing family operators (55 per cent).[11] There is a small number of medium-sized private companies. There is also a degree of public-sector participation in the industry, such as government and municipal nurseries.
Geographical location	Nursery production occurs predominantly along the eastern seaboard of Australia. The majority of business activity (84 per cent)[12] is concentrated in NSW, VIC and QLD.
Automation and digitalisation	The level of integration of digital technology depends on the scale of production. Some producers are using computer-based systems and software to achieve better inventory and production planning, and improved distribution systems.

[10] Horticulture Innovation Australia, 2016, *Australian Horticulture Statistics Handbook: Other Horticulture – 2014–15*, viewed April 2017, http://horticulture.com.au/wp-content/uploads/2016/10/Australian-Horticulture-Statistics-Handbook-Other.pdf.
[11] Australian Bureau of Statistics, 2017, 'Counts of Australian businesses, including entries and exits, June 2012 to June 2016', viewed April 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202012%20to%20Jun%202016?OpenDocument.
[12] Horticulture Innovation Australia, 2016, *Australian Horticulture Statistics Handbook: Other Horticulture – 2014–15*, viewed April 2017, http://horticulture.com.au/wp-content/uploads/2016/10/Australian-Horticulture-Statistics-Handbook-Other.pdf.

Sub-sector name	Floriculture production
Scope of work	Producers in this sub-sector grow or produce flowers, foliage and seeds, either outdoors or in greenhouses, cold frames, and cloth or lath houses. Floriculture production is organised into both under-cover and outdoor production systems.
Producers	In June 2016, there were 786 floriculture producers in Australia, comprising 175 under-cover producers and 611 outdoor producers.[13] Most of these were non-employing, family-owned businesses or small-employing operators. The sub-sector has a small number of medium-sized floriculture producers.
Geographical location	While floriculture producers are located in most Australian states, the sector is concentrated in VIC, NSW and QLD (74 per cent).
Automation and digitalisation	Some producers are using computer-based systems and software to achieve better inventory and production planning, and improved marketing and distribution systems.

Sub-sector name	Vegetable growing
Scope of work	Companies in this sub-sector grow and harvest a diverse range of vegetable crops, either outdoors or in greenhouses, cold frames, and cloth or lath houses. The vegetables are sold to vegetable processors, wholesalers, supermarkets and grocery stores. Vegetable production is organised into both under-cover (hydroponics/greenhouse) and outdoor (field) production systems.
Growers	In June 2016, there were 5,871 vegetable growers in Australia, consisting of 836 under-cover producers and 5,035 outdoor producers.[14] More than half operate as small, family, non-employing businesses, and almost a third are small operators with fewer than 20 permanent and/or part-time employees. However, vegetable growers have among the highest labour needs during peak season, with the number of casual employees increasing considerably. The sub-sector also includes over 225 medium-sized businesses that grow vegetables predominantly outdoors in open fields, as well as ten large growers whose growing is generally integrated with logistics and packing activities. Small producers have a significant role in small local markets, and also in market-gardening activity close to the peri-urban fringe.

[13] Australian Bureau of Statistics, 2017, 'Counts of Australian businesses, including entries and exits, June 2012 to June 2016', viewed April 2017, http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8165.0Jun%202012%20to%20Jun%202016?OpenDocument.
[14] Ibid.

Sub-sector name	Vegetable growing
Geographical location	Vegetable growers are spread across Australia, with the majority located in NSW, QLD, VIC, SA and WA.
Automation and digitalisation	Operators in the vegetable growing sub-sector use automated planting and transplanting processes, integrated biological and chemical pest control, mechanical harvesting, micro-irrigation and wireless sensors for maintaining soil moisture levels, and turning irrigation systems. The sub-sector is also increasingly using controlled atmosphere storage to regulate temperature, oxygen, carbon dioxide and humidity of storage conditions, maintaining supplies of fresh vegetables out of season.

Sub-sector name	Fruit and nut tree growing
Scope of work	The sub-sector consists of companies that grow and harvest a wide range of fruits, including table grapes, apples and pears, stone fruits, tropical fruits, berry fruits, olives and tree nuts. Fruits are sold as fresh products to fruit and vegetable wholesalers, directly to retailers, supermarkets, grocery stores and small fruit markets, or to producers for further processing into fruit produce.
Growers	The fruit growing sub-sector is characterised by a large number of operators, totalling 14,662 businesses in June 2016.[15] About 67 per cent are non-employing family farms operating as sole traders, and 29 per cent are farms employing fewer than 20 people. During busy harvesting periods, small- to large-scale operators engage additional casual employees. The sub-sector includes 604 medium-sized businesses that employ between 20 and 199 employees, and 20 large fruit or nut growers that employ at least 200 employees, with most of these operating as vertically integrated companies.
Geographical location	Fruit producers are located in regional areas with suitable climatic conditions in all Australian states and territories. Temperate fruit farming activity is concentrated in regional NSW, VIC, SA and TAS. Tropical fruit growers are predominantly located in far north QLD, NT and WA. Tree nuts are mainly produced in south-east QLD, northern NSW and temperate climates along the Riverina and Sunraysia regions.
Automation and digitalisation	The fruit growing sector is characterised by improvement in machinery, particularly mechanical harvesters, and more efficient irrigation systems, including drip, micro-spray and mini-sprinkler systems. The sub-sector also integrates data collection software that allows farmers to manage planting activity, cropping dates, input costs and field output. Precision farming, based on extensive soil testing, and GPS systems are also applied by growers. The introduction of controlled-atmosphere storage technology, which regulates and monitors temperature, oxygen, carbon dioxide and

[15] Ibid.

Sub-sector name	Fruit and nut tree growing
	humidity, provides growers with an alternative to chemical preservatives and pesticides.

Sub-sector name	Viticulture
Scope of work	This sub-sector consists of companies that grow and harvest table or wine grapes, or sun-drying grapes. Grapes are sold as fresh products to wine and spirit producers for further processing into wine and wine-based alcoholic beverages, to fruit and vegetable wholesalers or to grape processing/crushing companies.
Growers	The viticulture sub-sector is characterised by a large number of operators, totalling 6,600 growers in 2016.[16] About 70 per cent are non-employing farms operating as sole traders, and 27 per cent are businesses employing fewer than 20 people. During busy harvesting periods, small-scale operators engage additional employees. The sub-sector includes a small number of medium-sized and large grape growers, with some operating as vertically integrated companies into downstream processes. Forty-six per cent of all wine grapes are grown in SA, with 31 per cent being grown in NSW and 20 per cent in VIC.
Geographical location	Vineyards are located in regional irrigable areas with suitable climatic conditions in all Australian states. Large growing regions for wine grapes include Barossa Valley, Clare Valley, Riverland, Coonawarra, Eden Valley and Adelaide Hills in SA; Sunraysia, Yarra Valley, Mornington Peninsula, Heathcote, Western District, Rutherglen and Beechworth in VIC; and the Riverina, Hunter Valley, Murrumbateman, Mudgee in NSW. Large growing regions for table grapes include Sunraysia and the Murray Valley in VIC, the Riverina in NSW, and south-east QLD.
Automation and digitalisation	The viticulture sub-sector is characterised by improvements in machinery, particularly mechanical harvesters, and more efficient irrigation systems, including drip, micro-spray and mini-sprinkler systems. The sub-sector also integrates data collection software that allows growers to manage planting activity, cropping dates, input costs and field output. Precision farming, based on extensive soil testing, and GPS systems are also applied by larger growers. The introduction of controlled-atmosphere storage technology, which regulates and monitors temperature, oxygen, carbon dioxide and humidity, provides growers with an alternative to chemical preservatives and pesticides.

[16] Ibid.

Broadacre farming

Sub-sector name	Grain growing
Scope of work	This sub-sector includes businesses that grow cereal grains, including wheat, rice, oats, rye, barley, corn, peas, millet and sorghum. Farms in the sub-sector frequently diversify into different cereal-cropping activities, and sometimes into livestock activities. Cereal crops are harvested and sold to cereal grain wholesalers or (for particular varieties) as feedstock for beef cattle and poultry.
Producers	The sector comprised 11,717 cereal grain producers in 2016, including many small, family-owned, non-employer farms (63 per cent) and farms employing fewer than 20 people.[17] The sector has a small number of large producers.
Geographical location	The location of grain farms in Australia is linked to climate and weather conditions suitable to the variety of grain. Most grain farms are established in NSW, VIC, SA, WA and QLD. The wheat-belt regions include the Wimmera and central west of VIC, the south east of SA, the mid-north and Flinders regions of SA, the central west of NSW, the goldfields region of WA and the Darling Downs in QLD. Rice farms are predominantly located in NSW.
Automation and digitalisation	Activity in this sub-sector is characterised by the use of capital-intensive equipment such as tractors and irrigation systems, and the introduction of advanced equipment to monitor planted areas, test soil, and irrigate and harvest crops. Rice farms, which are water-intensive operations, use laser technology and advanced software to design farm irrigation systems and achieve water savings. The sub-sector also integrates computer-based technologies and sensors, such as WeedSeeker technology, to accurately identify and spray weeds to achieve efficient use of herbicides. Global positioning systems, geographic information systems and spectral imaging for remote sensing assist grain farmers to determine which crops are best suited to each area.

Sub-sector name	Fodder growing
Scope of work	This sub-sector comprises businesses that produce fodder crops, including hay, alfalfa and silage. Fodder growers sell the crops to animal farms, wholesalers and beef cattle feedlots.
Growers	The sub-sector includes many small fodder growers, most of which are non-employing businesses.

[17] Ibid.

Sub-sector name	Fodder growing
Geographical location	VIC, NSW and QLD all have significant numbers of fodder growers.
Automation and digitalisation	Fodder crops involve capital-intensive irrigation systems and mechanical harvesters.

Sub-sector name	Sugar cane growing
Scope of work	This sub-sector includes businesses that grow sugar cane. The crop is sold to sugar manufacturing companies.
Producers	The sub-sector consisted of 4,825 sugar cane producers in 2016.[18] The majority are small, family-owned businesses employing fewer than 20 people. There is a small presence of medium-sized sugar cane growers, which are generally corporates or farmers' cooperatives with operations integrated vertically with downstream sugar cane processing.
Geographical location	The sub-sector is highly concentrated in QLD as sugar cane requires specific climatic conditions to grow. Australia's major sugar cane region spans the coastal and river plains in QLD and northern NSW.
Automation and digitalisation	Tractors, highly mechanised harvesters and irrigation systems are involved in the sub-sector's activity.

Sub-sector name	Cotton growing
Scope of work	This sub-sector comprises businesses that grow cotton. The crop is sent to cotton ginning businesses for further processing (to separate the cotton fibres/lint from the cottonseed).
Producers	The sector included 957 cotton producers in 2016.[19] The majority are small, family-owned businesses with either no employees or fewer than 20 employees. There is a small presence of medium-sized cotton growers. These businesses are generally fully integrated operations, involved in the growing, ginning and marketing of cotton, or their operations diversify into other agricultural sectors such as horticulture and animal farming.
Geographical location	The sub-sector is highly concentrated in NSW and QLD.
Automation and digitalisation	The sub-sector is highly mechanised, and benefits from new irrigation systems and technologies that measure soil moisture, enabling farmers to more accurately schedule watering to suit conditions.

[18] Ibid.
[19] Ibid.

Sub-sector name	Seed production
Scope of work	This sub-sector consists of businesses that produce seeds for crops such as grains, vegetables, fruit, flowers and oilseeds.
Producers	The sub-sector includes several large global seed production players and many small-scale seed growers.
Geographical location	Producers are generally located near areas with high concentrations of agricultural activities, particularly in NSW, VIC and WA.
Automation and digitalisation	The sector is characterised by capital-intensive laboratory settings, equipped with biotechnology-related infrastructure. X-ray technology is used intensively throughout the research, and to gain an understanding of seed structures and internal compositions.

Livestock farming

Sub-sector name	Livestock farming
Scope of work	This sub-sector consists of either specialised or mixed livestock farms that breed and farm one or a variety of animals, including sheep, beef cattle, dairy cattle and poultry, or other livestock including deer, pigs and bees. Animals are grown for meat or to produce wool, raw milk, eggs or honey. Farmers supply live animals to meat processors, or supply animal products such as wool, milk, eggs and honey to wholesalers or food processors.
Producers	The sub-sector is characterised by a large number of operators, totalling 88,068 farms in 2016.[20] Half are specialised beef cattle farmers. About 75 per cent of livestock farms are non-employing, family-run businesses, and 23 per cent employ fewer than 20 people. Few medium-sized farms operate in the sub-sector, with some being vertically integrated into meat processing.
Geographical location	Although livestock farming occurs across Australia, most of the activity is in QLD, NSW, VIC, WA and SA.
Automation and digitalisation	Cattle and livestock farming in general involves capital-intensive machinery to maintain cattle grazing pastures, equipment for branding, electric cattle tagging, and vehicles for traveling around large properties. Most dairy cattle farmers use automated or robotic milking systems and computerised inventory systems. Computer-based technologies, involving chip-collar sensors, allow improved quality control. The systems monitor, analyse and record data relating to production volumes and herd health.

[20] Ibid.

Mixed crop and livestock farming

Sub-sector name	Mixed crop and livestock farming
Scope of work	This sub-sector includes farms that grow grain in conjunction with beef cattle or sheep farming activities. Diversification in multiple agriculture sub-sectors allows farmers to reduce the business risks associated with unfavourable weather conditions and the volatility of markets and prices.
Producers	The sub-sector consists of a large number of operators, totalling 21,940 mixed crop and livestock farms in 2016.[21] The majority are small, family-owned and operated businesses. There is a small presence of medium-sized farms.
Geographical location	Mixed crop and livestock farming occurs across Australia; however, most crop and livestock farming establishments are located in NSW, VIC, WA, SA and QLD.
Automation and digitalisation	Similar to specialised crop and livestock farming, this sub-sector employs a range of highly mechanised equipment and computer-based technology and systems to effectively and efficiently produce its agricultural products.

Agriculture support services

Sub-sector name	Agriculture support services
Scope of work	Businesses in this sub-sector provide the agricultural sector with services including aerial agricultural services, shearing, contract crop harvesting, and animal testing. This sub-sector includes businesses involved in ginning and trading cotton.
Businesses	There were 1,004 shearing businesses, 41 cotton ginning businesses and 10,746 other agriculture and fishing support services in Australia in 2016.[22] The majority are small-scale family businesses operated by owners or employing fewer than 20 people. There are also several medium-sized operators in the sub-sector.
Geographical location	The majority of businesses are located in NSW, VIC and QLD, close to agricultural farms.
Automation and digitalisation	This sub-sector benefits from the use of new technology and ongoing automation in harvesting and aerial processes.

[21] Ibid.
[22] Ibid.

Agricultural product wholesaling

Sub-sector name	Agricultural product wholesaling
Scope of work	Businesses in this sub-sector wholesale on behalf of farmers through supply of: • fresh fruit and vegetables to fruit and vegetable retailers, supermarkets and grocery stores, or to the catering and food services sub-sector; produce is brushed, washed or packaged by either producers or packaging companies • cereal grains to livestock farms and food processors • wool to textile producers • fresh, frozen or processed fish to specialist fish and seafood retailers, supermarkets and grocery stores, food catering services and restaurants • other agricultural products. Wholesalers can also be importers and exporters of agricultural products.
Wholesalers	There were 4,230 wholesaling units in the sector in 2016.[23] About half are non-employing businesses, and most of the remainder employ fewer than 20 people. These businesses normally distribute to local and smaller markets. The few large wholesalers cover significant markets, with some being part of global corporations.
Geographical location	Agricultural product wholesalers operate throughout Australia, yet the majority are concentrated in the states with the most economic activity, such as NSW, VIC and QLD.
Automation and digitalisation	The sub-sector benefits from the use of computerised automation of inventory control and online trading. Radiofrequency identification systems, supported by computerised databases, are widely adopted to record information on products and storage times. An increasing number of wholesaling operators have set up online marketplaces to bring together growers and buyers. In addition, wholesalers use digital technology and websites to provide market information and value-added services to growers, as well as facilitate cost control and manage commodity and exchange-rate risks. Parts of the sub-sector use specialised commercial chillers capable of reliably maintaining optimal temperatures, humidity level, light and carbon dioxide supply. Global positioning systems are used to track deliveries, achieve optimal routes and coordinate stock.

[23] Ibid.

Conservation

Sub-sector name	Conservation operations
Scope of work	This sub-sector comprises businesses and organisations that operate: • Nature reserves and conservation parks, including national parks, state parks and other parks, to preserve flora and fauna in their natural environment • National parks, Nature Reserves, Council reserves (these are complex and large reserve systems across the country), Indigenous Protected Areas, Commonwealth lands (e.g. Defence lands), private land (e.g. farms, rivers and creeks that form corridors across a range of tenures and areas), botanical gardens
Organisations	Parks and reserves are operated by all levels of government, Aboriginal people (land and sea), a wide range of not for profit organisations (Bush Heritage, Nature Conservancy etc.) and private landholders to restore and conserve flora and fauna; as well as assist with broader issues such as managing erosion, improving water quality and preserving cultural connections. **Main organisations[24]** • Zoological Parks and Gardens Board (VIC) • Zoological Parks Board of New South Wales • Royal Botanic Gardens and Domain Trust (NSW) • Department of Parks and Wildlife (WA) • Office of Environment and Heritage (NSW) • NSW Parks • Department of Environment, Land, Water and Planning (VIC) Department of National Parks, Sport and Racing • Department for Environment and Water • Society of Ecological Restoration Australasia (SERA) (SA) • Australian Association of Bush Regenerators (AABR) • Commonwealth Departments and contractors (e.g. defence land); Office of Environment and Heritage etc. • MANY State departments (e.g. National Parks and Wildlife Service); Department of Environment and Heritage Protection (Qld); Other State departments such as water authorities (Seqwater in QLD); • Local government - likely the largest employer across the country of employees and contractors specialising in weed management, animal management, restoration, fire management etc. Also manage many volunteer groups and environmental education programs. Local govt may also assist managing landcare, Coastcare, Rivercare groups not supported by NRM bodies etc. • Natural Resource Management (NRM) groups – operate regionally and 56 groups occur across the country often managing Landcare program as well as State funded programs etc. In SEQ the group is Healthy, Land and Water • Large not for profit organisations that buy up land for conservation (e.g. Bush Heritage, Nature Conservancy, Queensland trust for Nature etc.)

Sub-sector name	Conservation operations
	• Australian Conservation Foundation • Australian Wildlife Conservancy • Indigenous Flora and Fauna Association • Great Barrier Reef Foundation • State Weed Societies (e.g. Weed Society of Queensland) and National Weeds committee (i.e. Australian Weed Society) • Wetland Care Australia • Greening Australia • Many private businesses • Botanical gardens • Permaculture Australia • LNA Master Landscapers Association
Geographical location	Each state and territory in Australia has government departments responsible for national park and conservation reserves. There is also at least one major public zoo and botanic garden in each state.
Automation and digitalisation	Digital technology is used heavily in this sub-sector, including tracking systems for animals, state-wide databases of flora and fauna, computerised maps and mapping, communication systems and local area networks to cover all offices in a state/territory. Computerised asset management systems are also used across the nature reserves and conservation parks sub-sector. In addition, fixed-wing aircraft, helicopters and other techniques are used to control and fight fire. Drones are also now used regularly for mapping, monitoring and assessment. Botanic gardens operators use breeding, national and international computerised classification for tracking of animals and plants, and microchip implants for all endangered species in their collection as a means of individual identification. In addition, computerised ticketing systems allow for the collection of information on visitor origins. Scientific research on endangered vegetation usually involves the use of satellite and global positioning systems. Handheld GPS and a range of cameras are also used to monitor wildlife, visitor numbers etc.

Sub-sector name	Land care and management
Scope of work	• Individuals, groups and the broader industry work in the restoration and management of natural areas as well as support private landholders, farmers and fishers across the country. They focus on the management of weeds, pest animals and often aim to improve water quality, soil, native vegetation, habitat and connectivity. The focus to ecosystem recovery is now being extended to coastal systems including the restoration of seagrass, coral and islands. Caring for the land and sea includes a range of activities: sustainable farm practices • restoring native habitats and revegetation • controlling weeds and pests

	• developing and sharing local natural resource management skills and knowledge. • threatened species management • sharing of cultural and management information
Groups	The sector includes land care groups, farming systems groups, 'friends of' groups and Indigenous land-management groups. It is estimated that there are 6,000 Landcare, Coastcare, Bushcare, Rivercare and other related community and farming groups, and over 100,000 volunteers across Australia caring for the land. Many farmers and landholders also undertake this work without being affiliated with a particular land care group.[25]
Geographical location	Land care groups and individuals are represented across all Australian states and regions.
Automation and digitalisation	No automation and digitisation at this stage

Relevant stakeholders

The agriculture, horticulture and conservation and land management industry sector is represented at a national level by more than 206 peak organisations (see Tables 1 and 2). These organisations include two industry umbrella associations, over 155 industry sector and sub-sector associations – including government and non-government organisations responsible for Australian fauna and flora conservation – a small number of associated industry sector associations, 15 professional associations, 13 industry research and development services bodies, and a number of regulatory bodies and other industry service organisations. These numbers do not include state- and territory-based industry associations.

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Table 1: Relative number of industry peak bodies

CATEGORY	NUMBER
Industry umbrella associations	2
Industry sector associations	155
Associated industry sector associations	7
Professional associations	12
Industry R&D services bodies	13
Regulatory bodies and other industry services	14
Total	203

Table 2: Peak industry sector organisations

CATEGORIES – PEAK INDUSTRY ORGANISATIONS
INDUSTRY UMBRELLA ASSOCIATIONS
National Farmers' Federation
Agribusiness Australia
Australian Workers' Union
INDUSTRY SECTOR ASSOCIATIONS
Amenity horticulture
Arboriculture:
Arboriculture Australia
South Australia Society for Arboriculture
Victorian Tree Industry Organisation
New South Wales Arborist Association
Queensland Arboriculture Association
Tree Guild West Australia
Northern Territory Arborist Association
Australian Capital Tree Community
Landscaping Australia Incorporated
Tree Contractors Association Australia
Soil Science Australia
Indoor plant hire and maintenance:
National Interior Plantscape Association
Turf and sports turf management:

Australian Golf Course Superintendents Association

Sports Turf Australia

Turf Grass Association of Australia

Turf Producers Australia

Turf Australia

Nursery:

Nursery and Garden Industry Australia

Floriculture:

Australian Flower Council

Australian Flower Industry

Wildflowers Society Australia

Wildflowers Industry Network NSW Inc

Production horticulture

Voice of Horticulture

Mushroom and vegetable growing:

Australian Asparagus Council

Australian Medical Cannabis Industry

Australian Mushroom Growers' Association Ltd.

Australian Sweet Potato Growers Inc.

AUSVEG

Hydroponic Farmers Federation

Potato Processing Association of Australia

Protected Cropping Australia

Onions Australia

Grape growing:

Australian Table Grape Association

Australian Vignerons

Wine Grape Growers' Australia

Wine Grapes Council of SA

Australian Society of Viticulture and Oenology

South Australian Wine Industry Association

Berry fruit growing:

Australian Blueberry Growers' Association

Raspberries and Blackberries Australia

Strawberries Australia Inc.

Apple and pear growing:

Apple and Pear Australia Limited

Stone fruit growing:

Summerfruit Australia Limited

Cherry Growers Australia Inc.

Citrus fruit growing:

Citrus Australia

Olive growing:

Australian Olive Association

Other fruit growing:

Australian Banana Growers' Council

Australian Custard Apple Growers Association

Australian Lychee Growers Association

Australian Mango Industry Association

Australian Melon Association Inc.

Tropical Exotic Fruit Australia

Australian Pineapple Association

Avocados Australia Ltd.

Australian Nut Industry Council

Dried Fruits Australia

Passionfruit Australia Inc.

Tree nut growing:

Almond Board of Australia

Australian Macadamia Society Ltd.

Chestnuts Australia Inc.

Hazelnut Growers of Australia Inc.

Australian Pecan Growers Association Inc.

Persimmons Australia Inc.

Pistachio Growers' Association Inc.

Other nut growing:

Peanut Company of Australia

Broadacre agriculture

Oilseeds:

Australian Oilseeds Federation

Australian Sunflower Association

Canola Association of Australia

Cereals:

Australian Grain Harvesters Association

Barley Australia

Grain Growers

Grain Producers Australia

Grain Trade Australia

Maize Association of Australia

Pulses:

Australian Mungbean Association

Bean Growers Australia

Pulse Australia

Soy Australia

Sugar cane:

Australian Cane Farmers Association

Canegrowers

Rice:

Ricegrowers' Association of Australia

Cotton:

Australian Cotton Shippers Association

Cotton Australia

Fodder:

Australian Fodder Industry Association

Seeds:

Australian Seed Federation

Livestock production

Beef cattle:

Cattle Council of Australia

Northern Territory Cattlemen's Association

Dairy cattle:

Australian Dairy Farmers

CATEGORIES – PEAK INDUSTRY ORGANISATIONS

Australian Dairy Industry Council

Sheep (meat, fibre, dairy):

Sheep Meat Council of Australia

Wool Producers Australia

Australian Association of Stud Merino Breeders

Poultry (meat, eggs):

Australian Chicken Growers' Council

Egg Farmers of Australia

Deer:

Deer Industry Association of Australia

Pigs:

Australian Pig Breeders Association

Beekeeping:

Australian Honey Bee Industry Council Inc.

Australian Queen Bee Breeders' Association

Crop Pollination Association Inc.

Honey Packers and Marketers Association of Australia Inc.

National Association of Crop Pollination Associations

Other livestock:

Australasian Alpaca Breeders Association

Australian Alpaca Association

Australian Ostrich Association

Crocodile Farmers Association of the Northern Territory

Dairy Goat Society of Australia

Goat Industry Council of Australia

Agriculture support services

Australian Cotton Shipping Association

Australian Livestock and Rural Transporters' Association

Australian Livestock Exporters' Council

Australian Lot Feeders' Association

Australian Wool Exchange

Cotton Australia

Australian Lot Feeders Association

Fertilising

Fertilizer Australia

Grain and Feed Trade Association

Grain Trade Australia

Irrigation

Irrigation Australia

Livestock, Bulk and Rural Carriers Association

National Irrigators' Council

Shearing

Shearing Contractors' Association of Australia

Woolclassers' Association of Australia

Biosecurity

Animal Health Australia

Plant Health Australia

Conservation and land management

Australian Conservation Foundation

Australian Institute of Lanscape Architects

Australian Institute of Landscape Designers and Managers

Australian Institute of horticulture

Australian Landcare Council

Australian National Botanic Gardens

Australian Native Plants Society

Australian Weeds Committee

Australian Wildlife Society

Australian Workers Union

Botanic Gardens

Botanic Gardens Australia and New Zealand inc

Centralian Land Management Association

Conservation Farmers Inc.

Conservation Volunteers Australia

Director of National Parks

Ecological Society of Australia

Farm Tree and Landcare Association

Garden Centres Association of Australia

Greening Australia

Indigenous Flora and Fauna Association

International Network for Environmental Compliance and Enforcement

International Plant Propagators Society Australia

Invasive Plants and Animals Committee

Landcare Australia Ltd

Landscaping Australia Inc.

Marine Estate Management Authority

National Aboriginal Lands Managers Association

National Association for Sustainable Agriculture Australia

National Environment Protection Council

National Environmental Law Association

National Landcare Network

National Landcare Program

National Parks and Nature Reserves

National Parks Australia Council

National Parks Conservation Association

National Urban Forest Alliance

Parks and Leisure Australia

Parks Australia

Soils for Life

Soil Science Australia

Society for Ecological Restoration Australasia

The Wilderness Society

Society of Ecological Restoration Australasia (SERA)

Australian Association of Bush Regenerators (AABR)

Commonwealth Departments and Contractors

Natural Resource Management (NRM)

Australian Conservation Foundation

Australian Wildlife Conservancy

Indigenous Flora and Fauna Association

Great Barrier Reef Foundation

Wetland Care Australia

Greening Australia

Permaculture Australia

CATEGORIES – PEAK INDUSTRY ORGANISATIONS

LNA Master Landscapers Association

Landscaping

Master Landscapers Association (LNA)

Landscaping Victoria (LV)

Landscape Queensland Industries (LQI)

Landscape Industries Association of WA (LIAWA)

Master Landscapers SA (MLSA)

Landscape Industries Association of Tasmania (LIAT)

ASSOCIATED INDUSTRY SECTORS ASSOCIATIONS

Australian Livestock and Property Agents Association

Australian Organics Recycling Association

Biological Farmers Australia

Green Roofs Australasia

National Herd Improvement Association of Australia Incorporated

Organic Federation of Australia

Sustainable Gardening Australia

PROFESSIONAL ASSOCIATIONS (National)

Australian Environmental Pest Managers Association

Australian Institute of Horticulture

Australian Institute of Landscape Architects

Australian Institute of Landscape Designers and Managers

Australian Society of Horticultural Science

Crop Consultants Australia

Institute of Australian Consulting Arboriculturists

Institute of Australian Geographers

Parks and Leisure Australia

Environment Institute of Australia and New Zealand

Utility Arborist Association Australia

RURAL RESEARCH AND DEVELOPMENT CORPORATIONS

AgriFutures Australia

Australian Egg Corporation Limited

Australian Pork Limited

Australian Wool Innovation

Cotton Research and Development Corporation

CATEGORIES – PEAK INDUSTRY ORGANISATIONS
Dairy Australia
Grains Research and Development Corporation
Horticulture Innovation Australia
LiveCorp
Meat and Livestock Australia
Wine Australia
REGULATORY BODIES AND OTHER INDUSTRY SERVICES
Australian Seeds Authority
Rural Skills Australia
Wheat Quality Australia
Australia Wool Testing Authority
Corporate Agriculture Australia
PrimeSafe
Livestock Biosecurity Network Inc.
Australian Organic
Organic Federation of Australia
Flower Export Council of Australia
Australian Seeds Authority Ltd
Australian Dairy Herd Improvement Scheme
Australian Wool Innovation
National Feedlot Accreditation Scheme

Industry and occupational regulations and standards

Industry regulations and standards

The Australian agriculture, horticulture and conservation and land management industry sector operates under a high level of regulation.

Regulation of genetically modified crops

Genetically modified (GM) crops in Australia, including seeds, are regulated under the *Gene Technology Act 2000* (Cth.) through the Office of the Gene Technology Regulator. The regulatory policy seeks to protect the health and safety of both people and the environment. The regulator identifies risks posed by, or as a result of, gene technology, and manages these risks. This Act regulates all dealings with live and viable genetically modified organisms (GMOs) in Australia, including research, manufacture, import, production, propagation, transport and disposal of GMOs. There is also corresponding legislation in each state and territory.

Environmental regulations

Most horticultural production systems are highly reliant on irrigation, fertilisers and pesticides. Laws governing environmental protection and management by horticultural producers include numerous federal, state and local Acts and regulations. Generally, these regulations relate to fertiliser and pesticide supply, handling, usage and storage; disposal of empty chemical containers and contaminated wastes; water usage; wastewater generation and the treatment of waste arising from production; biodiversity; and land and soil management.

National environmental legislation and regulations relevant to the industry include:[26]

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth.)
- *Hazardous Waste (Regulation of Exports and Imports) Act 1989* (Cth.)
- *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (Cth.)
- *Water Act 2007*, *Water Amendment Act 2008* (Cth.) and associated water regulations
- National Water Quality Management Strategy
- National Environment Protection (Assessment of Site Contamination) Measure 1999
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
- Australian Drinking Water Guidelines (2011)
- Australia New Zealand Food Standards Code
- National Residue Survey
- National Environment Protection (Air Toxics) Measure.
- Vegetation Management Acts per state
- Biosecurity legislation per state
- State legislation for the management of threatened species

State/territory government agencies regulate water usage via the allocation of water licences and dam management. They also decide on the timing and amount of water able to be accessed by irrigators. Water legislation focuses on developing efficient water usage for agriculture, while limiting its environmental effect, particularly in the Murray–Darling Basin, which supports a large proportion of Australia's fruit and vegetable crops.

Food regulations

Food Standards Australia New Zealand (FSANZ) establishes standards relevant to the agriculture industry, particularly for poultry, meat, dairy, eggs and egg products, and seed sprout. FSANZ aims to strengthen food safety by reducing the incidence of foodborne illness associated with seed sprouts and eggs or egg products. In addition, dairy standards outline the implementation of documented food safety programs for primary dairy production and for the collection, transportation and processing of raw milk, as designed to protect public health across all jurisdictions.

The majority of fresh horticultural produce in Australia is grown under industry-based food safety schemes.[27] These schemes, and several state/territory regulations and guidelines, work to minimise risks linked to microbiological, chemical and physical factors that may be present in fresh produce for sale in Australia.

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[26] Horticulture for Tomorrow and Horticulture Australia Limited, 2014, Guidelines for Environmental Assurance in Australian Horticulture, viewed April 2017, http://horticulturefortomorrow.com.au/manage/wp-content/uploads/2014/05/Environmental-Assurance-Guidelines-2014-full-version-2.pdf.

[27] Food Standards Australia New Zeeland, 2014, 'Horticulture', viewed April 2017, http://www.foodstandards.gov.au/code/primaryproduction/horticulture/Pages/default.aspx.

State/territory government regulations and guidelines include the following:

- *Food Act 2003*
- Food Standards Code
- The *Food (Plant Products Food Safety Scheme) Regulation (2005)* (NSW) provides specific control measures to manage the safe production and supply of seed sprouts, fresh-cut fruit and vegetables, and juices.
- The *Food Production (Safety) Regulation (2014)* (QLD) sets out requirements for the transport and processing of fresh primary produce.
- The NSW Food Authority's *Industry Guide for the Development of a Food Safety Program (High Priority Plant Products Industry)* (2005) covers seed sprouts, fresh-cut fruits and vegetables, unpasteurised juice, and vegetables in oil.
- *Guidelines for On-Farm Food Safety for Fresh Produce* (2004) was published by the Australian Government Department of Agriculture, Fisheries and Forestry, now the Federal Department of Agriculture and Water Resources.

Industry food safety schemes in Australia include:

- HACCP Australia
- Freshcare
- Harmonised Australian Retailer Produce Scheme (HARPS)
- GlobalGAP
- supermarket quality and food safety schemes.

Grape growing legislation

The Australian viticulture sub-sector is subject to a number of federal and state/territory laws and regulations, including the *Australian Grape and Wine Authority Act 2013* (Cth.) and the *Australian Grape and Wine Authority Regulations 1981* (Cth.). These Acts provide for, among other things, the Label Integrity Program and the Register of Protected Geographical Indications and Other Terms.

Livestock management legislation

The Department of Agriculture and Water Resources (DAWR) provides policies and legislation concerning aspects of livestock management and biosecurity, including live exports and supply of agricultural chemicals. DAWR is responsible for Australia's livestock export licences, and regularly carries out inspections to ensure that biosecurity, traceability and animal welfare requirements are being met for both export-licensing and importing countries. DAWR also manages quarantine controls at borders and provides import and export inspection and certification.

In addition, state/territory governments are responsible for livestock management, disease response and welfare arrangements within their jurisdictions, in terms of both enforcing national standards and agreements, and administering state/territory legislation.

Legislation relating to livestock management includes:[28]

- *Agricultural and Veterinary Chemicals (Control of Use) Act 1992* (VIC)
- *Agricultural and Veterinary Chemicals (Control of Use) Regulations 2007* (VIC)
- *Impounding of Livestock Act 1994* (VIC)
- *Impounding of Livestock Regulations 2008* (VIC)
- *Livestock Disease Control Act 1994* (VIC)
- *Livestock Disease Control Regulations 2017* (VIC)

[28] Agriculture Victoria, 2016, 'Livestock management', viewed April 2017, http://agriculture.vic.gov.au/agriculture/farm-management/legal-information-for-victorian-landholders/livestock-management.

- *Livestock Management Act 2010* (VIC)
- *Livestock Management Regulations 2011* (VIC)
- *Prevention of Cruelty to Animals Act 1986* (VIC)
- *Prevention of Cruelty to Animals Regulations 2008* (VIC)
- *Prevention of Cruelty to Animals (Domestic Fowl) Regulations 2016* (VIC)
- *Stock (Seller Liability and Declarations) Act 1993* (VIC).

Australian ruminant feed ban

Australia has an inclusive ban on the feeding of restricted animal material (RAM), including meat and bone meal derived from all vertebrates including fish and birds, to all ruminant animals. An enforceable ban seeks to minimise the risk of spreading the infectious agent in bovine spongiform encephalopathy ('mad cow disease'), in the unlikely event that it is introduced to Australia. The ruminant feed ban is nationally coordinated by Animal Health Australia, and is part of a comprehensive national TSE (transmissible spongiform encephalopathy) Freedom Assurance Project. The prohibition and program target livestock producers and other end users of manufactured stockfeed, retailers of manufactured stockfeed, and stockfeed manufacturers. Each Australian state/territory adopted the ruminant feed ban in legislation, indicating feeding prohibition and requirements for labelling and RAM content.

In addition, the industry implements the FeedSafe accreditation program through the Stock Feed Manufacturers' Council of Australia. To achieve FeedSafe accreditation, feed manufacturing sites are required to address the elements of the Code of Good Manufacturing Practice for the Feed Milling Industry, particularly methods to ensure effective cleaning, flushing and sequencing between different types of stockfeed, to minimise the possibility of cross-contamination.

Biosecurity legislations

The Department of Agriculture and Water Resources is responsible for developing and reviewing biosecurity policies for the safe importation of animals and animal products. The Department co-administers the *Biosecurity Act 2015* (Cth.) with the Department of Health, replacing the *Quarantine Act 1908* (Cth.).

In addition, state/territory biosecurity agencies develop policy, standards, delivery systems and services that reduce the threat of invasive plants and animals to agriculture and the natural environment; protect animals and plants from pests and diseases; enhance food safety; ensure minimal and effective chemical use; protect the welfare of animals; and preserve and expand market access for primary industries.

Live-animal export legislation

Two bills were enforced in Australia to amend the *Australian Meat and Live-stock Industry Act 1997* (Cth.) and *Export Control Act 1982* (Cth.) in response to animal welfare concerns in the live-cattle export trade.

The *Live Animal Export Prohibition (Ending Cruelty) Bill 2014* (Cth.) and the *Live Animal Export (Slaughter) Prohibition Bill 2014* (Cth.) were introduced to prohibit the export of livestock for slaughter on or after 1 July 2017, and to compel export licence holders to ensure all livestock are treated satisfactorily prior to slaughter.

Conservation laws

Government-managed nature reserves, including marine reserves, and conservation parks are licensed and regulated by federal, state and territory environment and conservation departments under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth.) (EPBC) and the *National Parks and Wildlife Act 1975* (Cth.). The EPBC Act contains an extensive regimen for the conservation of biodiversity.

Industry codes of practice

A number of codes of practice have been developed across the industry sub-sectors to set out industry standards of conduct, including the following:

- Horticulture Code of Conduct
- Growing Australian Grain
- Mandatory Port Access Code of Conduct for Grain Export Terminals
- Food and Grocery Code of Conduct
- Animal Welfare Codes of Practice
- Australian Animal Welfare Standards and Guidelines (for cattle and sheep)
- Animal Welfare Code of Practice – Commercial Pig Production
- RSPCA Approved Farming Scheme
- Australian Wine Industry Code of Conduct
- Code of Good Manufacturing Practice for the Feed Milling Industry
- Code of Practice: Amenity Tree Industry (WorkCover)
- Model Code of Practice for the Welfare of Animals – Domestic Poultry
- National Farm Biosecurity Manual – Poultry Production
- Farm Biosecurity Manual for the Duck Meat Industry
- Guide for managing the risks of machinery in rural workplaces

Grain trade standards and legislation

Grain Trade Australia oversees standards for wheat and coarse grain trade in the domestic and international markets.

International regulations and access to markets

To ensure access to European markets, Australian beef producers must follow a series of European Union regulations, laws and other rules governing beef cattle farming. These measures take the form of chain-of-custody certification involving cattle properties, feedlots and processors, and integrate the National Livestock Identification Scheme, which allows for the permanent identification of cattle using electronic microchips.

Industry certification programs

The industry has developed and implemented integrity systems to verify and assure food safety and other quality attributes of livestock. Examples of industry certification programs include:

- Livestock Production Assurance – an on-farm food safety certification program for cattle, sheep and goats
- National Feedlot Accreditation Scheme – encompassing animal health and welfare, environmental conservation, food safety and product integrity
- Australian Dairy Food Safety Scheme – monitoring compliance with food standards to ensure the integrity of the dairy supply chain
- Australian Pork Industry Quality Assurance Program – providing standards for Australian pig producers
- Egg Corp Assured – a quality assurance program administered by the National Egg Corporation
- Q-Alpaca – a quality assurance program for voluntary use by Australian alpaca breeders and owners
- B-QUAL – a voluntary program for apiarists and honey-processing businesses that ensures honey bee industry standards meet best practice, and domestic and international market demands
- FeedSafe – the quality assurance program for the Australian stockfeed industry
- Freshcare – the largest on-farm HACCP assurance program

- Harmonised Australian Retailer Produce Scheme (HARPS) implemented in in 2018 as the one standard for all retailers of fresh food.

Regulated occupations in the industry

Regulated occupations are bound by legal (or industry) requirements or restrictions to perform the work. Regulated occupations require a licence from, or registration by, a professional association or occupational licensing authority.

The industry does not have any specific trade-licensed occupations. However, it involves different professional accreditation structures overseen by industry bodies. For example, in Victoria, landscapers are required by the *Domestic Building Contracts Act 1995* (VIC) to be registered with the state Building Practitioners Board in order to carry out large-scale structural landscaping. Qualifications include completion of Certificate III courses in landscape construction or horticulture.

Similarly, arborists do not need a licence to practise arboriculture in Australia, yet WorkCover, the Tree Contractors Association of Australia, Arboriculture Australia and the Local Government Tree Resources Association recommend that professional arborists meet several requirements. Arborists practising in Australia should represent a professional business, hold proper worker's compensation insurance, and have minimum qualifications of Certificate II in Horticulture (Arboriculture) for carrying out ground and climbing work, and Certificate III in Horticulture (Arboriculture) for supervising climbing work.

Challenges and opportunities in the sector

The Australian agriculture, horticulture and conservation and land management industry sector operates in a dynamic environment that is shaped by a range of natural factors, as well as by policy frameworks at state/territory, national and international levels. Access to free trade and knowledge of market requirements have become increasingly important, along with developing new and innovative technologies in order to adapt to changes in land and water availability, biosecurity and climatic conditions. Challenges and industry opportunities for growth are discussed below; however, the outlook for the Australian agricultural sector is strong, with the world's demand for food rising, driven by population growth and calls for higher quality and a greater variety of food.

Government policies

Agriculture, along with the food manufacturing sector, is at the forefront of the Australian Government policy agenda, and has been prioritised as a growth sector. Opportunities in the sector are provided by the importance of food security globally and by higher demand for food in expanding markets, such as Asia-Pacific region. The Australian Government facilitates the sector's growth through a range of initiatives, including, among others, the following:

- Agricultural Competitiveness White Paper
- White Paper on Developing Northern Australia
- Food and Agribusiness Growth Centre
- CSIRO Food and Nutrition Flagship Program
- further global trade liberalisation through new free trade agreements, enabling increased tariff-free access to a diverse range of overseas markets.

State/territory governments have also seen the agricultural and food sectors as critical contributors to local growth and exports, leading with policies based on state-/territory-based industry strategies and action plans. The challenge for individual companies is to unlock commercial benefits from these government programs and agreements by becoming export-ready, culturally literate and market-savvy.

Governments have a shared responsibility to develop national surveillance and diagnostic programs to address Australia's broad range of biosecurity issues, including activities to investigate the presence or prevalence of pests and diseases in an animal population and its environment. A new state framework to manage biosecurity issues is the Western Australian Biosecurity Strategy, which helps protect WA growers from incursions of pests and diseases that could negatively affect production and access to markets, and which covers the period from 2016–2025.[29]

In an effort to combat invasive species that cost farmers billions of dollars in livestock losses, state/territory governments develop policies and allocate funds for new action plans and controls. A recent example is the Victorian Government, which allocated $11 million in baiting, hunting and trapping programs in its 2016–17 budget. Similarly, the Western Australia Government announced a wild-dog action plan for the next five years centred around cell fencing grants, doggers, and restoration and extension of the existing state barrier fence.[30] The Australian Government is also supporting farmers and the community to tackle established pest animals through a recent funding program to support the development of, and/or improvements to, innovative and forward-thinking control tools and technologies from 2017 to 2019.[31]

Under work health and safety laws, Australia implemented the Global Harmonised System (GHS) on 1 January 2017, which makes mandatory that all chemicals be labelled and comply with GHS regulations.[32]

The climate's impact on agricultural crops

Climate change and soil degradation are factors that agricultural producers will increasingly have to deal with if they are to maintain or improve levels of productivity.

Future weather and climate scenarios projected by CSIRO, which include more extreme daily rainfall in most regions, more hot days, and an increase in droughts in southern Australia, have the potential to affect all upstream and downstream sectors of the industry.

Increased warming has significant implications for the geographic suitability of specific crops, livestock and aquatic species, and, consequently, for agricultural productivity. For instance, it is known that wine grapes are very sensitive to subtle shifts in temperature, rain and sunshine, and research predicts that up to 70 per cent of Australia's wine growing regions will be less suitable for grape growing by 2050.[33] Farmers recognise that, for example, 50 years ago, frost would remain on the ground for six weeks in winter in the south west of New South Wales; this is no longer the case, and that affects biosecurity. There are also new weeds and the tick-borne *Theileria* parasite, which spreads and causes anaemia in cattle.[34]

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[29] Department of Agriculture and Food, Western Australian Government, 2016, 'Western Australian biosecurity supported with new strategy', viewed April 2017, https://www.agric.wa.gov.au/newsletters/agmemo-rangelands/rangelands-agmemo-december-2016-issue-4?page=0%2C6.

[30] ABC News, 2016, 'Wild dog fencing key to bringing more sheep back to Western Australia, industry says', viewed April 2017, http://www.abc.net.au/news/2016-11-15/wild-dog-funding-will-boost-sheep-flock-wa/8026018?WT.mc_id=newsmail.

[31] Department of Agriculture and Water Resources, 2016, 'Control tools and technologies for established pest animals and weeds competitive grants programme' viewed April 2017, http://www.agriculture.gov.au/pests-diseases-weeds/pest-animals-and-weeds/wp-comp-grants-programme.

[32] Work Safe Australia, 2017, 'Hazardous chemicals', viewed April 2017, http://www.safeworkaustralia.gov.au/sites/swa/whs-information/hazardous-chemicals/pages/hazardous-chemicals-other-substances.

[33] Melbourne Sustainable Society Institute, 2015, *Appetite for Change: Global Warming Impacts on Food and Farming Regions in Australia*, viewed April 2017, http://sustainable.unimelb.edu.au/sites/default/files/MSSI_AppetiteForChange_Report_2015.pdf.

[34] ABC News, 2016, 'National Farmers' Federation partner with Climate Action farmers', viewed April 2017, http://www.abc.net.au/news/2016-11-23/nff-link-with-farmers-for-climate-action/8049846?WT.mc_id=newsmail.

The agriculture sector will need to adapt to these changing conditions. There are opportunities for adaptation to the impacts of changed weather patterns through improved farming technologies and practices. For example, among many other benefits to emerging challenges, ongoing discoveries in biotechnology can benefit the environment through alternative species and hybrids that are salt-tolerant and resistant to drought, disease and pest species.

The challenge for individual farmers is to capitalise on technology that supports decision-making to develop large-scale farming systems for increased productivity, efficiency and optimisation of available resource utilisation.

Water and land availability

Land and water constraints are characteristic in Australian agriculture. Access to freshwater varies considerably across Australia; drought is frequent, as is the occurrence of flooding. Managing Australia's water more efficiently and increasing water capture and storage will be critical in maintaining, and ideally increasing, agricultural and food production levels given current predictions for the declining availability of freshwater.

As the population continues to expand, land remains an issue for agricultural production. A recent report reveals that Melbourne can currently provide enough food to meet 41 per cent of the city's food needs, but that urban expansion is putting city-fringe farmland at risk. By 2050, Melbourne will only be able to produce 18 per cent of what its people eat.[35]

Embedding sustainable practices as a core business strategy applied across the industry sub-sectors and their supply chains will lead to sustainable management of land and water and an ability to address the challenge of water and land availability.

Market and trade

Agriculture is an important part of the Australian economy and is a competitive net exporter sector, with around two-thirds of total production being exported.[36] Over the 10 years to 2016–17 the share of Australia's total farm exports shipped to Asia increased from 52 per cent to 69 per cent. The fastest growing export destinations over this period included China, India, Indonesia, the Philippines, the Republic of Korea and Vietnam.[37]

Opportunities to increase market access can extend beyond free trade agreements, through the building of brand awareness for Australia as a globally recognised producer of safe, clean food and fibre products.

Key points on the industry's international trade include the following:[38]

- The value of farm production is forecast to decline by 5 per cent to $59 billion in 2017–18 before increasing by 3 per cent to $61 billion in 2018-19.
- The value of livestock production is forecast to increase by around 3 per cent to $29.6 billion in 2018–19, following a forecast increase of 2 per cent in 2017–18.
- The value of crop production is forecast to increase by 3 per cent to $31 billion in 2018–19, after a forecast decline of 11 per cent in 2017–18.

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[35] Carey, R., Larsen, K., Sheridan, J. & Candy, S., 2016, *Melbourne's Food Future: Planning a Resilient City Foodbowl*, viewed April 2017, http://www.ecoinnovationlab.com/wp-content/attachments/Melbourne-Food-Future-planning-a-resilient-city-food-bowl-web.pdf.

[36] Department of Agriculture and Water Resources, 2017, 'Trade and market access', viewed April 2017, http://www.agriculture.gov.au/market-access-trade.

[37] ABARES, 2018, Agricultural Commodities March Quarter 2018.

[38] ABARES, 2018, Agricultural Commodities March Quarter 2018.

- Export earnings from farm commodities are forecast to be $48.5 billion in 2018–19, slightly higher than the forecast $47 billion in 2017–18.
- Export earnings in 2018–19 are forecast to rise for canola (22 per cent), cotton (17 per cent), barley (12 per cent), lamb (9 per cent), wool (7 per cent), wheat (6 per cent), rock lobster (4 per cent) and live feeder/slaughter cattle (1 per cent). The growth is driven by forecast higher export prices for these commodities.
- Export earnings in 2018–19 are forecast to decline for chickpeas (54 per cent), sugar (11 per cent) and wine (2 per cent). Export earnings for beef and veal, cheese and mutton are forecast to be unchanged. The decline is driven by a fall in export prices for these commodities.

Many agricultural companies are already engaged in exporting agricultural commodities from Australia, and a few are currently involved in other international relationships (such as importing goods or services, or being involved in an international supply chain or in international research and development collaboration); but many others see opportunities and plan to expand overseas in the coming years. The most significant challenges for the agricultural sector in doing business overseas includes:[39]

- high domestic costs in Australia
- adverse exchange-rate movements
- increased international competition
- risk of financial or economic crisis in key overseas market
- 'red tape' in Australia.

Global farming trends aimed at using less arable land, less water and fewer resources while feeding (and providing products for the medicinal purposes of) a population of 12 billion people by 2100, include:[40,41]

- Farming the new species of seaweed to process into traditional pasta, or flakes to feed farmed abalone, and growing seaweed for cosmetics and nutrients.
- Growing fly larvae and bugs on food and agriculture waste for conversion to stockfeed and fertiliser to increase yields.
- Growing medicinal cannabis as it became legalised, but strictly controlled. The raw material is difficult and expensive to import, but the domestic market for medicinal cannabis is worth an estimated $100 million per year.

Research, innovation and applied technology

In order to secure future success of the agriculture sector, it is crucial that research and development are used to build knowledge and an understanding of challenges, so that research outcomes can be applied, with the aid of technology, as innovative solutions to challenges. It is necessary to bridge the gap between research results and application on-farm/on-site, so as to harness the value of the investment in research through extension services. Greater application of technology from research

[39] Australia's International Business Survey, 2016, *Industry Profile Report: Agriculture, Forestry and Fishing*, viewed April 2017, https://www.austrade.gov.au/ArticleDocuments/1358/AIBS-2015-agricultural-forestry-fishing-industry-profile.pdf.aspx.
[40] ABC News, 2016, 'Food and agriculture companies seeking to secure future food supply pitch innovative ideas', viewed April 2017, http://www.abc.net.au/news/2016-11-07/food-bytes-innovation-to-unlock-greater-food-production/8001442.
[41] ABC News, 2017, 'Medicinal cannabis market offers new opportunities for agriculture', viewed April 2017, http://www.abc.net.au/news/2017-02-22/medicinal-cannabis-new-agricultural-opportunity/8287346.

investment will see improved access to new technologies and application of best practice on a broader scale. Increased coordination and communication between new technology and policy developments will lead to improved productivity, quality and profitability of Australian agriculture.[42]

Less than 25 per cent of arable farmland in Australia is currently managed using precision agriculture technologies. As a result, a project has been recently co-funded by the Victoria State Government to empower grain growers to understand the benefits of data management, and to increase the uptake of precision agricultural technologies, including digital technologies and analytics that will increase productivity and profitability.[43]

Unmanned aerial vehicles (UAVs), or drones, have many applications in agriculture, and the recent introduction of new legislation at federal and state/territory levels is helping producers to use technology to both spray and monitor crops on their properties. Using UAVs to spray crops is now possible in Queensland because of amendments to the *Agricultural Chemicals Distribution Control Act 1966*.[44, 45] For use of smaller, lightweight UAVs, which are useful for monitoring crops for pest, disease and weed presence, the Federal Government passed legislation in September 2016 to allow a person to operate a very small (less than 2 kg) remotely piloted aircraft (RPA) without certification, if it is being operated in standard RPA operating conditions.[46]

A broad range of growers and producers, from nut, citrus, berry, tropical fruit and vegetable growers to nursery product producers, are expected to benefit in the future from increased access to chemicals from a large research program supported by AgVet grant funding to provide specific data. Growers will be provided with more opportunities to better manage pests, weeds and disease, ensuring the sustainability and profitability of the industry – and quality products for consumers.[47]

Embracing innovation and adopting new technologies to respond to market changes, open up new markets and maintain a competitive edge in the face of economic and climatic challenges will be essential for the agriculture sector.

[42] National Farmers' Federation, 2013, *Blueprint for Australian Agriculture 2013–2020*, viewed April 2017, http://www.nff.org.au/blueprint.html.
[43] Premier of Victoria, 2017, 'Supporting grain growers – adapting to climate change', viewed April 2017, http://www.premier.vic.gov.au/supporting-grain-growers-adapting-to-climate-change/.
[44] Queensland Government, 2016, 'Queensland farmers can now spray crops from drones', viewed April 2017, http://statements.qld.gov.au/Statement/2016/11/10/queensland-farmers-can-now-spray-crops-from-drones.
[45] Biosecurity Queensland, n.d., 'Drones spray and monitor crops in Queensland', viewed April 2017, http://www.vision6.com.au/em/message/email/view?a=10433&id=1133087&k=WgSTvyPipOAMlGqtk2udFuhAAb1TO84AM6lspWx3xGM.
[46] Civil Aviation Safety Authority, 2016, 'Flying drones/remotely piloted aircraft in Australia', viewed April 2017, https://www.casa.gov.au/aircraft/landing-page/flying-drones-australia.
[47] Horticulture Innovation Australia, 2017, 'More than $1.2 million in chemical grants secured', viewed April 2017, http://horticulture.com.au/growing-innovation/issue-21-agvet-grants/.

C. EMPLOYMENT

Employment update

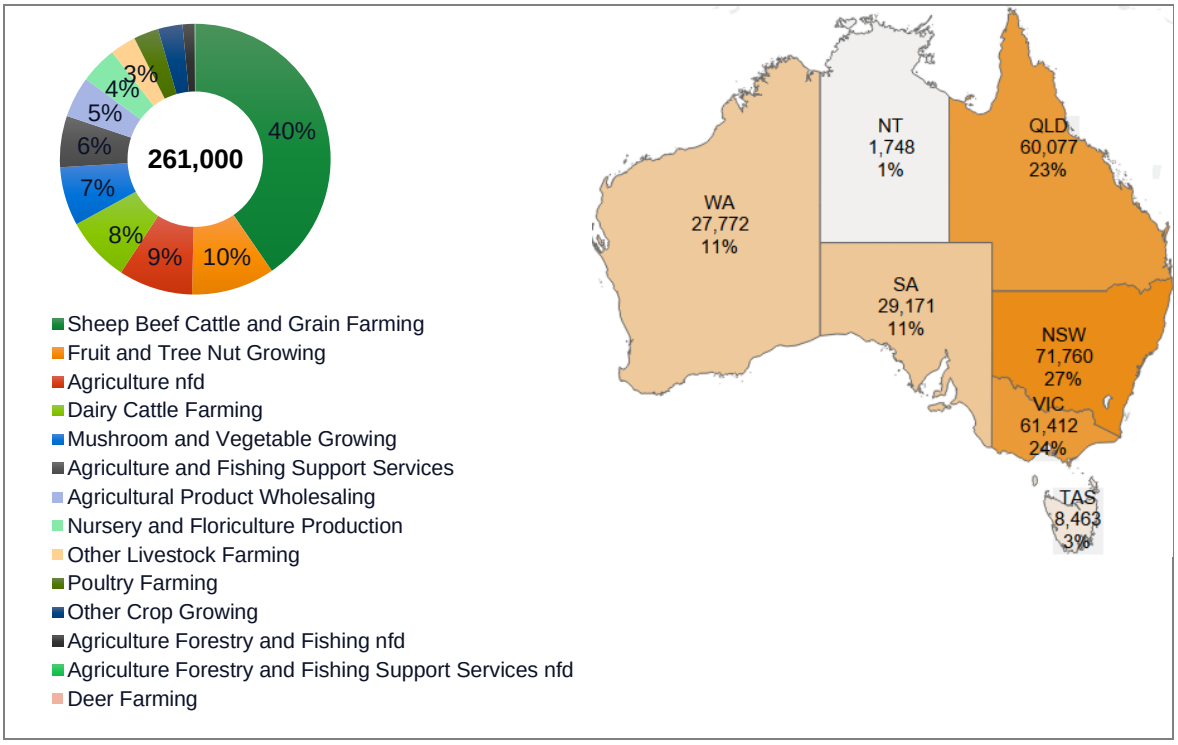
Total employment

According to census data, the Australian agriculture, horticulture and agricultural product wholesaling industry employed 261,000 people in 2016.[48,49] This covers all agriculture subsectors, including agriculture support services and related wholesaling activities. It does not cover parks and garden operations.

About 70 per cent of these people were employed full time.

Sheep, beef cattle and grain farming together with fruit and tree nut growing accounted for 50 per cent of this industry's employment. The industry was concentrated in New South Wales, Victoria and Queensland, providing 74 per cent of the industry employment.

Figure 1. Industry employment by subsectors and states and territories, 2016



Changes in employment, 2006 to 2016

The agriculture and agricultural product wholesaling industry experienced an overall decline in employment from 2006 to 2016. This decline was due to an apparent significant employment fall (–39 per cent) in the agricultural product wholesaling sector, and additional workforce reductions in sheep, beef cattle and grain farming (–21 per cent) and fruit and tree nut growing (–15 per cent).

[48] All employment data in this report is sourced from the ABS Census datasets via the TableBuilder Pro product.

Note that the 2016 Census processed an increased number of incomplete, non-specific or imprecise responses, which could not be coded to the most detailed level of ANZSIC classification and were added as Agriculture nfd (not further defined).

A sub-sector analysis also shows that mushroom and vegetable growing, agriculture support services, nursery and floriculture production and poultry farming went through positive employment growth from 2006 to 2016. The employment levels in all other industry sub-sectors remained relatively stable.

Figure 2. Employment trends, 2006–2016

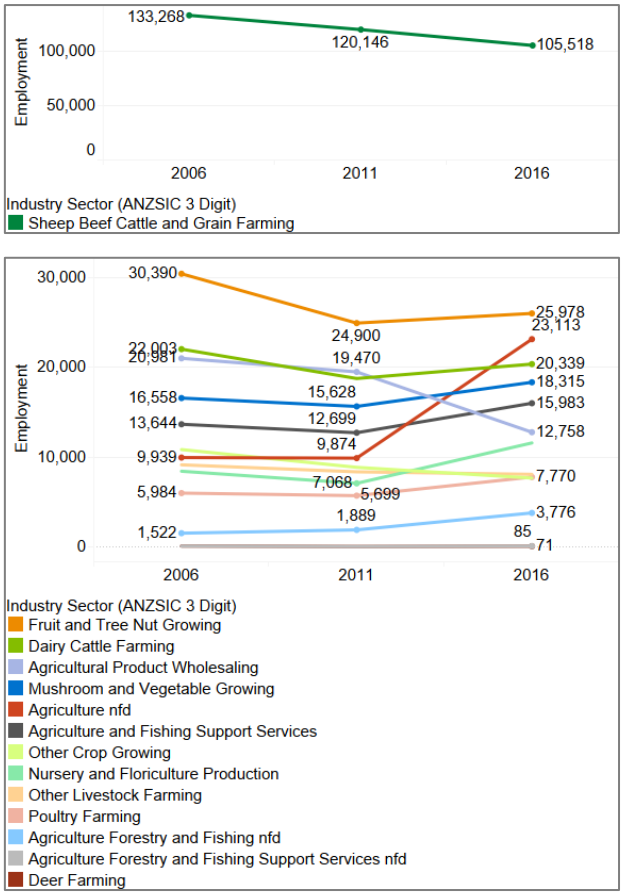
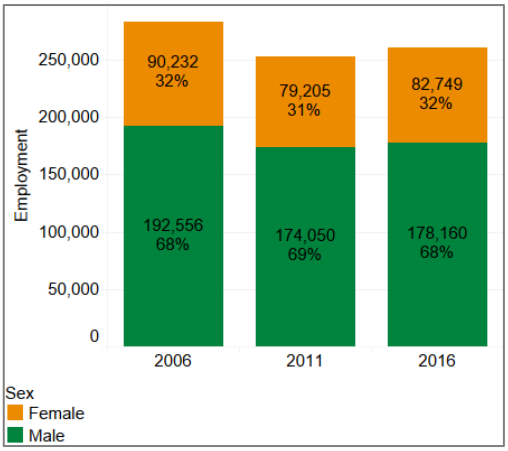


Figure 3. Industry employment by gender, 2006–2016



Gender composition of the workforce

This industry has a higher level of male employees than female. In 2016, woman represented 32 per cent of industry's employees and men 68 per cent. Data also shows that the proportion of male and female participation did not change from 2006 to 2016.

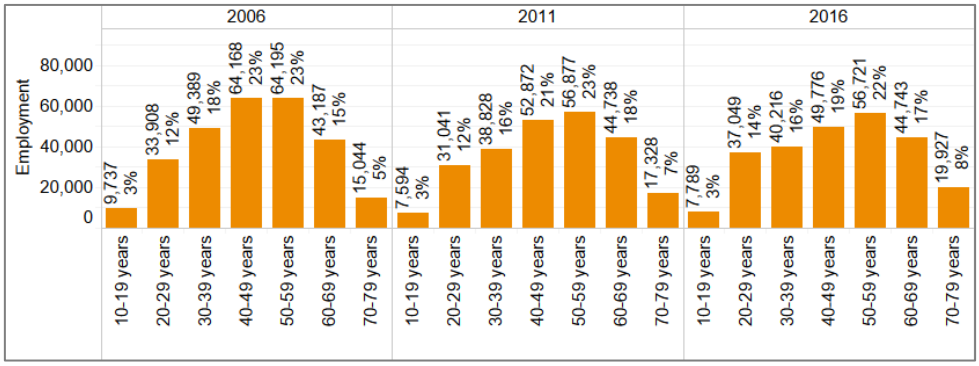
A sub-sector analysis indicates that nursery and floriculture production had the highest female participation (43 per cent) of all industry sub-sectors in 2016, followed by other livestock farming (40 per cent), mushroom and vegetable growing (39 per cent) and agricultural product wholesaling (38 per cent). The lowest level was in agriculture support services (23 per cent), other crop growing (24 per cent) and sheep, beef cattle and grain farming (29 per cent).

Age levels of the workforce

The industry workforce is ageing. The proportion of employees in each age group category over 60 years increased by up to 3 per cent in 2016, when compared with 2006.

Among all industry sub-sectors, agriculture support services, mushroom and vegetable growing, and poultry farming employed a higher proportion of people in the age group 20 to 29 years (23, 21 and 20 per cent respectively) and a lower proportion in the older age groups (10 per cent).

Figure 4. Industry employment by age level, 2006–2016



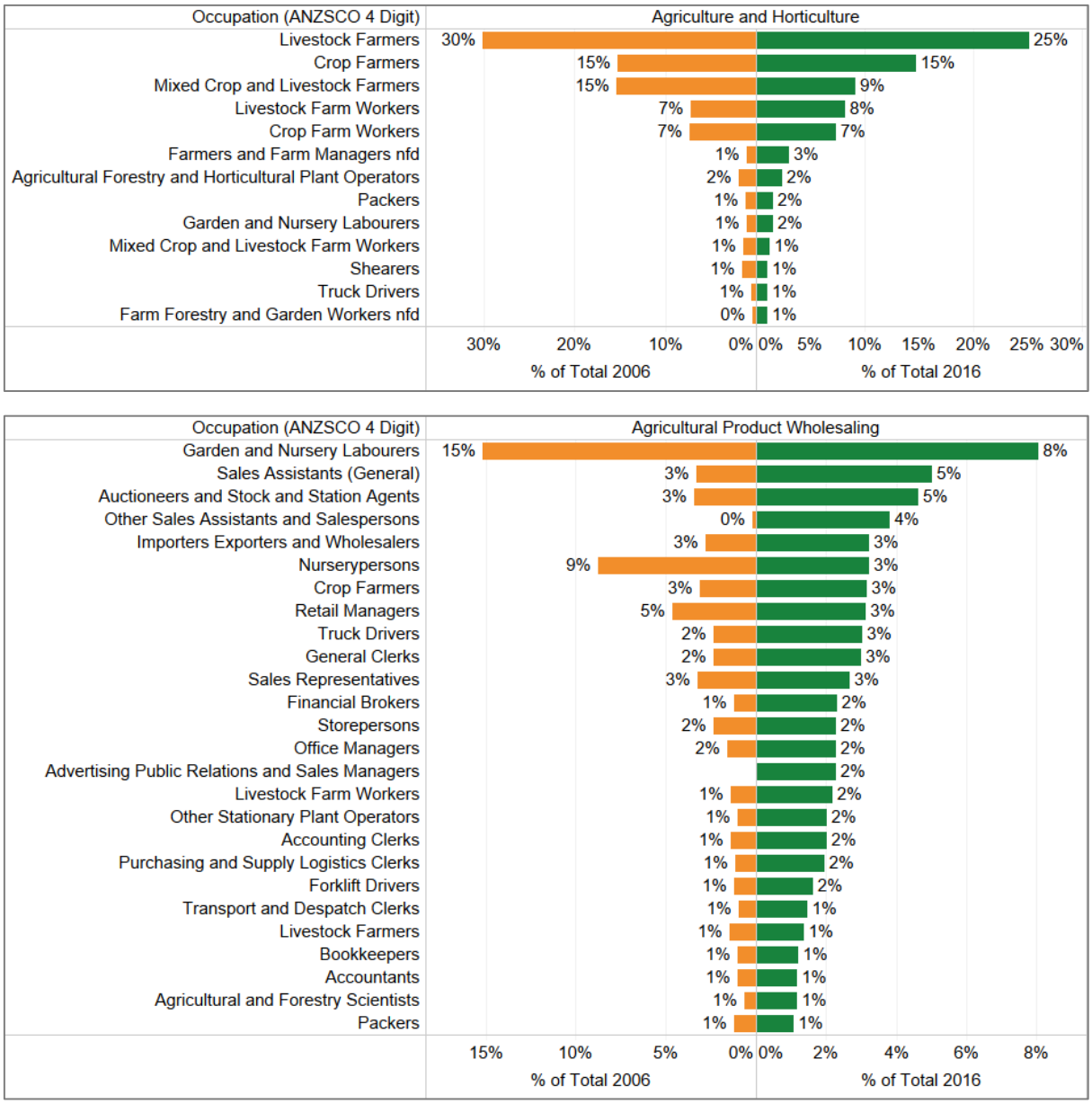
Changes in occupation of employment, 2006 to 2016

The most common occupation in the industry is livestock farmers. In 2016, livestock farmers represented 24 per cent of total industry employment.

Other popular occupations include crop farmers, mixed crop and livestock farmers, livestock farm workers and crop farm workers.

In terms of occupational dynamics, the proportion of livestock farmers and mixed crop and livestock farmers decreased each by more than 5 per cent across the agriculture industry. The proportion of gardeners and nursery labourers, including nursery persons, was also considerably lower in 2016 when compared to 2006. Conversely, the relative number of sales assistants, auctioneer and stock and station agents, salespersons, financial brokers, sales managers and farm managers increased in the industry from 2006 to 2016. All other occupations remained relatively stable over this period of time.

Figure 5. Changes in occupation of employment, 2006 to 2016



Employment outlook

The Department of Employment estimates that total employment in the agriculture, horticulture and conservation and land management industry will remain relatively stable over the next five years to 2022 (Table 3) [50,51].

[50] Department of Employment, 2016, *'Industry Employment Projections – Five Years to May 2022*', viewed December 2017, <http://lmip.gov.au/default.aspx?LMIP/EmploymentProjections>.

[51] The Department's projections are based on based on the forecasts and projections set out in the Mid-Year Economic and Fiscal Outlook (MYEFO).

At the sub-sector level, the forecast indicates a negative employment growth in sheep, beef cattle and grain farming and other livestock farming; and a positive employment growth in most other industry sub-sectors.

Table 3: Department of Employment Industry Projections – five years to May 2022[52]

Industry Sector	Employment Level	Employment Projections		
	May 2017 ('000)	May 2022 ('000)	Growth ('000)	(%)
Agriculture, nfd	42.1	43.2	1.1	2.7
Nursery and Floriculture Production	11.2	11.8	0.7	5.8
Mushroom and Vegetable Growing	19.2	20.4	1.2	6.1
Fruit and Tree Nut Growing	37.5	42.4	4.9	13.1
Sheep, Beef Cattle and Grain Farming	90.8	75.8	-15.1	-16.6
Other Crop Growing	4.5	4.4	0.0	-0.7
Dairy Cattle Farming	27.2	29.0	1.8	6.7
Poultry Farming	9.8	10.5	0.7	6.9
Deer Farming	0.1	0.1	0.0	0.0
Other Livestock Farming	7.6	6.7	-0.9	-11.6
Agriculture, Forestry and Fishing Support Services, nfd	0.1	0.1	0.0	0.4
Agriculture and Fishing Support Services	23.4	25.6	2.2	9.2
Agriculture, Forestry and Fishing, nfd	1.7	1.7	0.0	1.5
Agricultural Product Wholesaling	22.2	23.9	1.7	7.7
Parks and Gardens Operations	19.3	19.8	0.5	2.5
Total	**316.7**	**315.5**	**-1.2**	**-0.4**

[52] Department of Employment, 2016, *'Industry Employment Projections – Five Years to May 2022*', viewed December 2017, <http://lmip.gov.au/default.aspx?LMIP/EmploymentProjections>.

D. SKILLS OUTLOOK

Anticipating future skills needs in the agriculture, horticulture and conservation and land management sector is crucial to preparing to meet the new demands of food markets, business requirements and biosecurity in Australia. Leading indicators of the current and future skills needs in the sector include:

- trends and/or estimates of workforce supply, skill shortages, employment growth or growing occupations
- future changes in workplace and job design that are driven by innovation at the business and/or industry level as a result of economic, technological, social and environmental factors
- the introduction of new policies and legislations.

This section identifies the priority skills needs in agriculture, horticulture and conservation and land management over the next four years (2018–2021) through an analysis of new and estimated future demands placed upon the industry. The section focuses on the skill needs that can benefit from improvement or the development of national skill standards, as opposed to market-adjustment mechanisms designed to balance the supply and demand of a skilled workforce.

The industry expects that the priority skill projects identified in this section will be undertaken over 2018 and 2019, so that the skills can be developed and available before 2020. Refer to *Attachment A – IRC Training Product Review Plan 2018–2021* for the proposed schedule of priority skill projects and units to be checked for currency, and possibly reviewed, as part of the four-year cycle.

Current project in the *AHC Agriculture, Horticulture and Conservation and Land Management Training Package* (AHC) are: Safe Operation Agricultural Machinery and New Technology, Pest Management (Wild Dogs), Chemical Handling and Advanced Skills in Apiculture (Bees).

Training activity

Number of training providers

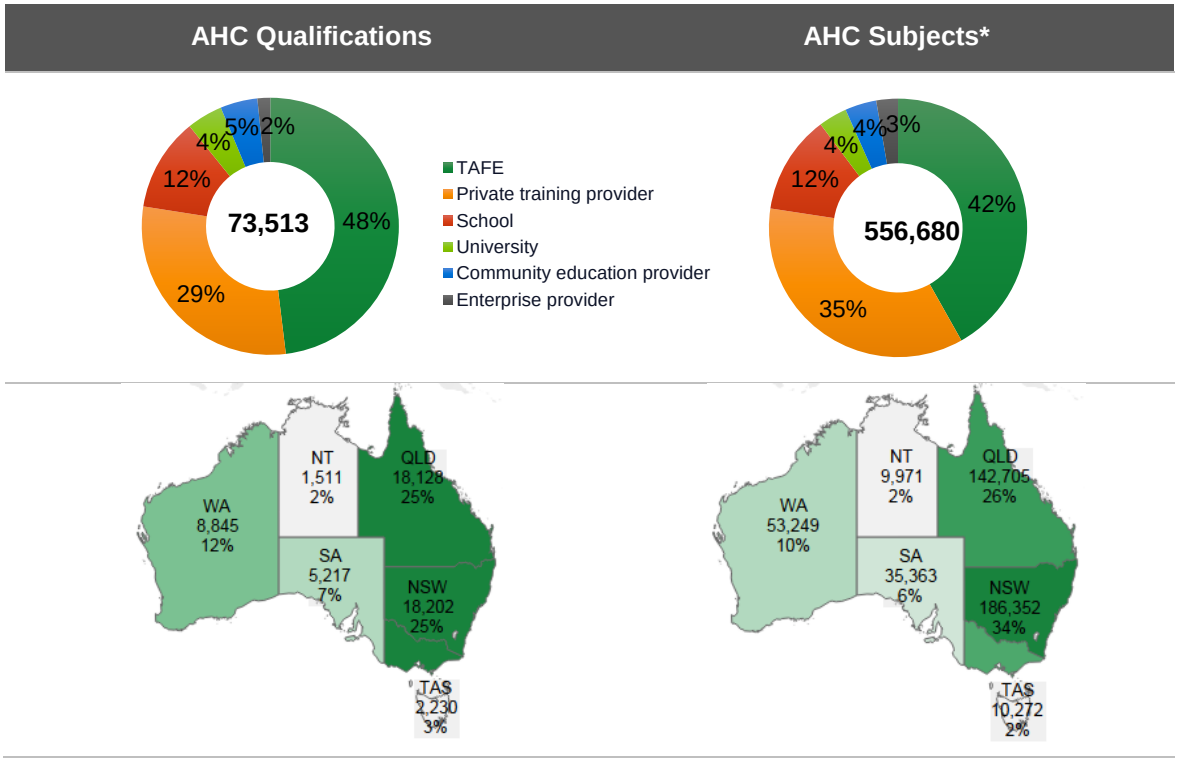
Currently, there are 643 registered training organisations with AHC training components on scope servicing the Australian agriculture industry sectors.[53]

Number of student enrolments

In 2016, there were 73,513 student enrolments in AHC qualifications and 556,680 in AHC units of competency. Most students were attracted by TAFE organisations and private training providers in Victoria, New South Wales and Queensland.[54]

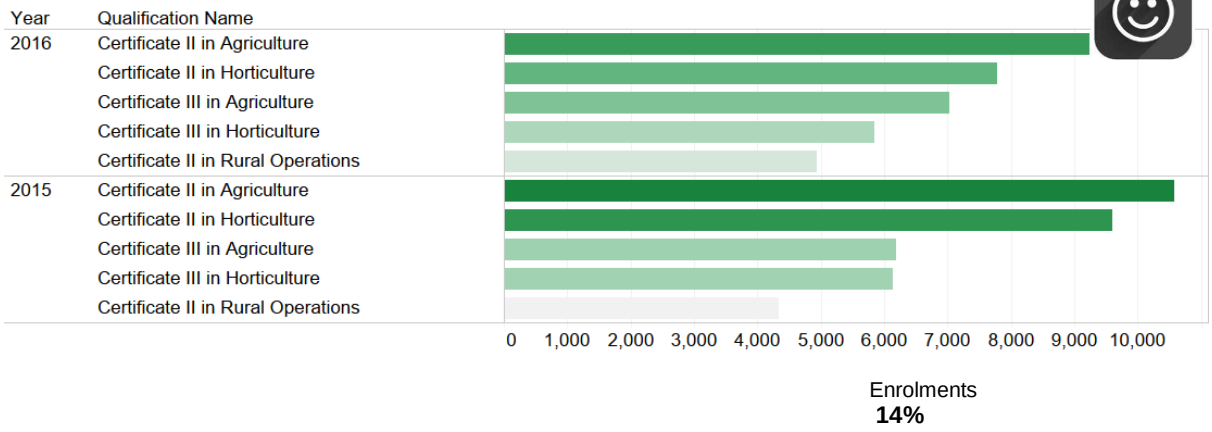
[53] training.gov.au
[54] All training data in this report is sourced from VOCSTATS

Figure 6. Student enrolments, 2016



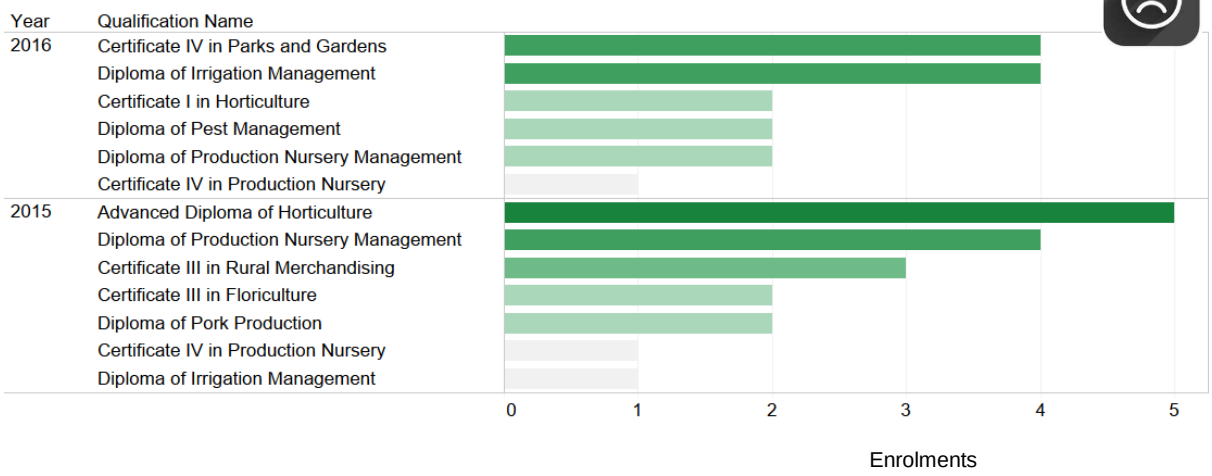
*Units of competency prefixed AHC, RTD, RTE, RTF and RUA.

Top 5 most popular qualifications



14%

Least popular qualifications



Qualifications with no enrolments

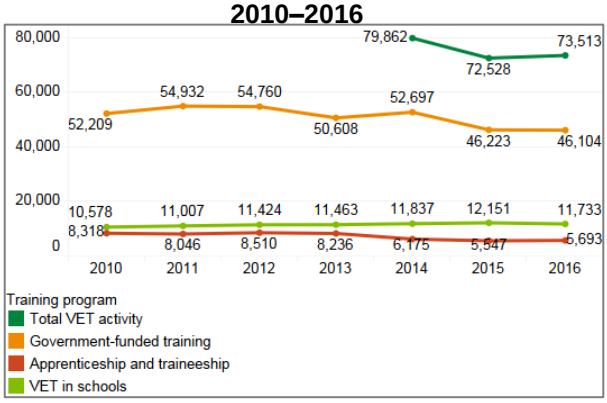
Year	Qualification Name	Qualification Name
2016	Certificate I in Permaculture	Certificate IV in Retail Nursery
	Certificate II in Floriculture	Certificate IV in Seed Production
	Certificate II in Irrigation	Certificate IV in Seed Testing
	Certificate II in Permaculture	Certificate IV in Shearing Contracting
	Certificate II in Retail Nursery	Diploma of Landscape Project Management
	Certificate III in Commercial Composting	Diploma of Permaculture
	Certificate III in Commercial Seed Processing	Diploma of Retail Nursery Management
	Certificate III in Conservation Earthworks	Graduate Diploma of Arboriculture
	Certificate III in Floriculture	Advanced Diploma of Arboriculture
	Certificate III in Lands, Parks and Wildlife	
	Certificate III in Rural Machinery Operations	
	Certificate III in Rural Merchandising	
	Certificate III in Seed Production	
	Certificate III in Seed Testing	
	Certificate IV in Arboriculture	
	Certificate IV in Landscape	
	Certificate IV in Pest Management	

Qualification enrolments

Total VET enrolments in AHC qualifications declined 8 per cent from 79,862 in 2014 to 73,513 in 2016. This includes enrolments from all types of providers and combines government-funded, apprentices, VET in schools and fee-for-service training from private and other training providers.

Apprenticeships and traineeships for agriculture trade and non-trade occupations fell by 31 per cent between 2013 and 2016.

Trends in enrolments for AHC qualifications, 2010–2016

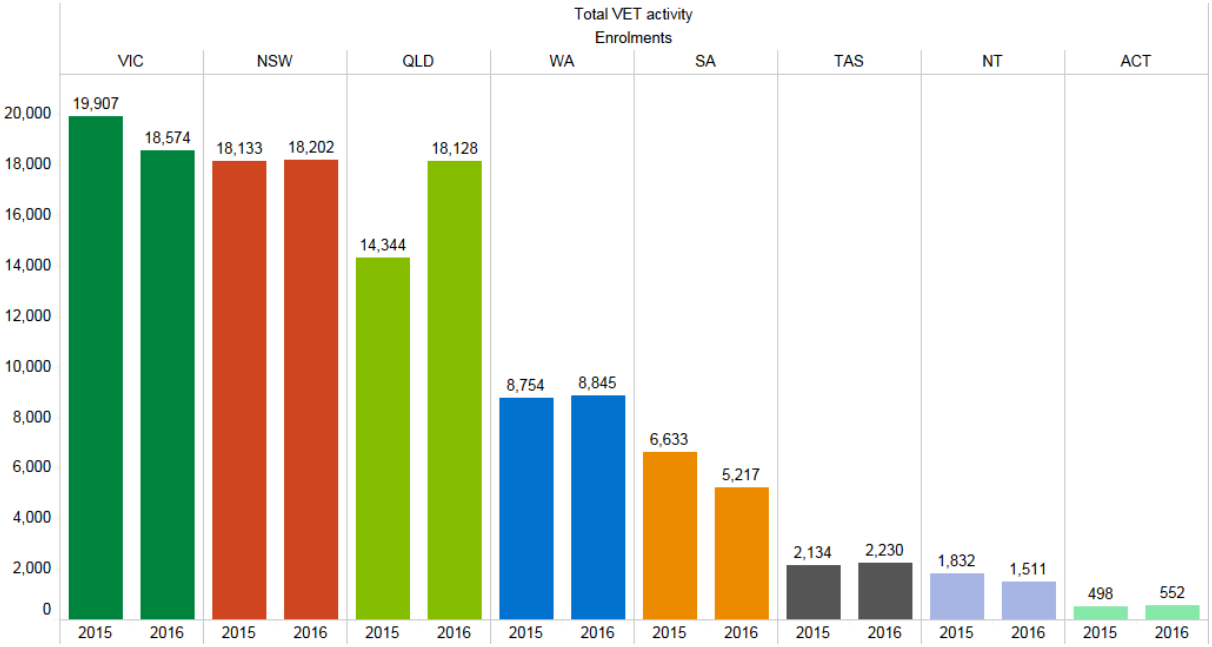


In 2016, there were 5,693 commencements for agriculture apprenticeships and traineeships.

Government-funded enrolments for AHC qualifications fluctuated over 2010–2016. In 2012 they increased to a peak of 54,760, declining to 50,608 in 2013. The number recovered slightly in 2014 to 52,697 enrolments. This was followed by a 13 per cent fall, reaching a low point of 46,104 in 2016.

VET in schools data, reflecting AHC qualifications delivered to students in schools, show a relatively stable number of enrolments between 2010 and 2016. In 2016, there were 11,733 enrolments for AHC qualifications delivered in schools.

Figure 7. State-level comparison for total VET enrolments in AHC qualifications, 2015–2016*



*State/territory of training organisation. Uncategorised data for state/territories (reported as 'Not known') is not included.

Attachment A also presents VET activity for the AHC qualifications in data tables by program type (total VET activity, apprenticeship and traineeship, government-funded training and VET in schools), training status (enrolments and completions), qualification names and state/territory for the period 2012–2016.

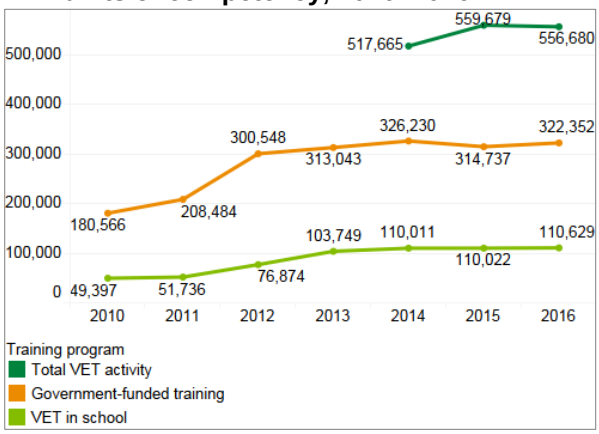
Subject enrolments

Total VET enrolments for AHC units of competency grew by 8 per cent (or 42,014 enrolments) from 2014 to 2015 and dropped slightly in 2016 to 556,680.

Government-funded enrolments increased sharply by 66 per cent (or 119,982 enrolments) from 2010 to 2012 and continued to rise gradually to 326,230 during 2013 and 2014. This growth was followed by a slight decline reaching 322,352 enrolments in 2016.

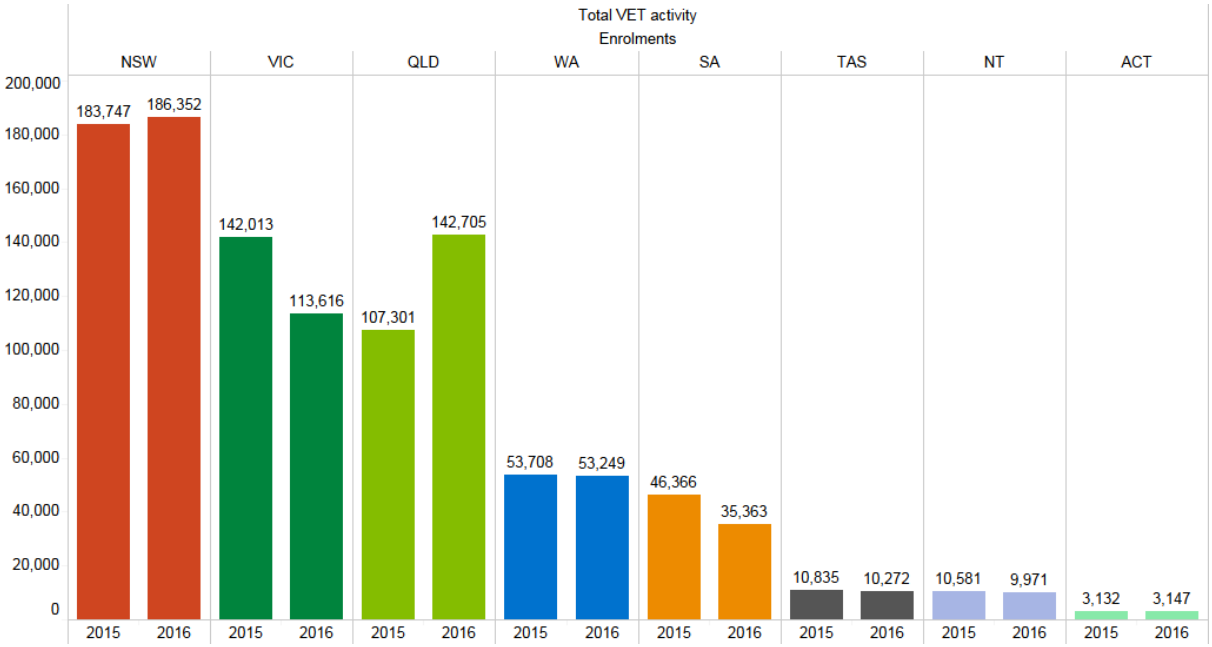
VET in schools activity regarding AHC subjects delivered to school students increased gradually from a low of 49,397 enrolments in 2010 to

Figure 8. Trends in enrolments for AHC units of competency, 2010–2016



110,629 enrolments in 2016. This represents a 124 per cent increase in enrolments over 2010–2016.

Figure 9. State-level comparison for total VET enrolments in AHC units of competency, 2015–2016*



*State/territory of training organisation. Uncategorised data for state/territories (reported as 'Not known') is not included.

Attachment B also presents VET activity for the AHC Agriculture, Horticulture, Conservation and Land Management Training Package units of competency in data tables by program type (total VET activity, government-funded training and VET in schools), training status (enrolments and completions) and units of competency for the period 2012–2016.

Student profile

Total student cohort enrolled in AHC qualifications was represented by 77 per cent male and 23 per cent female in 2016. The highest proportion of students were in the age groups 15 to 19, 20 to 24 and 30 to 39 years. There was a small representation of Indigenous students (53,911). Over a third of students lived in major cities and over half in inner and outer regional Australia. About 1 per cent of students resided overseas.

Figure 10. Student personal characteristics: GENDER AND AGE*

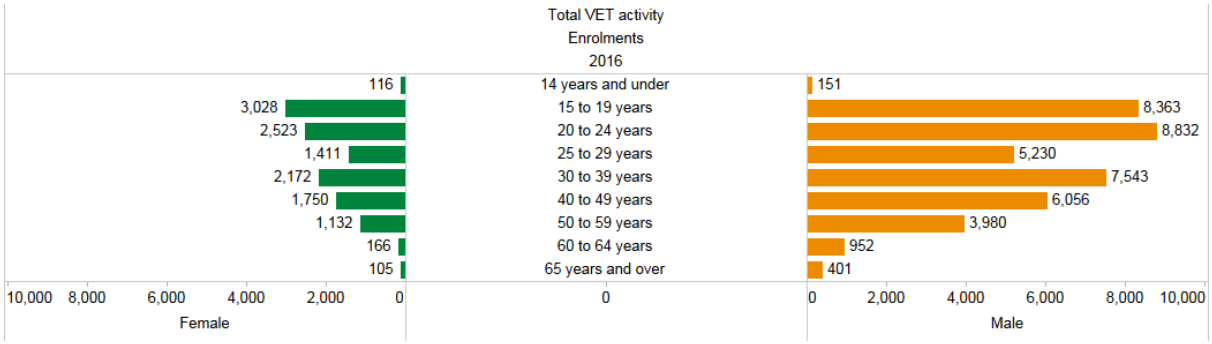


Figure 11. Student personal characteristics: INDIGENOUS STATUS*

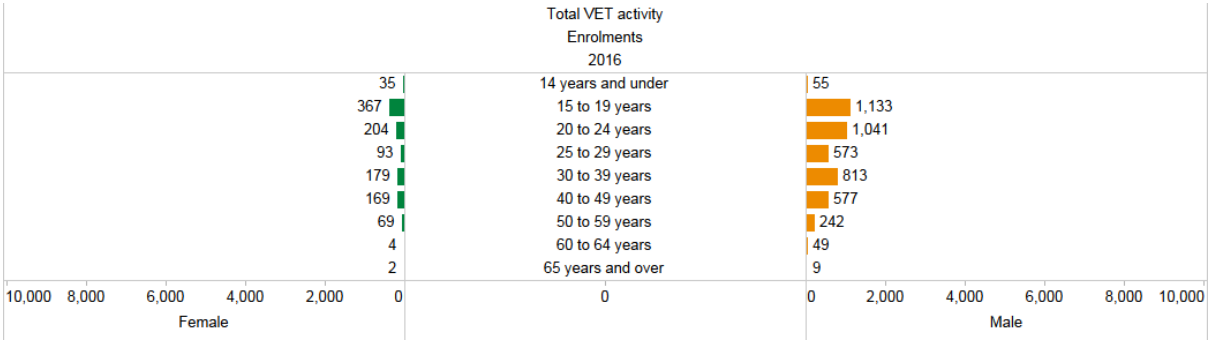
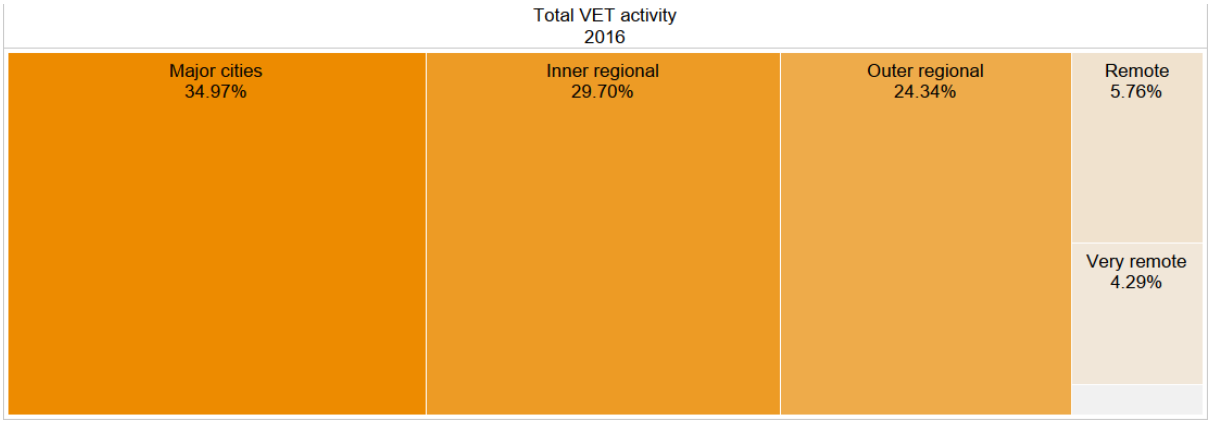


Figure 12. Student personal characteristics: REMOTENESS*



* Uncategorised data (reported as 'Not known') is not included.

Industry priority skills

The 2018–2021 outlook for skills needs and priorities in the agriculture, horticulture and conservation and land management sector is shaped by a range of development trends and factors, as outlined below. (Note: These are broken up into two sections for each of the different IRCs.)

AMENITY HORTICULTURE, LANDSCAPING, CONSERVATION AND LAND MANAGEMENT IRC	
Priority skill 1	**Skill description**
Conservation and land management	The agriculture, horticulture and conservation and land management industry sector is highly diverse, and the conservation and land management sub-sector comprises businesses and organisations that operate: • nature reserves and conservation parks, including national parks, state parks and other parks, to preserve flora and fauna in their natural environment • botanic gardens

	Caring for the land includes a range of activities, including: • sustainable farm practices • restoring native habitats and revegetation • controlling weeds and pests • developing and sharing local natural resource management skills and knowledge.
	Relevant occupations Trainee to senior field officer, field supervisor, ranger, senior ranger.
	Training package solutions • Review 6 qualifications • Review 150 units
Priority skill 2 Production nurseries skills in integrated pest management , growing media & environmental control	**Skill description** Businesses in this sub-sector are involved in growing trees and shrubs, ornamental plants, and bulbs. These businesses sell to retailers or wholesalers, landscapers, local government and councils, and orchardists. Nursery production is organised into both under-cover and outdoor production systems. Industry consultation has identified a need for specific knowledge and skills in integrated pest management, soil management and the efficient use of irrigation systems.
	Relevant occupations Nursery worker, greenhouse worker, production worker, crop protection worker, equipment maintenance worker, manager of crop production or crop protection.
	Drivers • The current qualifications encourage an overreliance on chemicals to manage plant pests and diseases. • Current development of new variants of agricultural chemicals and integrated pest management strategies are key skills areas that are needed in this industry. Industry and other stakeholders have commented on the structure of the qualifications indicating they do not provide the necessary skill sets for integrated pest management, soil management and efficient irrigation systems.
	Drivers The IRC has identified that updates are required to all of the production nursery qualifications to ensure that skills are developed in the use of new

	variants of agricultural chemicals and integrated pest management strategies.
	Training package solutions • Develop up to 5 new skill sets • Develop up to 25 new units • Review 2 qualifications • Review 38 units
Priority skill 3 Landscape qualifications: pathways and ecology	**Skill description** Landscape design, with a focus on construction units.
	Relevant occupations Landscape design supervisor, landscape design team leader, architect, builder, interior designer, pool designer.
	Drivers The LNA Master Landscapers Association has raised concerns that *AHC42016 Certificate IV in Landscape* currently has no entry requirements. The LNA Master Landscapers Association had made a submission to the previous Industry Skills Council to review qualifications and entry requirements in 2015. Their concerns were not addressed in the new release of AHC42016 in 2016. The intention was that *AHC30916 Certificate III in Landscape Construction* would be part of the pathway from a Certificate III to a Diploma-level qualification. There are no clear pathways for landscape design or landscape construction-focused job roles. Feedback received has indicated that there is a need to have qualifications that have clear pathways to job outcomes in one or the other field. Industry would benefit from clear delineation of the skills involved when seeking applicants for specialised positions. As such, there are sectors that are encroaching and tendering for works in high-risk design and construct works in landscaping without full understanding of WorkSafe, Australian Standards in building, the latest Pool Fencing Act, chemical handling requirements, ecology, horticulture basics, plant knowledge or engineering details. This can be detrimental to the professionalism that landscaping industry is working to uphold.
	Training package solutions • Develop 5 new skill sets • Develop 20 new units as identified during review • Review 3 qualifications • Review 32 units

Priority skill 4	Skill description
Sports turfs	Changes in turf management have increased the need for skills in the use of turf surface health and usability monitoring technology; knowledge of the use and effects of growth regulators as an integral part of surface maintenance; and skills in using GPS-assisted machinery, hydraulics and hybrid/battery machines.
	Relevant occupations Turf manager, greenkeeper, groundsperson, garden maintenance worker.
	Drivers Advances in technology for monitoring and maintaining turf surfaces in addition to improved efficiency of growth regulators require qualification and unit review to ensure that students have developed competency in current industry practices (e.g. A*HCTRF303 Implement a grassed area maintenance program* no longer meets industry requirements).
	Training package solutions • Develop up to 4 new skill sets • Develop up to 5 new units • Review 2 qualifications • Review 38 units

Priority skill 5	Skill description
Rooftop gardening and green walls	Knowledge of environmental factors of microclimates, plant selection, installation of vertical water delivery systems, filtration systems, drainage facilities, waterproof barrier selection, nutrient requirements, working at heights on elevated work platforms, and local government legislation.
	Relevant occupations Rooftop gardener, horticulturist, nursery worker/advisor.
	Drivers Population growth in the cities is influencing government policies around sustainable living and urban greening within high-density living areas. There will be an increasing demand for skills in developing rooftop gardens and green walls.
	Training package solutions • Develop 1 new qualification • Develop up to 5 new skill sets • Develop up to 25 new units

Priority skill 6 Carbon farming skill sets	**Skill description** Working knowledge of carbon farming and legislation, and carbon project management.
	Relevant occupations Agribusiness worker, farmer, farm manager, technical advisor.
	Drivers Support from the National Farmers' Federation enabling farmers to access the Emissions Reduction Fund,[55] and a growing interest from farmers in diversifying farming activities and income, have increased awareness of carbon farming. Currently, there is no nationally-accredited training available for farmers or managers to fill this growing skills gap. Previously accredited carbon farming units and skills sets have been superseded, with no replacements. Requests to reinstate units and skill sets have been made by Carbon Farming Australia.
	Training package solutions • Develop up to 8 skill sets • Develop up to 11 new units • Review 11 units

Priority skill 7 Permaculture review	**Skill description** The permaculture industry covers a diverse range of applications, from broad scale organic farming and intensive farming through to community and school gardens. The skills and knowledge required cover permaculture system design, sustainability, animal health and welfare programs, and understanding soil and plant bioregional characteristics and applications.
	Relevant occupations Gardeners, food producers, permaculture landscapers.
	Drivers A low number of RTOs have the permaculture certificates on the scope of their delivery. It has been identified to members of the IRC that some of the units, such as *AHCORG403 Manage organic soil improvement* no longer meet the needs of the whole permaculture sector as this unit requires broad scale farming practice rather than small intensive farming or other applications. A review of the qualifications is required to ensure that the low enrolments in these qualifications reflects the niche skill market rather than reflection of the lack of qualification currency or application.

[55] Australian Farmers, 2016, 'Time to unlock carbon markets for forestry', viewed April 2017, http://www.farmers.org.au/content/nff/en/news-updates/nff-news/forestry-method-181016.html.

Training package solutions

- Review 3 qualifications

AGRICULTURE AND PRODUCTION HORTICULTURE IRC

Priority skill 1
Protected horticulture

Skill description

Managing closed cropping systems, nutrient film techniques, flooding and draining, aeroponics, growth media, setup and maintenance of protected cropping irrigations systems, setup trellis systems, operation of automated controls and climate control technologies.

Relevant occupations

Horticulturist, nursery worker, farm hand, farm manager, harvesting operator, greenhouse technician.

Drivers

The Australian protected cropping industry is the fastest growing food producing sector in Australia. Valued at $1.3 billion farm gate per year, this equates to 20 per cent of total value of vegetable and flower production. The Industry employs 10,000 and is expanding at a rate of 4–6 per cent per year. Current investment is conservatively valued at $975 million with annual investment at $50 million per year.[56]

As the sector is growing and changing with technology, more skilled labour is required to fill skills gaps to meet the demand from retailers. It is predicted an increase in consumption of protected cropping produce is set to rise by 50 per cent in the next five to eight years.[57]

Reasons for growth include:

- faster growth, higher yields, better quality
- extended growing seasons
- reduced impact on environment
- better efficiencies in energy and water use.

Training package solutions

- Develop 2 new qualifications at AQF 3 and 4 levels
- Develop up to 5 new skill sets as identified during review
- Develop up to 25 new units

[56] https://www.protectedcroppingaustralia.com/wp-content/uploads/2016/06/National-Training-Centre-for-Controlled-Environment-Horticulture-PART-1.pdf
[57] Ibid.

Priority skill 2 Irrigation technology, design and processes	**Skill description** Ability to apply various types of irrigation systems, such as pressurised and gravity-fed irrigation, and to use existing and new technologies (e.g. mobile apps, capacitance probes, tensiometers, neutron probes) in irrigation monitoring.
	Relevant occupations Irrigation installation site worker and manager, worker and manager of irrigation systems, irrigation business manager, irrigation service worker.
	Drivers Ongoing implementation of new processes and technologies in irrigation has facilitated the need for flexibility in irrigation specialities. An example of new technology is mobile apps designed to help guide irrigation decisions.[58] The Industry Reference Committee has received feedback that existing units need to be reviewed and updated to ensure that different types of irrigation (broadacre, gravity fed, pressurised, domestic/urban irrigation) are covered in the range of units and are able to be delivered separately based on specific job roles.
	Training package solutions • Develop up to 5 new skills sets as identified during review • Develop up to 25 new units as identified during review • Review 4 qualifications • Review 48 units

Priority skill 3 Agriculture skills in data capture and analysis	**Skill description** Knowledge of, and ability to use, specialised geospatial software and technologies, including remote sensors, drones, new-generation satellite imagery technologies, and wearable and mobile technologies and apps. Knowledge of data capture from a range of devices (e.g. drones, digital cameras, infrared cameras, mobile apps, soil moisture sensors, climate data loggers, etc.). Ability to apply a range of analytical methods to geospatial and other technology-platform data that directly support assessment of crop/livestock health, planning, diagnosis and decision making.
	Relevant occupations Animal attendant/stockperson, farm or station hand, farm or station worker, farm or station labourer, livestock transport driver, farm team leader, farm

[58] Horticulture Innovation Australia, 2016, 'New app will tell growers when plants need watering', viewed April 2017, http://horticulture.com.au/new-app-will-tell-growers-when-plants-need-watering/.

supervisor, farm production manager, production unit manager, agronomist, station/property manager.

Drivers

There is growing investment in integrated world-leading technology, such as robotics, digital and wireless. These technologies assist to monitor farm operations and detect issues with crop or livestock health, along with quality standards in operations and industry databases including commodity-specific production platforms and other technology platforms, and are expected to influence the roles of farmers.

Continuous development of new technologies with the potential to support farmers with emerging challenges, including those arising from climate change, pressure on global food supplies and fresh water, and the management of pests and diseases, will add to the vocational outcomes of the agricultural work sector.

Training package solutions

- Develop 3 new skill sets
- Develop 10 new units as identified during review
- Review 4 qualifications
- Review 7 units

Priority skill 4
Biosecurity skill sets

Skill description

Skills are required for developing and implementing preventive biosecurity strategies within agribusinesses. Skills required include: biosecurity surveillance, monitoring agricultural products and information analysis, implementing preventive biosecurity programs and environmental impacts of exotic disease to the Australian native flora and fauna.

Relevant occupations

Stockperson, farm or station hand, farm or station worker, farm or station labourer, livestock transport driver, farm team leader, farm supervisor, farm production manager, production unit manager, agronomist, station/property manager.

Drivers

Agriculture biosecurity is a key in accessing premium markets and improving international trade to grow farm businesses. Investment in biosecurity prevention is paramount to ensuring that our agricultural products remain attractive within a global market, and maintaining our disease/pest-free status against many pathogens that affect other agricultural markets around the world.

Current training has a focus on biosecurity response rather than prevention. It is anticipated that this project will provide new units of competency and skills sets that can be used as electives within other agriculture, horticulture and public safety qualifications.

	Training package solutions • Develop up to 5 new skills sets • Develop up to 25 new units
Priority skill 5 Agribusiness Innovations and Farmgate Value-Adding	**Skill description** Skills in strategic planning, risk management, mergers and acquisitions, online marketing, business development and financial planning to respond to the dynamic and changing operating environment, with increased competition and opportunities to reach global markets. New skills in agricultural innovation strategies, implementation of new products and innovation leadership to lead innovative thinking and practice.
	Relevant occupations Rural and regional agribusiness managers (including lending managers, insurance brokers, machinery dealers, chemical resellers, stock agents, grain marketers and real estate agents), agriculture enterprise business managers, production horticulture enterprise business managers, agribusiness administrators.
	Drivers Increasing market demands for innovation in product development to ensure viability of enterprises and to take opportunities in the new free trade agreement with Asia-Pacific region partners.
	Training package solutions • Develop up to 2 new skill sets as identified during review • Develop up to 10 new units as identified during review • Review 3 qualifications • Review 51 units
Priority skill 6 Compliance and Regulation of Medicinal Crops	**Skill description** The medicinal cropping skill set providing specialist knowledge required for medicinal cropping relates to the need for these crops to be highly regulated due to their value in terms of a pharmaceutical agent.
	Relevant occupations Farm worker, greenhouse worker, farm manager, rural agribusiness manager, crop production manager, harvesting operator.
	Drivers Medicinal crops, such as medicinal cannabis, are already a rapidly growing industry in countries around the world. New legislation in Australia is allowing for the production of medicinal cannabis, which, in addition to the expanding poppy crops, has led to growth in the medicinal crop industry. The domestic market for medicinal cannabis is worth an estimated $100 million per year.

	New skills will be emerging related to growing and harvesting the crops, security, understanding and implementing compliance, and government regulation.
	Training package solutions • Develop up to 4 new skill sets • Develop up to 25 new units as identified during project
Priority skill 7 Diploma of Viticulture review	**Skill description** Working knowledge of vineyard operations, leadership, farm management, irrigation and quality assurance systems.
	Relevant occupations Viticulture manager
	Drivers Industry has raised concerns over the job outcomes of the Diploma of Viticulture and its role in the wine industry. Concerns include: • lack of recognition by the industry or identified need for a Diploma of Viticulture • lack of entry requirements creates a misleading expectation • Diploma does not provide 'the right focus' • employers at this level look for skills in leadership and management, not specialist viticulture skills.
	Training package solutions • Develop new skill sets and units as identified during review • Review of 1 qualification and 11 units

Industry priority for generic skills

Industry Reference Committees were consulted on ranking the generic skills priorities for the industry from a list provided by the Department of Education and Training. **Error! Reference source not found.** following table outlines the advice received.

Rank	Generic skill
1	**Learning agility/Information literacy/Intellectual autonomy and self-management skills** Ability to identify a need for information. Ability to identify, locate, evaluate, and effectively use and cite the information. Ability to discriminate and filter information for importance. Ability to do more with less. Ability to quickly develop a working knowledge of new systems to fulfil the expectations of a job. Ability to work without direct leadership and independently.
2	**Managerial/Leadership skills** Ability to effectively communicate with all functional areas in the organisation. Ability to represent and develop tasks and work processes for desired outcomes. Ability to oversee processes, guide initiatives and steer employees toward achievement of goals.
3	**Financial skills** Ability to understand and apply core financial literacy concepts and metrics, streamlining processes such as budgeting, forecasting, reporting and stepping up compliance. Ability to manage costs and resources, and drive efficiency.
4	**Technology use and application skills** Ability to create and/or use technical means and understand their interrelation with life, society and the environment. Ability to understand and apply scientific or industrial processes, inventions, methods, etc. Ability to deal with increasing mechanisation, automation and computerisation. Ability to do work on mobile devices rather than from paper.
5	**Science, Technology, Engineering and Maths (STEM) skills** Sciences, mathematics and scientific literacy.
6	**Language, Literacy and Numeracy skills** Foundation skills of literacy and numeracy.
7	**Environmental and Sustainability skills** Ability to focus on problem solving and the development of applied solutions to environmental issues and resource pressures at local, national and international levels.

8	**Communication/Collaboration, including virtual collaboration/Social intelligence skills** Ability to understand and apply the principles of creating more value for customers with fewer resources (lean manufacturing), plus collaborative skills. Ability to critically assess and develop content that uses new media forms, and leverage these media for persuasive communications.
9	**Design mindset/Thinking critically/System thinking/Solving problems skills** Ability to adapt products to rapidly shifting consumer tastes and trends. Ability to determine the deeper meaning or significance of what is being expressed via technology. Ability to understand how things that are regarded as systems influence one another within a complete entity or larger system. Ability to think holistically.
10	**Entrepreneurial skills** Ability to take an idea, whether it be a product or service, and turn that concept into reality, bring it to market and make it viable. Ability to focus on the very next step to get closer to the ultimate goal. Ability to weather the ups and downs of any business. Ability to sell ideas, products or services to customers, investors, employees, etc.
11	**Data analysis skills** Ability to translate vast amounts of data into abstract concepts and understand data-based reasoning. Ability to use data effectively to improve programs, processes and business outcomes. Ability to work with large amounts of data: facts, figures, number crunching, analysing results.
12	**Customer service/Marketing skills** Ability to interact with others, whether helping them find, choose or buy something. Ability to meet customer wants and needs via face-to-face interactions or digital technology. Ability to manage online sales and marketing. Ability to understand and manage digital products.
13	**Other generic skills** Responses included: emotional intelligence, social media, broad blueprint of general knowledge, human resources, people management, observation skills.

E. IRC SIGNOFF

This IRC Skills Forecast and Proposed Schedule of Work was agreed as a result of a properly constituted Industry Reference Committee decision.

Signed for and on behalf of the two **Industry Reference Committees** by its appointed Chairs:

Agriculture and Production Horticulture IRC

Signature of Deputy Chair

Geoff Harvey

Date: 27th April 2018

Amenity Horticulture, Landscaping, Conservation and Land Management IRC

Signature of Chair

Esther Ngang

Date: 27th April, 2018

ATTACHMENT A

IRC Training Product Review Plan 2018–2021 for the Agriculture, Horticulture and Conservation and Land Management Industry Sector

Relevant training package: *AHC Agriculture, Horticulture and Conservation and Land Management*

Contact details: Skills Impact Ltd, 559A Queensberry Street, North Melbourne, VIC, 3051

Date submitted to Department of Education and Training: 28 April 2018

2018 Amenity Horticulture, Landscaping, Conservation and Land Management IRC	
Conservation and land management	The IRC has identified that updates are required to all of the conservation and land management qualifications to align with new practices in land management, restoration and cultural practices currently being used in industry.
Production nurseries skills in integrated pest management (IPM), growing media & environmental control	The current qualifications encourage an overreliance on chemicals to manage plant pest & diseases. Specifically Treat Pests and Diseases & Control Pests and Diseases along with Treat Weeds and Control Weeds. AHCPMG302 - Control plant pests, diseases and disorders, AHCPMG301 - Control weeds, refer to IPM programs however there is no curriculum associated with the development and operation under an IPM program. The level II AHCPMG202 - Treat plant pests, diseases and disorders & AHCPMG201 Treat weeds are predicated strongly on chemical intervention and while with latitude IPM ideologies can be worked into the content it isn't the key intent of the UoC. It is critical that IPMwhich has been actively practiced in other sectors for over 30 years, such as vegetables particularly brassicas that were decimated by multiple pesticide resistant pests in the 80's & 90's and widely in cotton. Now many commercial crops utilise IPM to monitor for, detect and decide on intervention methods for pests and diseases (potatoes, strawberries, cotton, soybeans, tree crops, nurseries and vegetables) and yet there are no clear UoC that delivers IPM in either the amenity or production sectors. IPM could be adapted across all Horticultural & Agricultural sectors

	where pest, disease and weed control is required, particularly protected cropping where chemical options are restricted due to closed environments and re-entry periods. Industries adopting IPM have shown massive reductions in chemical usage and pest populations are less likely to fluctuate due to more balanced populations of beneficial and pest organisms.
Landscape qualifications: pathways and ecology	Industry consultation has highlighted that there are no clear pathways for landscape construction or landscape design roles and that industry workers are missing key skills in ecology. This project aims to develop key skills in landscape design with a focus on construction units will be relevant for the following occupations: Landscape design supervisor and Landscape design team leader
Sports turf skills update	This project addresses the need for skills and knowledge of increasingly complex turf management processes. This includes the ability to: • use advancing technology in monitoring of turf surface health and usability e.g. portable soil moisture/salinity and temp sensors; weed and disease predicting software incorporating weather stations; GPS technology for marking out turf areas, weed/disease locating and mapping, etc • use of growth regulators as an integral part of surface maintenance • use of GPS, hydraulics, hybrid/ battery machines e.g. GPS driven lawn mowers, etc • to bring back to the AHCTRF303 – Implement a Grassed area maintenance program. This unit did cover marking out the playing areas for various sports where it is now very broad and discusses generic turf maintenance regimes such as weed control, topdressing and coring.
2019 Amenity Horticulture, Landscaping, Conservation and Land Management IRC	
Carbon farming skill sets	This purpose of this project is to provide a working knowledge of carbon farming and legislation, and carbon project management to farm workers, agribusiness managers and technical advisors.
Rooftop and vertical gardening	This project will provide key knowledge and skills in rooftop and vertical gardening covering; environmental factors of microclimates, plant selection, installation of vertical water delivery systems, filtration systems,

	drainage facilities, waterproof barrier selection, nutrient requirements, working at heights on elevated work platforms, and local government legislation.
2020–2021 Amenity Horticulture, Landscaping, Conservation and Land Management IRC	
Permaculture qualification review	The purpose of this project is to ensure that skills and knowledge required by this diverse permaculture application are met. This includes; permaculture system design, sustainability, animal health and welfare programs, soil and plant bioregional characteristics and applications.

2018 Agriculture and Production Horticulture IRC	
Protected horticulture	As the sector is growing and changing with technology more skilled labour is required to fill skills gaps to meet the demand from retailers (predicted increase in consumption of protected cropping produce is set to rise by 50 per cent in the next five to eight years)
Irrigation technology, design and processes	Irrigation technology, design and process refers to the ability to apply various types of irrigation systems, such as pressurised irrigation and gravity-fed irrigation, and to use existing and new technologies (e.g. mobile apps, capacitance probes, tensiometers and neutron probes) in irrigation monitoring.
Agricultural skills in data capture and analysis	This project aims to increase knowledge and skills in specialised geospatial software and technologies, data capture from a range of devices and apply a range of analytical methods to geospatial and other technology-platform data that directly support assessment of crop/livestock health, planning, diagnosis and decision making.
Biosecurity skill sets	Skills are required for developing and implementing preventive biosecurity strategies within agribusinesses. Skills require include; biosecurity surveillance, monitoring agricultural products and information analysis, implementing preventive biosecurity programs and environmental impacts of exotic disease to the Australian native flora and fauna.

2019 Agriculture and Production Horticulture IRC	
Agribusiness innovations and farmgate value-adding	Skills in strategic planning, risk management, mergers and acquisitions, online marketing business development and financial planning to respond to the dynamic and changing operating environment, with increased competition and opportunities to reach global markets. New skills in agricultural innovation strategies, implementation of new products and innovation leadership to lead innovative thinking and practice.
Compliance and regulation of medicinal crops	The medicinal cropping skill set will provide specialist knowledge required for medicinal cropping relates to need for these crops to be highly regulated and their value in terms of a pharmaceutical agent.
2020–2021 Agriculture and Production Horticulture IRC	
Diploma of Viticulture review	Working knowledge of vineyard operations, leadership, farm management, irrigation and quality assurance systems.

ATTACHMENT B

Active IRC Projects for the Agriculture, Horticulture and Conservation and Land Management Industry Sector

Relevant training package: *AHC Agriculture, Horticulture and Conservation and Land Management*

Contact details: Skills Impact Ltd, 559A Queensberry Street, North Melbourne, VIC, 3051

Date submitted to Department of Education and Training: 28 April 2018

YEAR	IRC	PRIORITY SKILLS	QUALIFICATION CODE & NAME
2017	AHLCLM	Chemical handling	• AHCSS00026 Advanced Chemical Spray Application • AHCSS00027 Agricultural Chemical • Commentary Skills Sets Chemicals
2017	AHP	Pest management (wild dogs)	• AHC33616 Certificate III in Pest Management • AHC3XX18 Certificate III in Rural Pest Management • AHCSS00043
2017	AHP	Advanced skills in apiculture (bees)	• AHC3XX18 Certificate III in Beekeeping • AHCSS00028 Basic beekeeping • AHCSS000XX Raise Australian native social bees • AHCSSXXX Pollination services • AHCSSXXX Queen bee breeding
2017	AHP	Safe operation of agricultural machinery and new technology	• AHC32618 Certificate III in Rural Machinery Operations

YEAR	IRC	PRIORITY SKILLS	QUALIFICATION CODE & NAME
2018 Awaiting approval of case for change	AHLCLM	Arboriculture qualification review	• AHC20516 – Certificate II in Arboriculture • AHC30816 – Certificate III in Arboriculture • AHC41916 – Certificate IV in Arboriculture • AHC50516 – Diploma of Arboriculture • AHC60516 – Advanced Diploma of Arboriculture • AHC80116 – Graduate Diploma of Arboriculture

AHLCLM – Amenity Horticulture, Landscaping, Conservation and Land Management
APH – Agriculture and Production Horticulture.

F. ATTACHMENT C

2018–2019 Project Details

N.B. Qualifications/skill sets/units of competency to be finalised after public consultation

Amenity Horticulture, Landscaping, Conservation and Land Management IRC

Project title: Conservation and Land Management	
Description	The agriculture, amenity horticulture, landscaping, conservation and land management industry sector is highly diverse, and the conservation and land management sub-sector comprises businesses and organisations that operate: • nature reserves and conservation parks, including national parks, state parks and other parks, to preserve flora and fauna in their natural environment • botanic gardens. Caring for the land includes a range of activities, including: • sustainable farm practices • restoring native habitats and revegetation • controlling weeds and pests • developing and sharing local natural resource management skills and knowledge.
Rationale	The IRC has identified that updates are required to all of the conservation and land management qualifications to align with new practices in land management, restoration and cultural practices currently being used in industry. Also, the current units of study do not incorporate essential knowledge pertaining to plants, animals and ecology. This involves the review of six qualifications and approximately 150 units.
Ministers' priorities addressed	Through the development of these training package components, more information about the conservation and land management industry's expectations of training delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices. The training system will better support individuals to move between ranges of conservation and land management industries – for example, gardeners and garden and nursery labourers. Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors, such as broadacre farming industries.

Consultation plan

The Amenity Horticulture, Landscaping, Conservation and Land Management IRC will support the progress of this review by sourcing key stakeholders involved in the range of conservation and land management organisations to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level.

Stakeholders that may be consulted include, but are not limited to:

- Australian Conservation Foundation
- Australian Wildlife Conservancy
- Australian Land Conservation Alliance and its member organisations.

Scope of project

This project will be completed over 12 months.

Five qualifications will be revised:

- *AHC21016 Certificate II in Conservation and Land Management*
- *AHC31416 Certificate III in Conservation and Land Management*
- *AHC40916 Certificate IV in Conservation and Land Management*
- *AHC51116 Diploma of Conservation and Land Management*
- *AHC60415 Advanced Diploma of Conservation and Land Management.*

Revision of 219 units of competency.

ACMGAS305 Rescue animals and apply basic first aid

AHCASW501 Survey and report on Aboriginal cultural sites

AHCBER401 Plan and supervise control activities on infected premises

AHCBER402 Carry out field surveillance for a specific emergency disease or plant pest

AHCBER502 Manage the implementation of an emergency disease or plant pest control program

AHCBER601 Plan and oversee an emergency disease or plant pest control program

AHCBIO201 Inspect and clean machinery for plant, animal and soil material

AHCBIO302 Identify and report unusual disease or plant pest signs

AHCBUS402 Cost a project

AHCBUS404 Operate within a budget framework

AHCBUS501 Manage staff

AHCBUS503 Negotiate and monitor contracts

AHCBUS504 Prepare estimates, quotes and tenders

AHCBUS508 Prepare and monitor budgets and financial reports

AHCBUS605 Manage human resources

AHCBUS608 Manage risk

AHCCCF401 Prepare a project acquittal

AHCCCF402 Report on project

AHCCCF403 Obtain and manage sponsorship

AHCCCF404 Contribute to association governance

AHCCCF405 Develop community networks

AHCCCF406 Facilitate ongoing group development

AHCCCF407 Obtain resources from community and groups

AHCCCF408 Promote community programs

AHCCCF409 Participate in assessments of project submissions

AHCCCF410 Support individuals in resource management change processes

AHCCCF411 Develop approaches to include cultural and human diversity

AHCCCF412 Coordinate board or committee elections

AHCCCF413 Service committees

AHCCCF414 Coordinate fundraising activities

AHCCCF415 Coordinate social events to support group purposes

AHCCCF416 Present proposed courses of action to meeting

AHCCCF601 Coordinate the development of regional plans

AHCCHM201 Apply chemicals under supervision

AHCCHM303 Prepare and apply chemicals

AHCCHM304 Transport and store chemicals

AHCCHM401 Develop procedures to minimise risks in the use of chemicals

AHCCHM402 Plan and implement a chemical use program

AHCFAU201 Recognise fauna

AHCFAU301 Respond to wildlife emergencies

AHCFAU501 Manage fauna populations

AHCFIR201 Assist with prescribed burning

AHCFIR501 Manage wildfire hazard reduction programs

AHCFIR502 Plan prescribed burning for fuel, ecological and cultural resource management

AHCILM201 Maintain cultural places

AHCILM202 Observe and report plants or animals

AHCILM203 Record information about Country

AHCILM302 Provide appropriate information on cultural knowledge

AHCILM305 Work with an Aboriginal Community or organisation

AHCILM306 Follow Aboriginal cultural protocols

AHCILM308 Identify traditional customs and land rights for an Indigenous Community

AHCILM401 Protect places of cultural significance

AHCILM402 Report on place of potential cultural significance

AHCILM403 Contribute to the proposal for a negotiated outcome for a given area of Country

AHCILM404 Record and document Community history

AHCILM405 Develop work practices to accommodate cultural identity

AHCILM501 Conduct field research into natural and cultural resources

AHCILM502 Develop conservation strategies for cultural resources

AHCILM503 Manage restoration of cultural places

AHCILM504 Develop strategies for Indigenous land or sea management

AHCILM505 Map relationship of business enterprise to culture and Country

AHCILM506 Operate within Community cultures and goals

AHCILM508 Propose a negotiated outcome for a given area of Country

AHCILM510 Plan for successful cultural practice at work

AHCILM601 Manage cultural processes in an Indigenous organisation

AHCINF201 Carry out basic electric fencing operations

AHCINF202 Install, maintain and repair farm fencing

AHCINF203 Maintain properties and structures

AHCINF301 Implement property improvement, construction and repair

AHCINF303 Plan and construct conventional fencing

AHCLPW301 Supervise park visitor activities

AHCLPW303 Construct access tracks

AHCLPW304 Carry out inspection of designated area

AHCLPW305 Perform diving for scientific purposes

AHCLPW306 Undertake sampling and testing of water

AHCLPW401 Process applications for changes in land use

AHCLPW402 Implement land and sea management practices

AHCLPW403 Inspect and monitor cultural places

AHCLPW404 Produce maps for land management purposes

AHCLPW405 Monitor biodiversity

AHCLPW501 Develop a management plan for a designated area

AHCLPW503 Assess applications for legislative compliance

AHCLPW505 Implement natural and cultural resource management plans

AHCLPW601 Coordinate the preparation of a regional resource management plan

AHCLSC201 Assist with landscape construction work

AHCLSC203 Install aggregate paths

AHCLSC205 Install tree protection devices

AHCLSC301 Set out site for construction works

AHCLSC304 Erect timber structures and features

AHCLSC401 Supervise landscape project works

AHCMOM201 Operate two wheel motorbikes

AHCMOM202 Operate tractors

AHCMOM203 Operate basic machinery and equipment

AHCMOM204 Undertake operational maintenance of machinery

AHCMOM205 Operate vehicles

AHCMOM206 Conduct grader operations

AHCMOM207 Conduct front-end loader operations

AHCMOM208 Conduct excavator operations

AHCMOM209 Conduct dozer operations

AHCMOM210 Conduct scraper operations

AHCMOM213 Operate and maintain chainsaws

AHCMOM301 Coordinate machinery and equipment maintenance and repair

AHCMOM302 Perform machinery maintenance

AHCMOM304 Operate machinery and equipment

AHCMOM305 Operate specialised machinery and equipment

AHCMOM314 Transport machinery

AHCMOM315 Operate chemical application machinery and equipment

AHCMOM402 Supervise the maintenance of property machinery and equipment

AHCMOM501 Manage machinery and equipment

AHCMOM502 Implement a machinery management system

AHCNAR201 Carry out natural area restoration works

AHCNAR202 Maintain wildlife habitat refuges

AHCNAR301 Maintain natural areas

AHCNAR302 Collect and preserve biological samples

AHCNAR303 Implement revegetation works

AHCNAR304 Undertake direct seeding

AHCNAR305 Collect native seed

AHCNAR306 Conduct photography for fieldwork

AHCNAR307 Read and interpret maps

AHCNAR401 Supervise natural area restoration works

AHCNAR402 Plan the implementation of revegetation works

AHCNAR501 Manage natural areas on a rural property

AHCNAR502 Conduct biological surveys

AHCNAR503 Design a natural area restoration project

AHCNAR504 Manage natural area restoration programs

AHCNAR505 Plan river restoration works

AHCNAR506 Develop and implement sustainable land use strategies

AHCNRM401 Plan and implement a biosecurity program

AHCNRM501 Develop a coastal rehabilitation strategy

AHCNRM502 Develop a water quality monitoring program

AHCNRM503 Support the implementation of waterways strategies

AHCNRM504 Interpret and report on catchment hydrology

AHCNRM505 Provide technical advice on sustainable catchment management

AHCNRM506 Plan and monitor works projects in catchments and waterways

AHCNRM507 Manipulate and analyse data within geographic information systems

AHCNRM508 Investigate suspected breaches of Natural Resource Management legislation

AHCNRM601 Review land management plans and strategies

AHCNRM602 Develop a monitoring, evaluation and reporting program

AHCNRM603 Implement a monitoring, evaluation and reporting program

AHCNSY202 Care for nursery plants

AHCNSY203 Undertake propagation activities

AHCPCM201 Recognise plants

AHCPCM202 Collect, prepare and preserve plant specimens

AHCPCM203 Fell small trees

AHCPCM302 Provide information on plants and their culture

AHCPCM303 Identify plant specimens

AHCPCM401 Recommend plants and cultural practices

AHCPCM502 Collect and classify plants

AHCPGD201 Plant trees and shrubs

AHCPGD206 Conduct visual inspection of park facilities

AHCPGD301 Implement a plant establishment program

AHCPGD304 Implement a landscape maintenance program

AHCPGD305 Conduct operational inspection of park facilities

AHCPGD306 Implement a maintenance program for an aquatic environment

AHCPGD402 Plan a plant establishment program

AHCPGD503 Manage parks and reserves

AHCPGD505 Conduct comprehensive inspection of park facilities

AHCPMG201 Treat weeds

AHCPMG202 Treat plant pests, diseases and disorders

AHCPMG301 Control weeds

AHCPMG302 Control plant pests, diseases and disorders

AHCPMG304 Use firearms to humanely destroy animals

AHCPMG305 Survey pests

AHCPMG306 Determine pest control techniques

AHCPMG307 Apply animal trapping techniques

AHCPMG308 Implement pest management strategies

AHCPMG310 Prepare, monitor and maintain biological agents

AHCPMG311 Use firearms for pest control activities from aircraft

AHCPMG409 Implement a pest management plan

AHCPMG410 Implement the pest monitoring and evaluation plan

AHCPMG411 Ensure compliance with pest legislation

AHCPMG412 Develop a pest management plan

AHCPMG413 Define the pest problem

AHCPMG506 Manage the implementation of legislation

AHCPMG507 Develop a regional pest management plan

AHCPMG508 Develop a system to monitor and evaluate the pest management plan

AHCPMG509 Investigate a pest control failure

AHCSAW201 Conduct erosion and sediment control activities

AHCSAW301 Construct conservation earthworks

AHCSAW302 Implement erosion and sediment control measures

AHCSAW401 Set out conservation earthworks

AHCSAW403 Supervise implementation of conservation earthworks plans

AHCSAW501 Design control measures and structures

AHCSAW502 Plan erosion and sediment control measures

AHCSAW503 Plan conservation earthworks

AHCSOL202 Assist with soil or growing media sampling and testing

AHCSOL401 Sample soils and interpret results

AHCSOL403 Prepare acid sulphate soil management plans

AHCSOL404 Supervise acid sulphate soil remediation and management projects

AHCSPO308 Sample seed before and after processing

AHCWHS201 Participate in work health and safety processes

AHCWHS301 Contribute to work health and safety processes

AHCWHS401 Maintain work health and safety processes

AHCWHS501 Manage work health and safety processes

AHCWRK201 Observe and report on weather

AHCWRK202 Observe environmental work practices

AHCWRK203 Operate in isolated and remote situations

AHCWRK204 Work effectively in the industry

AHCWRK205 Participate in workplace communications

AHCWRK206 Observe enterprise quality assurance procedures

AHCWRK207 Collect and record production data

AHCWRK208 Provide information on products and services

AHCWRK209 Participate in environmentally sustainable work practices

AHCWRK303 Respond to emergencies

AHCWRK304 Respond to rescue incidents

AHCWRK305 Coordinate work site activities

AHCWRK309 Apply environmentally sustainable work practices

AHCWRK310 Provide on-job training support

AHCWRK311 Conduct site inspections

AHCWRK401 Implement and monitor quality assurance procedures

AHCWRK402 Provide information on issues and policies

AHCWRK403 Supervise work routines and staff performance

AHCWRK502 Collect and manage data

AHCWRK503 Prepare reports

AHCWRK508 Interpret legislation

AHCWRK509 Provide specialist advice to clients

AHCWRK511 Develop workplace policy and procedures for sustainability

AHCWRK601 Monitor projects in a program

Project title: Production nurseries skills in integrated pest management (IPM), growing media & environmental control

Description

In the Amenity Horticulture, Landscaping, Conservation and Land Management areas, a significant number of the workforce occupy roles that are specific to industry sub-sectors, including agricultural and horticultural plant operators, nurserypersons, gardeners, and garden and nursery workers.

Businesses in this sub-sector are involved in growing trees, shrubs, herbs bulbs and ornamental plants. These businesses sell to retailers, wholesalers, landscapers, local & state government, orchardists, plantations, bush regeneration, bio-remediation, forestry, floriculture, vegetable and herb / salad leaf growers. Nursery production is organised into protected, undercover and outdoor production systems with associated degrees of environmental control and risk factors.

Industry consultation has identified that there is a need to provide specific training in integrated pest management, soil management and the efficient use of irrigation systems.

Solutions for training packages are:

- review of two qualifications and 34 units across production nursery
- development of new skill sets and units as identified during the review.

Rationale

IPM

The current qualifications encourage an overreliance on chemicals to manage plant pest & diseases. Specifically Treat Pests and Diseases & Control Pests and Diseases along with Treat Weeds and Control Weeds. AHCPMG302 - Control plant pests, diseases and disorders, AHCPMG301 - Control weeds, refer to IPM programs however there is no curriculum associated with the development and operation under an IPM program. The level II AHCPMG202 - Treat plant pests, diseases and disorders & AHCPMG201 Treat weeds are predicated strongly on chemical intervention and while with latitude IPM ideologies can be worked into the content it isn't the key intent of the UoC. It is critical that IPMwhich has been actively practiced in other sectors for over 30 years, such as vegetables particularly brassicas that were decimated by multiple pesticide resistant pests in the 80's & 90's and widely in cotton. Now many commercial crops utilise IPM to monitor for, detect and decide on intervention methods for pests and diseases (potatoes, strawberries, cotton, soybeans, tree crops, nurseries and vegetables) and yet there are no clear UoC that delivers IPM in either the amenity or production sectors. IPM could be adapted across all Horticultural & Agricultural sectors where pest, disease and weed control is required, particularly protected cropping where chemical options are restricted due to closed environments and re-entry periods.

Industries adopting IPM have shown massive reductions in chemical usage and pest populations are less likely to fluctuate due to more balanced populations of beneficial and pest organisms.

Environmental Control & Irrigation Management:

The nursery industry has utilised computer- controlled irrigation and environmental management for over 3 decades and yet no clear UoC exists to deliver the critical skills or knowledge of how to set or operate such controls with many reverting to installer default knowledge settings rather than a solid understanding of crop requirements and customisations. Basic knowledge of crop factors is still poorly understood with few businesses modifying irrigation as a result of daily conditions outside of extreme events of rain, wind or heat. Simple pan evaporation is barely used to modify irrigation applications and this is the simplest saving that can be achieved.

Currently the protected cropping industries use similar technology to irrigate and supply environmental control within growing structures that the nursery industry utilises for growth and propagation. Complex irrigation and sensor-based systems are currently utilised yet no specific training is available to guide users in their correct programming and operation based on crop requirements. It is evident that many operators have poor knowledge of the parameters used to set such devices and this may result in reduced production and quality. Businesses that have a good understanding are able to achieve significant improvements in production and quality.

Growing media:

Growing media has completely different physical and chemical properties to soil and as identified in the protected cropping review there is a real need to develop competencies that deal specifically with inert mineral or organic products as well as those based around composts with biota that respond and act differently to soils and require specific understanding due to function and use. Emerging sectors such as green walls and roofs also require specific artificial media to function in their intended applications. It is critical that artificial media i.e. growing media are dealt with as a separate UoC to soils. Businesses utilising high level knowledge in growing media have significantly better production. Current skills fail to acknowledge the critical role of a correctly developed growing media on crop performance and associated yield.

Ministers' priorities addressed

Through the development of these training package components, more information about the production nursery industry's expectations of training delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices.

The training system will better support individuals to move between ranges of production nursery industries – for example, landscaping or nursery work.

Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors, such as other cotton growing or fodder growing industries.

Consultation plan

The Amenity Horticulture, Landscape, and Conservation and Land Management IRC will support the progress of this review by sourcing key stakeholders involved in the production nursery industries to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level.

Stakeholders that may be consulted include, but are not limited to:

- Soil Science Australia
- Soils for Life
- Nursery and Garden Industry Association and state bodies
- Australian Golf Environmental Initiative
- Irrigation Australia
- Australian Workers' Union (AWU).

Scope of project

This project will be completed over 12 months.

Two qualifications will be revised:

- *AHC31116 Certificate III in Production Nursery*
- *AHC40616 Certificate IV in Production Nursery.*

Development of five new skill sets.

Revision of 34 units of competency and development of 25 new units.

AHCBER301 Work effectively in an emergency disease or plant pest response

AHCBER303 Carry out emergency disease or plant pest control procedures at infected premises

AHCBER304 Carry out movement and security procedures

AHCBIO302 Identify and report unusual disease or plant pest signs

AHCHYD301 Implement a maintenance program for hydroponic systems

AHCHYD302 Install hydroponic systems

AHCMER301 Process customer complaints

AHCMER303 Sell products and services

AHCNSY301 Maintain nursery plants

AHCNSY302 Receive and dispatch nursery products

AHCNSY303 Install and maintain plant displays

AHCNSY304 Deliver and promote sales of plants

AHCNSY305 Prepare specialised plants

AHCNSY306 Implement a propagation plan

AHCNSY307 Operate fertigation equipment

AHCPCM301 Implement a plant nutrition program

AHCSOL202 Assist with soil or growing media sampling and testing

AHCSOL301 Prepare growing media

AHCSOL401 Sample soils and interpret results

AHCWAT301 Monitor and operate water treatment processes

AHCWHS301 Contribute to work health and safety processes

AHCWRK303 Respond to emergencies

AHCWRK305 Coordinate work site activities

AHCWRK309 Apply environmentally sustainable work practices

AHCBER401 Plan and supervise control activities on infected premises

AHCBER402 Carry out field surveillance for a specific emergency disease or plant pest

AHCBIO403 Plan and implement a farm or enterprise biosecurity plan

AHCNSY401 Plan a growingon program

AHCNSY402 Plan a propagation program

AHCPCM401 Recommend plants and cultural practices

AHCPCM402 Develop a soil health and plant nutrition program

AHCPCM501 Diagnose plant health problems

AHCPHT502 Develop a horticultural production plan

AHCPMG410 Implement the pest monitoring and evaluation plan

Project title: Landscape Qualifications: Pathways and Ecology	
Description	The sector comprises companies that construct landscapes, which may include planting, land forming, the provision of retaining walls and paths, and the installation of garden drainage control, garden watering systems and structural garden features. Industry consultation has indicated that there are no clear pathways for landscape construction or landscape design roles. Industry workers are missing key skills in ecology and there is a growing need for it to be implemented during the design and construction phases. Key skills in landscape design with a focus on construction units will be relevant for the following occupations: • landscape design supervisor • landscape design team leader.
Rationale	Concerns have been raised by industry that the qualification *AHC42016 Certificate IV in Landscape* currently has no entry requirements. In 2015, a submission was made to the previous Industry Skills Council to review qualifications and entry requirements, but these were not addressed in the new release of AHC42016 in 2016. The intention was that *AHC30916 Certificate III in Landscape Construction* would provide a pathway from Certificate III to Diploma level qualification. There are no clear pathways for landscape design or landscape construction-focused job roles. Feedback received has indicated that there is a need to have qualifications that have clear pathways to job outcomes in one or the other field. Industry would benefit from clear delineation of the skills involved when seeking applicants for specialised positions. As such, there are sectors that are encroaching and tendering for works in high-risk design and construction in landscaping, without full understanding of WorkSafe, Australian Standards in building, the latest Pool Fencing Act, chemical handling requirements, ecology, horticulture basics, plant knowledge or engineering details. This can be detrimental to the professionalism the landscaping industry is working to uphold.
Ministers' priorities addressed	Through the development of these training package components, more information about the landscaping industry's expectations of training delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices. The training system will better support individuals to move between ranges of landscaping industries, for example, arboriculture or turf and sports turf management.

Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors, such as production nurseries or land management businesses.

Consultation plan

The Amenity Horticulture, Landscape, and Conservation and Land Management IRC will support the progress of this review by sourcing key stakeholders involved in the range of landscaping industries to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level.

Stakeholders that may be consulted include, but are not limited to:

- LNA Master Landscapers Association
- Landscaping Australia Inc. and all state bodies
- Australian Institute of Landscape Designers and Managers
- Australian Institute of Landscape Architects
- Garden Centres Association of Australia
- Soil Science Australia
- Australian Workers' Union (AWU).

Scope of project

This project will be completed over 12 months.

Review of three qualifications:

- AHC30916 Certificate III in Landscape Construction
- AHC42016 Certificate IV in Landscape
- AHC50616 Diploma of Landscape Design.

Development of up to five new skills sets.

Review of 32 Units of Competency and development of 20 new units.

AHCARB502 Identify, select and specify trees

AHCCCF402 Report on project

AHCDES501 Design sustainable landscapes

AHCDES502 Prepare a landscape design

AHCDES503 Assess landscape sites

AHCDES504 Design for construction of landscape features

AHCLSC301 Set out site for construction works

AHCLSC302 Construct landscape features using concrete

AHCLSC303 Construct brick and block structures and features

AHCLSC305 Construct stone structures and features

AHCLSC306 Implement a paving project

AHCLSC307 Implement a retaining wall project

AHCLSC401 Supervise landscape project works

AHCLSC501 Survey and establish site levels

AHCLSC502 Manage landscape projects

AHCNAR401 Supervise natural area restoration works

AHCPCM302 Provide information on plants and their culture

AHCPCM503 Specify plants for landscapes

AHCPCM504 Design specialised landscape

AHCPER401 Provide advice on permaculture principles and practices

AHCPER403 Design an urban permaculture system

AHCPER404 Plan and implement permaculture works

AHCPER505 Plan and supervise the implementation of permaculture project works

AHCPGD301 Implement a plant establishment program

AHCPGD401 Design plant displays

AHCPGD402 Plan a plant establishment program

AHCSOL303 Implement soil improvements for garden and turf areas

AHCWRK503 Prepare reports

AHCWRK507 Implement professional practice

AHCWRK508 Interpret legislation

AHCWRK509 Provide specialist advice to clients

AHCWRK510 Audit site operations

Project title: Sports Turf Skills Update

Description

This project addresses the need for skills and knowledge of increasingly complex turf management processes. This includes the ability to:

- use advancing technology in monitoring of turf surface health and usability e.g. portable soil moisture/salinity and temp sensors; weed and disease predicting software incorporating weather stations; GPS technology for marking out turf areas, weed/disease locating and mapping, etc
- use of growth regulators as an integral part of surface maintenance
- use of GPS, hydraulics, hybrid/ battery machines e.g. GPS driven lawn mowers, etc
- to bring back to the AHCTRF303 – Implement a Grassed area maintenance program. This unit did cover marking out the playing areas for various sports where it is now very broad and discusses generic turf maintenance regimes such as weed control, topdressing and coring.

Rationale

Computerisation and advance technology are playing a major role in the sports turf management industry. Sports turf management relies on the operation of equipment that requires a diverse skill set from digitalisation of monitoring equipment (portable soil moisture sensors through to hydraulics or battery-operated machinery and equipment with integrated GPS such as *robotic* lawn mowers, line markers, etc.

Turf science has shown an improved quality and efficiency of growth regulators has resulted in changes in watering and clipping programs of sports turf. The application of these chemicals and an understanding of how the growth promoters will affect these programs needs to be included to industry standards within the qualifications.

There are currently units that are no longer meeting the industry standard, for example, *AHCTRF303 Implement a grassed area maintenance programme. The marking out of sports areas is not being taught anymore and is a huge loss to the training needs of the Greenkeeper*

The proposed response is to review and improve 38 units of competency and two qualifications. Furthermore it is proposed that an additional five new units and four new skill sets be developed.

Ministers' priorities addressed

Review of the qualifications will likely result in removal of some obsolete and superfluous units of competency, in addition to ensuring the qualifications reflect industry expectations of training delivery. Several of the units within the qualifications are cross-sector horticultural units, which allow for individuals to move easily between sports turf management and other types of turf management.

The development of up to five new units and up to four new skills sets will meet industry requirement and allow for the development of skills in niche markets.

Consultation plan

The Amenity Horticulture, Landscaping, and Conservation and Land Management IRC will support the progress of this review by sourcing key stakeholders and industry experts in sports turf management.

Key stakeholders include, but are not limited to:

- Australian Golf Course Superintendents' Association and state associations
- National Turf Education Working Group
- Sports Turf Association of Australia and state associations
- Bowling Greenkeepers' Association
- Turf Australia including state associations
- Victorian Turf Cricket Association
- Golf Course Management Australia
- Irrigation Australia
- Society of Australian Golf Course Architects
- Australian Racecourse Managers Association
- Cricket NSW
- Abel Sports
- Toro
- Jacobsen
- Turfcare WA
- Evergreen Turf
- Elite Sand & Soil
- Turf Drain
- Australian Workers' Union.

Scope of project

This project will be completed over 12 months.

Review of two qualifications:

- *Certificate III Sports Turf Management*
- *Diploma of Sports Turf Management.*

Development of up to four new skill sets.

Review of 41 units of competency and development of up to five new units.

AHCIRG331	Install pressurised irrigation systems
AHCMOM304	Operate machinery and equipment
AHCPCM301	Implement a plant nutrition program
AHCPCM302	Provide information on plants and their culture
AHCPMG301	Control weeds
AHCPMG302	Control plant pests, diseases and disorders
AHCTRF301	Construct turf playing surfaces
AHCTRF302	Establish turf

AHCTRF303	Implement a grassed area maintenance program
AHCTRF305	Renovate sports turf
AHCWHS301	Contribute to work health and safety processes
AHCCHM303	Prepare and apply chemicals
AHCCHM304	Transport and store chemicals
AHCDRG301	Install drainage systems
AHCIRG306	Troubleshoot irrigation systems
AHCIRG332	Operate pressurised irrigation systems
AHCIRG333	Maintain pressurised irrigation systems
AHCSOL303	Implement soil improvements for garden and turf areas
AHCSOL401	Sample soils and interpret results
AHCWRK305	Coordinate work site activities
AHCWRK309	Apply environmentally sustainable work practices
AHCCHM501	Develop and manage a chemical use strategy
AHCPCM501	Diagnose plant health problems
AHCSOL501	Monitor and manage soils for production
AHCTRF501	Plan the establishment of sports turf playing surfaces
AHCBUS501	Manage staff
AHCBUS508	Prepare and monitor budgets and financial reports
AHCDRG501	Design drainage systems
AHCIRG502	Design irrigation system maintenance and monitoring programs
AHCLSC502	Manage landscape projects
AHCMOM501	Manage machinery and equipment
AHCPCM601	Develop and implement a plant health management strategy
AHCPMG508	Develop a system to monitor and evaluate the pest management plan
AHCTRF502	Manage sports turf renovation programs
AHCTRF503	Develop sports turf management programs
AHCTRF504	Manage sports turf facility assets
AHCWHS501	Manage work health and safety processes
AHCWRK505	Manage trial and research material
BSBHRM506	Manage recruitment, selection and induction processes
SRXGOV004B	Work effectively with the Board of an organisation

Project title: Rooftop and Vertical Gardening	
Description	Industry consultation has identified in the review that there is a need to develop a new qualification, skills sets and units. The following key knowledge and skills in rooftop and vertical gardening have been identified: • knowledge of environmental factors of microclimates and plant selection • installation of vertical water delivery systems, filtration systems and drainage facilities, • waterproof barrier selection • nutrient requirements • working at heights on elevated work platforms • local government legislation. Relevant occupations that will benefit from the development of this new qualification may include: • rooftop gardeners • horticulturists • nursery workers and advisors.
Rationale	Population growth in the cities is influencing government policies around sustainable living and urban greening within high-density living areas. There will be increasing demand for skills in developing rooftop gardens and green walls.
Ministers' priorities addressed	Through the development of these training package components, more information about the landscaping industry's expectations of training delivery will be available to training providers to improve their delivery and to consumers to enable better informed choices. The training system will better support individuals to move between ranges of landscaping industries including nurseries or floriculture production. Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors, such as production nurseries or land management businesses.
Consultation plan	The Amenity Horticulture, Landscape, and Conservation and Land Management IRC will support the progress of this review by sourcing key stakeholders involved in the range of landscaping industries to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level. Stakeholders that may be consulted include, but are not limited to: • Australian Institute of Horticulture

- Nursery and Garden Industry Australia
- International Plant Propagators' Society
- Horticultural Therapy Society of NSW
- Australian Society of Horticultural Science
- LNA Master Landscapers Association
- Landscaping Australia Inc. and state associations

Scope of project

This project will be completed over 12 months.

Development of one new qualification.

Development of up to five new skill sets.

Development of up to 25 new units.

Project title: Carbon Skill Farming Skill Sets	
Description	This project focuses on the need for skill sets to address the emerging practices of carbon farming, which is of increased interest since the Paris Agreement on 4 November 2016. It is intended that the skills sets will provide skills and knowledge for agribusiness workers, farmers, managers and technical advisors in the areas of: • working knowledge of carbon farming and carbon project management • carbon farming legislation.
Rationale	This project receives support from the National Farmers' Federation for farmers to access the Emissions Reduction Fund, and in response to a growing interest from farmers in diversifying farming activities and income through increased awareness of carbon farming. Currently, there is no nationally accredited training available to farmers or managers to fill this growing skills gap as previously accredited carbon farming units and skills sets have been superseded with no replacements.
Ministers' priorities addressed	The development of the carbon farming skill sets fosters recognition of the emerging trend of inclusion of carbon farming into current agribusiness practice. These skill sets allow for individuals to move from different agribusiness occupations where carbon farming skills are sought. Future carbon farming qualifications can be quickly developed from clustering or drawing on a number of the developed carbon farming skill sets to meet future industry needs particular to this niche.
Consultation plan	The Amenity Horticulture, Landscaping, and Conservation Land Management IRC will support the progress of this review by sourcing key stakeholders and industry experts in sports turf management, notably the Australian Carbon Society.
Scope of project	This project will be completed over 12 months. Development of up to eight new skill sets. Review of 11 units of competency and up to five new units.

Project title: Permaculture Qualifications Review	
Description	The permaculture industry covers a diverse range of applications, from broad scale organic farming and intensive farming through to community and school gardens. The purpose of this project is to ensure that the skills and knowledge required by this diverse permaculture application are met. These skills and knowledge include: • permaculture system design • sustainability • animal health and welfare programs • soil and plant bioregional characteristics and applications.
Rationale	A low number of RTOs have the permaculture certificates in on the scope of their delivery. It has been identified to members of the IRC that some of the units – such as *AHCORG403 Manage organic soil improvement* – no longer meet the needs of the whole permaculture sector as this unit requires broad scale farming practice, rather than small intensive farming or other applications. A review of the qualifications is required to ensure that the low subscription to these qualifications reflects the niche skill market, and not a lack of qualification currency or application.
Ministers' priorities addressed	The review will address whether any of the permaculture qualifications are obsolete and superfluous, so they can be removed from the system. By reviewing the permaculture qualifications, information to training providers can be provided about industry expectation. This may result in increased training delivery and further training opportunities.
Consultation plan	This project will commence by identifying key stakeholders through engagement of industry and networks within the Amenity Horticulture, Landscaping, Conservation and Land Management IRC. Consultation with key stakeholders will identify industry requirements and necessary revisions to the current qualification, in support of the project recommendations by the IRC.
Scope of project	This project will be completed over 12 months. Review of three qualifications: • *Certificate II in Permaculture* • *Certificate III in Permaculture* • *Certificate IV in Permaculture.*

Agriculture and Production Horticulture IRC

Project title: Protected Horticulture	
Description	Protected horticulture refers to the management of closed cropping systems, and covers areas such as: • nutrient film techniques • flooding and draining • aeroponics • growth media • setup and maintenance of protected cropping irrigation systems • setup of trellis systems • operation of automated controls and climate control technologies. The Australian protected cropping industry is the fastest growing food producing sector in Australia. With farmgate value at $1.3 billion per year, it is equivalent to 20 per cent of the total value of vegetable and flower production. The industry employs 10,000 people and is expanding at a rate of four to six per cent per year. Current investment is conservatively valued at $975 million, with annual investment at $50 million per year. Relevant occupations include: • horticulturist • nursery worker • farm hand • farm manager • harvesting operator • greenhouse technician.
Rationale	As the sector is growing and changing with technology, more skilled labour is required to fill skills gaps and meet the demand from retailers. Consumption of protected cropping produce is predicted to rise by 50 per cent in the next five to eight years. Reasons for growth include: • faster growth, higher yields and better quality • extended growing seasons • reduced impact on environment • better efficiencies in energy and water use.
Ministers' priorities addressed	Through the development of these training package components, more information about the horticulture industry's expectations of training delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices. The training system will better support individuals to move between sectors of the production horticulture industry, for example, vegetable growing or production nursery services producing a range of fruit trees.

Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors. Such as retail nursery production, specialised seed production and conservation industries.

Consultation plan

The Agriculture and Production Horticulture IRC will support the progress of this review by sourcing key stakeholders involved in the range of horticulture industries to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level.

Stakeholders that may be consulted include, but are not limited to:

- Protected Cropping Australia
- Australian Workers' Union (AWU)
- Australian Vegetable Growers Association
- Australian Medical Cannabis Industry
- Horticulture Innovation Australia
- Hydroponic Farmers Federation
- Irrigation Australia

Scope of project

This project will be completed over 12 months.

Development of two new qualifications at AQF 3 and 4 levels.

Development of up to five new skill sets.

Development of up to 25 new units.

Project title: Irrigation Technology, Design and Processes	
Description	Irrigation technology, design and process refers to the ability to apply various types of irrigation systems, such as pressurised irrigation and gravity-fed irrigation, and to use existing and new technologies (e.g. mobile apps, capacitance probes, tensiometers and neutron probes) in irrigation monitoring. Relevant occupations include: • irrigation installation site worker and manager • worker and manager of irrigation systems • irrigation business manager • irrigation service worker.
Rationale	Ongoing implementation of new processes and technologies in irrigation has facilitated the need for flexibility in irrigation specialities. An example of new technology is mobile apps designed to help guide irrigation decisions. IRC feedback has identified existing units need to be reviewed and updated to ensure different types of irrigation (broadacre, gravity fed, pressurised, domestic/urban irrigation) are covered in the range of units and can be delivered separately based on specific job roles. Solutions include: • review of 48 units of competency and four qualifications • development of new units and skills sets as identified in the review.
Ministers' priorities addressed	Through the development of these training package components, more information about the horticulture industry's expectations of training delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices. Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple industry sectors, such as other horticulture or farming industries.
Consultation plan	The Agriculture and Production Horticulture IRC will support the progress of this review by sourcing key stakeholders involved in the range of horticulture industries to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level. Stakeholders that may be consulted include, but are not limited to: • Irrigation Australia • Australian Workers' Union (AWU) • Australian Vegetable Growers Association • *Broolga's environment (expert)* • Cotton Growers Association • Dairy Australia

- *Department of Water (WA)*
- Horticulture Innovation Australia
- National Irrigators Council
- *Lower Murray Water*
- *Mallee Catchment Management Authority*
- *Ord Irrigation Cooperative*
- *South Australian Research and Development Institute (SARDI)*
- Wine Grape Growers Australia
- *WA Vegetables*

Scope of project

This project will be completed over 12 months

Review of four qualifications:

- *AHC21116 Certificate II in Irrigation*
- *AHC32416 Certificate III in Irrigation*
- *AHC41116 Certificate IV in Irrigation*
- *AHC51616 Diploma of Irrigation Management.*

Development of up to five new skill sets.

Review of 48 units of competency and development of up to 25 new units.

AHCIRG101 Support irrigation work

AHCIRG202A Assist with the operation of pressurised irrigation

AHCIRG215 Assist with low volume irrigation operations

AHCIRG216 Assist with surface irrigation operations

AHCIRG217 Assist with pressurised irrigation operations

AHCIRG218 Assist with pump and flow control device operations

AHCIRG301A Implement a maintenance program for an irrigation system

AHCIRG302A Install irrigation systems

AHCIRG303 Measure irrigation delivery system performance

AHCIRG306 Troubleshoot irrigation systems

AHCIRG308 Monitor soils under irrigation

AHCIRG309 Install irrigation pumps

AHCIRG310 Operate and maintain irrigation pumping systems

AHCIRG315 Interpret irrigation plans and drawings

AHCIRG325 Operate irrigation technology

AHCIRG326 Operate irrigation injection equipment

AHCIRG327 Implement an irrigation schedule

AHCIRG331 Install pressurised irrigation systems

AHCIRG332 Operate pressurised irrigation systems

AHCIRG333 Maintain pressurised irrigation systems

AHCIRG334 Operate and maintain gravity fed irrigation systems

AHCIRG335 Operate and maintain moving irrigation system

AHCIRG402 Determine hydraulic parameters for an irrigation system

AHCIRG404 Implement an irrigation related environmental protection program

AHCIRG406A Plan onsite irrigation system installation and construction work

AHCIRG407A Supervise onsite irrigation installation and construction work

AHCIRG408 Schedule irrigations

AHCIRG410 Select and manage pumping systems for irrigation

AHCIRG415 Interpret and apply irrigation designs

AHCIRG422 Manage a moving sprinkler irrigation system

AHCIRG426 Evaluate water supply for irrigation

AHCIRG431 Supervise irrigation system installation

AHCIRG432 Supervise irrigation system maintenance

AHCIRG433 Manage irrigation systems

AHCIRG434 Manage surface irrigation systems

AHCIRG501 Audit irrigation systems

AHCIRG502 Design irrigation system maintenance and monitoring programs

AHCIRG503 Design irrigation, drainage and water treatment systems

AHCIRG504 Develop an irrigation and drainage management plan

AHCIRG505 Establish and maintain an irrigationrelated environmental protection program

AHCDRG401 Coordinate and supervise installation of an irrigation drainage system

AHCDRG201 Maintain drainage systems

AHCDRG301 Install drainage systems

AHCDRG302 Measure drainage system performance

AHCDRG303 Troubleshoot drainage systems

AHCDRG304 Maintain and repair irrigation drainage systems

AHCDRG402 Monitor and control irrigation drainage systems

AHCDRG501 Design drainage systems

Project title: Agricultural Skills in Data Capture and Analysis	
Description	Data capture and analysis in agriculture involves: • knowledge and skills in specialised geospatial software and technologies, including remote sensors, drones, new-generation satellite imagery technologies, and wearable and mobile technologies and apps • knowledge of data capture from a range of devices (e.g. drones, digital cameras, infrared cameras, mobile apps, soil moisture sensors, climate data loggers, etc.) • ability to apply a range of analytical methods to geospatial and other technology-platform data that directly support assessment of crop/livestock health, planning, diagnosis and decision making. Relevant occupations include: • animal attendant/stockperson • farm or station worker • livestock transport driver • farm team leader • farm supervisor • farm production manager • production unit manager • agronomist • station/property manager.
Rationale	Continuous development of technology, with new discoveries providing the potential to support farmers with emerging challenges – including those arising from climate change, pressure on global food supplies and fresh water, and the management of pests and diseases – will add to the vocational outcomes of the agricultural work sector. Other areas identified include: • growing investment in integrated world-leading technology (such as robotics and digital and wireless technology to monitor farm operations and detect issues with crop or livestock health) • quality standards in operations • industry databases (including commodity-specific production platforms and other technology platforms). Training package solutions identified are: • review of four qualifications and seven units • development of up to ten new units and skill sets as identified during review.
Ministers' priorities addressed	Through the development of these training package components, more information about the agriculture industry's expectations of training

delivery will be available to training providers to improve their delivery, and to consumers to enable better informed choices.

The training system will better support individuals to move between ranges of agricultural industries, such as support services or product wholesaling.

Improved efficiency of the training system will be gained through the development of units that can be owned and used by multiple agricultural industry sectors.

Consultation plan

The Amenity and Production Horticulture IRC will support the progress of this review by sourcing key stakeholders involved in the range of agricultural industries – for example AgriFutures Australia – to consult with Skills Impact when developing training package components, structuring the qualification and determining the skills required for the industry on a national level.

There is a shared interest among the agriculture, forestry and animal care and management industries in specialised skills for using geospatial software and technologies to capture data that support both biosecurity programs and strategic decisions in these industries.

Hence, there is an opportunity for a joint project between three training packages: ACM, AHC and FGM.

Key Stakeholders

- Agribusiness Association of Australia
- Ag Force (Queensland Farmers)
- Australia Vegetable Growers Association
- Cattle Council of Australia
- Irrigation Australia

Industry Experts

- Komatsu Australia
- Swarm farm Robotics

Scope of project

This project will be completed over 12 months

Review of four qualifications:

- *AHC20116 Certificate II in Agriculture*
- *AHC30116 Certificate III in Agriculture*
- *AHC40116 Certificate IV in Agriculture*
- *AHC50116 Diploma of Agriculture.*

Development of up to three new skill sets.

Review of seven units of competency and up to ten new units.

Review of seven Units of Competency.

AHCAGB506 Manage application technology

AHCAGB507 Select and use agricultural technology

AHCAGB508 Improve agricultural sustainability using renewable energy and recycle systems

AHCAGB509 Select and implement a Geographic Information System (GIS) for sustainable agricultural systems

AHCAGB510 Implement the introduction of biotechnology into the production system

AHCAGB511 Develop and manage a plan for sustainable production reflecting sustainable production principles

AHCBUS301 Use hand held ebusiness tools

There are no related units in the existing AHC. Therefore, no units will need to be reviewed. However, ten new units will need to be developed:

AHCXXXXXX Operate digital applications in agriculture

AHCXXXXXX Develop digital applications in agriculture

AHCXXXXXX Operate data loggers in agriculture

AHCXXXXXX Maintain and set up data loggers in agriculture

AHCXXXXXX Detecting issues with crop heatlh

AHCXXXXXX Interpreting data in crop heatlh

AHCXXXXXX Detecting issues in livestock heatlh

AHCXXXXXX Interpreting data in livestock heatlh

AHCXXXXXX Develop agricultural databases

AHCXXXXXX Using robotics in agriculture

Project title: Biosecurity

Description

This project will develop the skills and knowledge required to support the growth in demand for employees skilled in preventive biosecurity practices. The training will also support the strategies defined by the Federal Government.

The focus of this project is developing biosecurity training in:

- biosecurity surveillance
- monitoring agricultural products and information analysis
- implementing preventive biosecurity programs
- environmental impacts of exotic disease on Australian native flora and fauna.

Rationale

Agriculture biosecurity is a key contributor to the fifth priority area in the 2017 Agriculture Competitiveness White Paper (Accessing premium markets – improving international trade to grow farm businesses). Investment in biosecurity prevention is paramount to ensuring that our agricultural products remain attractive within a global market, and maintaining our disease/pest-free status against many pathogens that affect other agricultural markets around the world.

Current training has a focus on biosecurity response rather than prevention. It is anticipated that this project will provide new units of competency and skills sets that can be used as electives within other agriculture, horticulture and public safety qualifications.

Ministers' priorities addressed

Biosecurity prevention training will give Australian agribusiness better information on market opportunities, risks and importing country requirements. The agricultural industry's priority should be implementing preventative biosecurity management strategies, rather than merely relying on response management.

Completion of skill sets will enable individuals to move to related occupations, such as farm management, working in scientific research facilities and other areas of agriculture and production horticulture.

Skills sets can be utilised by a diverse range of stakeholders, from frontline workers through to managers of any agribusiness enterprise, in addition to be an add-on to other qualifications.

Consultation plan

Members of the Agriculture and Production Horticulture IRC will gather further industry intelligence related to biosecurity skills requirements via broad consultation across various industry sectors.

Key stakeholders include, but are not limited to:

- National Biosecurity Committee
- National Biosecurity Emergency Preparedness Expert Group
- Animal Health Australia
- Plant Health Australia

- Australian Veterinary Association
- Primary Producers SA
- Australian Alpaca Association
- Australian Vegetable Growers Association
- NRM South/ Southern Tasmanian Council Association
- Recognised Biosecurity Groups
    - Livestock Biosecurity Network
    - Sheep Connect Tasmania
- Australian Association of Stud Merino Breeders
- Meat and Livestock Australia
- Australian Lot Feeders Association
- Australian Workers' Union

Scope of project

This project will be completed over 12 months.

Development of five new skill sets to cover the industry sectors:

- biosecurity measures for large animal production
- biosecurity measures for pig production
- biosecurity measures for poultry production
- biosecurity measures for cropping
- biosecurity measures for floriculture.

Development of up to 25 new units of competency.

Project title: Advanced Skills in Rural Management and Agribusiness	
Description	This project aims to develop skills and knowledge to create opportunities and increase competitiveness in the global agribusiness markets. New skills will be developed in agricultural innovation strategies, implementation of new products and leadership strategies that promote innovative thinking and practice.
Rationale	There are increasing market demands for innovation in product development to ensure viability of enterprises. To take advantage of opportunities provided in the new free trade agreement via the trans-Pacific Partnership and the Regional Comprehensive Economic Partnership, agribusinesses require information on market opportunities, risks and importing country requirements. Industry recognises the importance of product value-adding – ensuring all product opportunities are utilised for any one business enterprise – for example, sale of jam at 'u-pick' strawberry farms, apple cider from apple orchards, etc.
Ministers' priorities addressed	Skill set development will enable individuals to upskill in the area of production globalisation, irrespective of education status. Advanced agribusiness skills allow individuals to progress to different occupations within sectors, such as farm management or specialised agricultural exporters, but also between sectors. These sectors agriculture or production horticultural business enterprise.
Consultation plan	Support for this plan is through a diverse range of stakeholders across sectors. Key stakeholders include, but are not limited to: • National Farmers' Federation and state federations • Agribusiness Association of Australia • AgForce • Australian Dairy Farmers • Australian Chicken Growers Council • Australian Livestock and Property Agents Association • Australian Pork Limited • Australian Wool Innovation • Cattle Council of Australia • Australian Livestock Export Corporation • Wool Producers Australia • Australian Workers' Union (AWU)
Scope of project	This project will be completed over 12 months. Review of three qualifications. AHC41016 Certificate IV in Agribusiness

AHC51416 Diploma of Agribusiness Management

AHC60316 Advanced Diploma of Agribusiness Management

Development of up to three new skill sets.

Review of 51 units of competency.

AHCAGB301 Keep production records for a primary production business

AHCAGB401 Plan and implement property improvement

AHCAGB402 Analyse and interpret production data

AHCAGB403 Keep financial records for primary production business

AHCBAC408 Manage agricultural crop production

AHCBUS401 Administer finance, insurance and legal requirements

AHCBUS402 Cost a project

AHCBUS404 Operate within a budget framework

AHCBUS405 Participate in an ebusiness supply chain

AHCBUS509 Develop and implement business structures and relationships

AHCLSK501 Manage livestock production

AHCPMG411 Ensure compliance with pest legislation

AHCSHG406 Prepare shearing team wages

AHCWHS401 Maintain work health and safety processes

AHCWRK401 Implement and monitor quality assurance procedures

AHCWRK402 Provide information on issues and policies

AHCWRK403 Supervise work routines and staff performance

AHCAGB501 Develop climate risk management strategies

AHCAGB502 Plan and manage infrastructure requirements

AHCAGB503 Plan and monitor production processes

AHCAGB504 Plan production for the whole business

AHCAGB505 Develop a whole farm plan

AHCBUS501 Manage staff

AHCBUS502 Market products and services

AHCBUS503 Negotiate and monitor contracts

AHCBUS504 Prepare estimates, quotes and tenders

AHCBUS506 Develop and review a business plan

AHCBUS507 Monitor and review business performance

AHCBUS508 Prepare and monitor budgets and financial reports

AHCBUS510 Manage finance, insurance and legal requirements

AHCNAR506 Develop and implement sustainable land use strategies

AHCWHS501 Manage work health and safety processes

AHCWRK511 Develop workplace policy and procedures for sustainability

AHCAGB601 Develop export markets for produce

AHCAGB602 Manage estate planning

AHCAGB603 Manage the production system

AHCAGB604 Analyse business performance

AHCAGB605 Manage business capital

AHCAGB606 Manage price risk through trading strategy

AHCBUS601 Manage capital works

AHCBUS602 Review land management plans and strategies

AHCBUS603 Develop and review a strategic plan

AHCBUS604 Design and manage the enterprise quality management system

AHCBUS605 Manage human resources

AHCBUS606 Develop a monitoring, evaluation and reporting program

AHCBUS607 Implement a monitoring, evaluation and reporting program

AHCBUS608 Manage risk

AHCMER501 Develop a sales strategy for rural products

AHCWRK601 Monitor projects in a program

AHCWRK602 Lead and manage community or industry organisations

AHCWRK603 Design and conduct a field-based research trial

Project title: Compliance and Regulation of Medicinal Crops	
Description	The medicinal cropping skill set project will bridge gaps of knowledge for individuals currently employed or training in the cropping and horticulture sectors. The specialist knowledge required for medicinal cropping relates to the need for these crops to be highly regulated, and their value in terms of a pharmaceutical agent.

Rationale	Medicinal crops, such as medicinal cannabis, are already a rapidly growing industry in countries around the world. New legislation in Australia is allowing for the production of medicinal cannabis, which, in addition to the expanding poppy crops, has led to growth in the medicinal crop industry. The domestic market for medicinal cannabis is worth an estimated $100 million per year. New skills will be emerging relating to growing and harvesting the crops, security, understanding and implementing compliance, and government regulation.
Ministers' priorities addressed	Completion of skill sets will enable individuals to move between highly regulated cropping enterprises, and within the career pathways related to those occupations. Skills sets can be utilised by a range of stakeholders, from fieldworkers, greenhouse workers and lab workers through to managers of medicinal cropping enterprises.
Consultation plan	Support for this plan is through a diverse range of stakeholders across sectors. Key stakeholders include, but are not limited to: • National Farmers' Federation • Protected Cropping Australia • AgriFutures Australia • Australian Medical Association • Australian Medical Cannabis Industry • Therapeutic Goods Administration • Medicines Australia • Medical Technologies and Pharmaceuticals Growth Centre.
Scope of project	This project will be completed over 12 months. Development of up to four new skill sets. Development of up to 25 new units of competency.

Project title: Review of Diploma of Viticulture	
Description	This project addresses industry concerns about the skills and knowledge requirements of the of the current Diploma of Viticulture.
Rationale	Industry has raised concerns over the job outcomes of the Diploma of Viticulture and its role in the wine industry. Concerns raised include: • industry does not recognise the need for a Diploma of Viticulture • lack of entry requirements creates a misleading expectation • Diploma does not provide the right focus. Industry expectations of employees holding an AQF 5 level qualification are for skills in leadership and management related to their knowledge of vineyard operations, rather than specific viticulture skills. It is proposed that a review of the Diploma of Viticulture and 11 units of competency will result in a qualification that more closely aligns with current industry expectations.
Ministers' priorities addressed	Review of the Diploma of Viticulture will ensure that more information is available to training providers about industry expectations of training delivery and outcomes at this level.
Consultation plan	The Agriculture and Production Horticulture IRC will support the progress of this review by sourcing key stakeholders involved in viticulture to consult with Skills Impact when developing training package components, structuring the qualification, and determining the skills required for the national industry. Key stakeholders include, but are not limited to: • SA Wine Industry Association • Australian Workers' Union (AWU)
Scope of project	This project will be completed over 12 months Review of one qualification: • *Diploma of Viticulture* Review of 11 units of competency. AHCBAC505 Plan and manage long-term weed, pest or disease control in crops AHCBER501 Manage active operational emergency disease or plant pest sites AHCBER502 Manage the implementation of an emergency disease or plant pest control program AHCORG501 Develop an organic management plan

AHCORG502 Prepare the enterprise for organic certification

AHCPHT504 Develop a grape production plan

AHCPHT505 Evaluate wine

AHCPHT506 Manage a wine making process

AHCSOL501 Monitor and manage soils for production projects

AHCWAT502 Manage water systems

AHCWRK501 Plan, implement and review a quality assurance program