DIGITAL EARTH AUSTRALIA

HARVESTING
THE BENEFITS OF
EARTH OBSERVATION

AUGUST 2020

Australian Government
Geoscience Australia

FRONTIER SI

Digital Earth
AUSTRALIA

EXECUTIVE SUMMARY

The Australian agriculture industry has grown by 20% (inflation adjusted) over the past two decades, with much of the productivity growth having been fuelled by the adoption of innovations in science and technology. Moreover, the agriculture sector, which operates over more than half of Australia's landmass and contributes ~2.2% of our GDP, needs to continually evolve technologically to remain competitive in the global marketplace. Agriculture is thus an attractive and growing market for technology-focused Australian companies.

Whereas agriculture has been an early adopter of many productivity-boosting new technologies, it has nevertheless shown less readiness to adopt and innovate with others, in spite of their demonstrated potential. One such technology is remote sensing from Earth observation satellites, which has a long history in the agriculture sector. Remote sensing has been used to monitor large land surface areas on a regular basis since the 1970s. Over that time Earth observation data and services have grown substantially, with data from over 300 satellites now being available for agriculture applications.

When combined with the increased computing power accessible through cloud-based services and the trend towards digital transformation of the industry itself, the agriculture sector should be reaping significantly greater benefits than it currently is from the utilisation of Earth observation across the value chain. Yet, Earth observation remains underutilised across the industry.

This report identifies a lack of trust in Earth observation products and services, as well as a poor communication of value, as the key barriers to greater adoption of the technology. Overcoming these barriers will help in closing the gap between potential and actual use of Earth observation.

The lack of trust has grown over time in three significant ways, namely: unclear links between Earth observation data and high confidence decision making, a lack of confidence that Earth observation will be a sustainable source of agriculture information, and the present shortage of skilled and proficient users of Earth observation among trusted advisors within the industry.

Poor communication of value is one of the largest impediments to adoption of new technology. The responsibility for this communication lies with the technology providers, and they are often unable to separate features and buzzwords from communication of real value. This leads to a supply push (technology
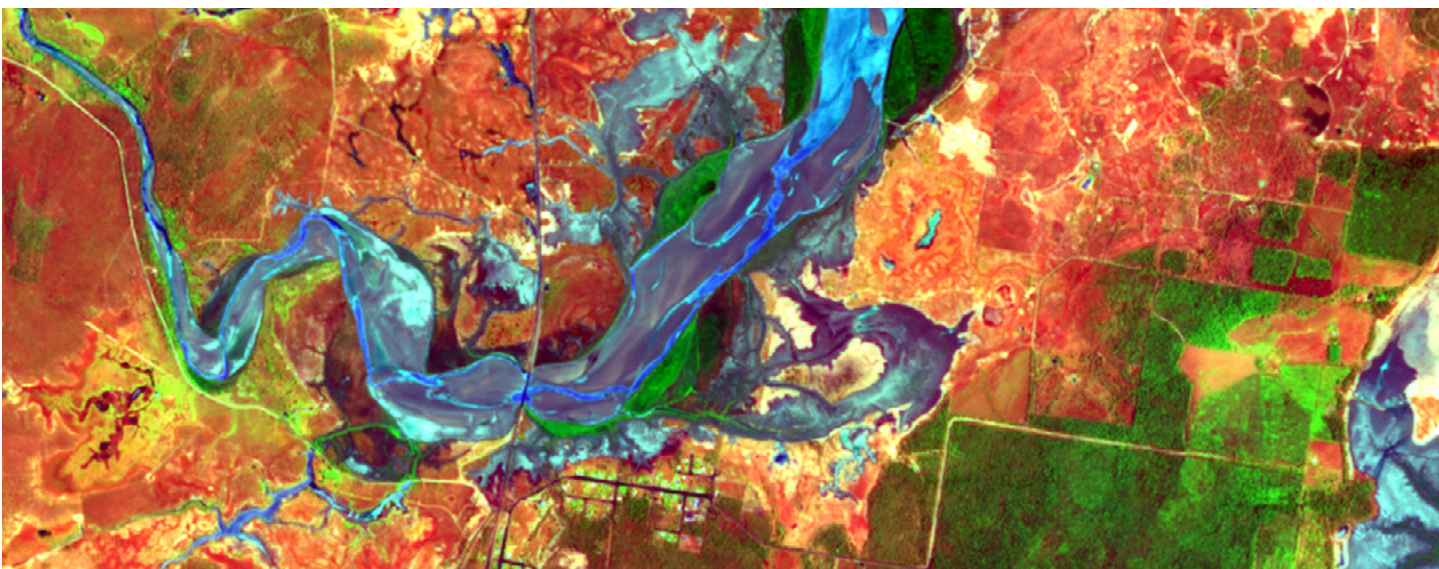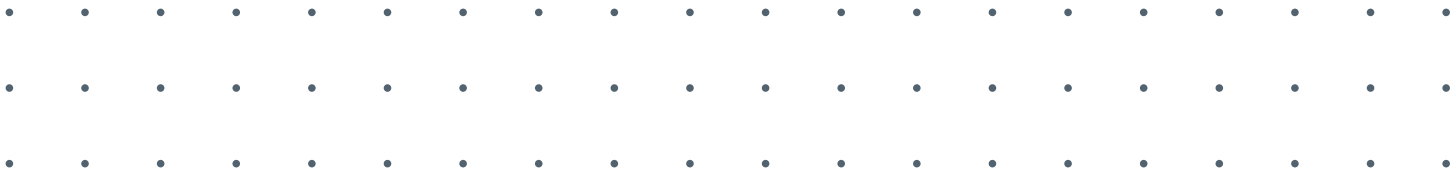
developed before market engagement), rather than a demand pull (market need that drives technology innovation).

This report identifies some of the first steps to be taken in bridging the communications divide, through provision of an overview of the agriculture sector, an assessment of the current state of Earth observation in the sector, detailed profiles of critical Earth observation users, and an expansion of some key value problems faced by the agriculture sector. Further, it presents current use cases of Earth observation in the sector and describes in language familiar to the producer the barriers to greater adoption, along with the problems to be solved.

There is significant opportunity for Earth observation to deliver decision making and productivity benefits within the agriculture sector. Anticipated benefits of higher-level application of Earth observation in the sector include:
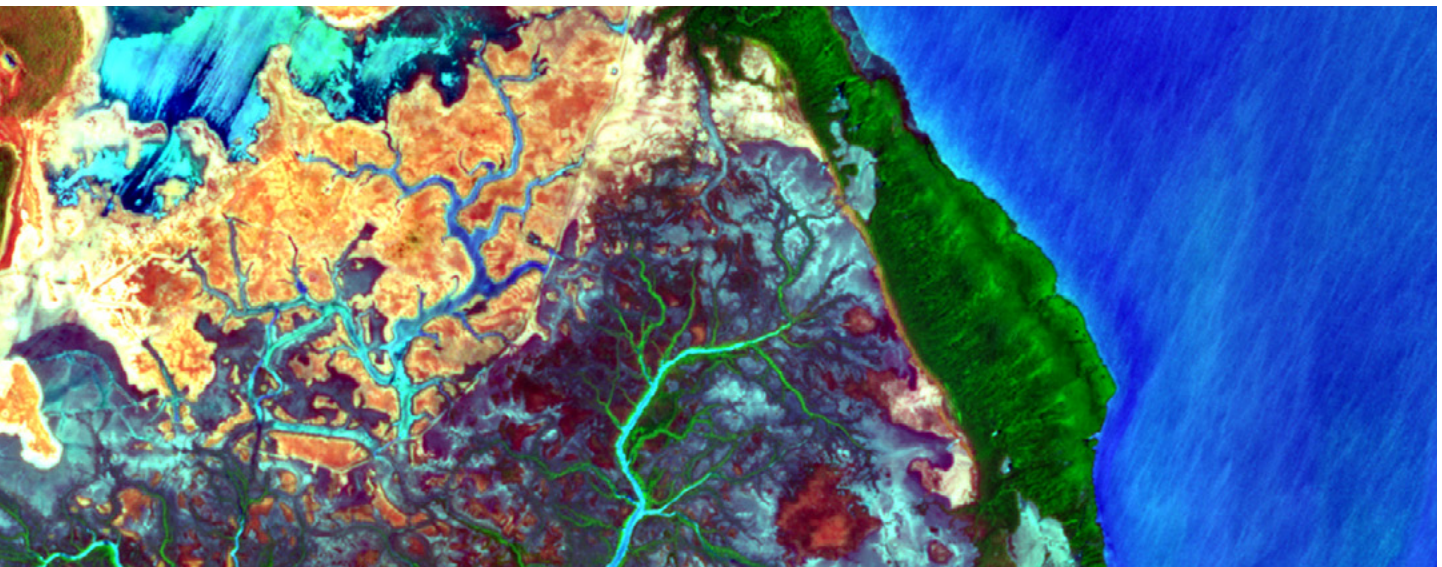- Risk management improvement.
- Continued development of community platforms which:
  - bring different datasets together in a single location, and
  - provide simple access to Earth observation datasets (decision ready data) that help farm-based decision making.

- Sustainability of Earth observation data sources.
- Increased opportunities for business to provide customised value-added products and services.
- Achievement by producers of a better balance in regard to financial, environmental and social sustainability.

The utility of Earth observation across the agriculture sector will be enhanced through development of a community of users of Earth observation-derived information products that harness available Digital Earth Australia (DEA) infrastructure.

Benefits flowing from formation of such a user community are expected to include:
- Provision of outreach and training to consolidate the link between the science and agronomic decisions.
- Producer involvement in development and validation of Earth observation data and technology.
- Support for the development of sustainable business models to deliver Earth observation products and services into the sector, bringing together public and private contributors within the agriculture community.
- The building of partnerships with producers to promote sustainability in the commercial exploitation of Earth observation.

CONTENTS

PURPOSE AND BACKGROUND

Agriculture in Australia is an attractive and growing market for technology-focused companies. The agriculture industry has grown by 20% (after adjusting for inflation) in the past 20 years[1], and much of the growth in the sector has been fuelled by adoption of science and technology innovations. The agriculture sector covers more than half of Australia's landmass, and contributes ~2.2% of our GDP, and it must continually evolve through adoption of new technology to remain financially competitive on the global market.

The sector often suffers from a perception of being late adopters of technology. While it is certainly true that the road to adoption of new technology can be long within the sector, this time duration is often due to issues of connectivity, time availability and trust/reliability, rather than a lack of willingness to innovate.

In fact, when the value proposition is clear and compelling, Australian primary producers are often world leading in their adoption of new technologies, even when adoption requires a fundamental pivoting of production as well as company management and infrastructure. Examples of this include automation, GPS guidance, yield mapping, sensors and remote imaging[2], with all now being commonplace in different parts of the agriculture sector.

However, adoption rates of key technologies are different across the various agriculture commodity types, often because a new technology is being pitched in a uniform way to the agriculture sector as a whole, rather than taking account of the differing drivers of value in different industry sub-sectors.

This communication of value is one of the largest impediments to adoption of new technology and approaches. The responsibility for effective communication lies with the technology providers, and they are often unable to separate features and buzzwords from a message of real value. This leads to a supply push (technology developed before market engagement), rather than a demand pull (market need driving technology creation).

This challenge is especially true with remotely sensed Earth observation data, and with the products and services generated through satellite remote sensing. Despite the potential of Earth observation to deliver over AU$750 million in economic benefit to agriculture by 2025[3], the deeply scientific nature of Earth observation leads to a range of industry specific terms (such as bands, resolution, pixels, wavelength, reflectance, etc), which at present renders the translation of Earth observation technical capability into market-valued products and services difficult.

This report takes some of the first steps in bridging this language divide, providing an overview of the agriculture sector, an assessment of the current state of Earth observation in the sector, and an expansion of some key problems faced by the agriculture sector that warrant solution. Through this account, technology companies, particularly those looking to use Earth observation data and services, can form a stronger understanding of the problems being faced, before embarking on the creation of new solutions. In addition, once Earth observation-derived products reach the market, this report will help solution providers communicate with the potential user community in agriculture in a language of problem solutions provision, rather than the 'language of the pixel'.

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1   https://www.agriculture.gov.au/abares/publications/insights/snapshot-of-australian-agriculture-2020#agricultural-production-is-growing
2   https://www.agrifutures.com.au/wp-content/uploads/2018/10/18-045.pdf
3   http://www.crcsi.com.au/assets/Program-2/The-Value-of-Earth-Observations-from-Space-to-Australia-ACIL-Allen-FINAL-20151207.pdf

Agriculture in Australia

by the numbers

Agriculture represents around 2.2% of Australia's GDP, and 2.6% of employment in 2018–19

$59 b is the estimated value of the agriculture industry in 2019-20, down 5% on the previous year, driven mostly by global market uncertainty

The mix of Australian agricultural activity is determined by **climate, water availability, soil type and proximity to markets**. **Livestock grazing** is widespread, occurring in most areas of Australia, while **cropping and horticulture** are generally concentrated in areas relatively close to the coast.

230,000 people were employed directly in the agriculture industry in 2016, with over 460,000 in the wider food and beverage industry
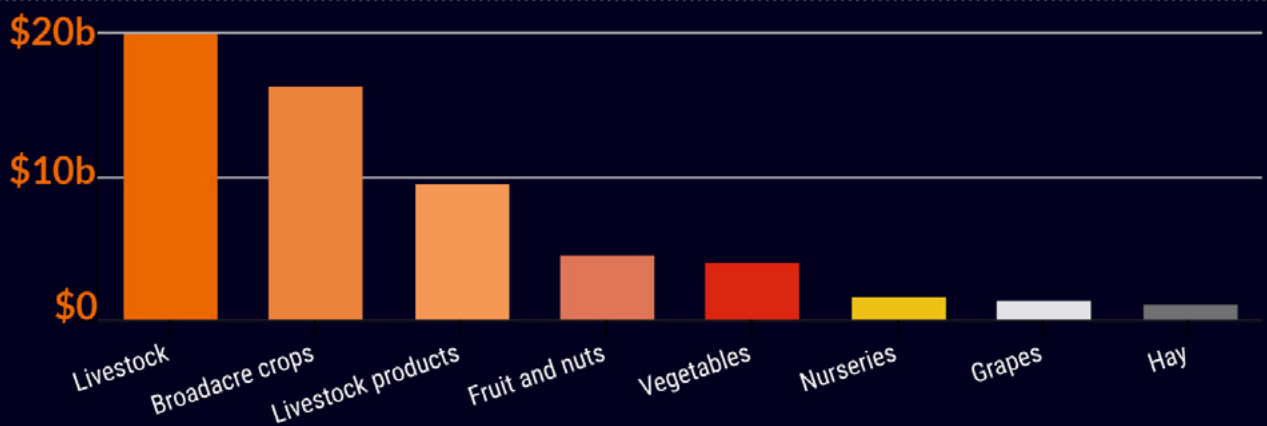
58% of Australian land use is for agricultural purposes, which is 446 million hectares

59% of water extractions in Australia are used by the agricultural industry. Variability in water availability (e.g. droughts) significantly impacts industry productivity

The value of key agricultural products to the Australian economy

Bar chart categories: Livestock, Broadacre crops, Livestock products, Fruit and nuts, Vegetables, Nurseries, Grapes, Hay (y-axis: $0, $10b, $20b)

66% is the proportion of the workforce who are male. The average age of workers is 49, with a typical week representing 48 hours of work

70% of our produce is exported, with meat and live animals driving growth

Source ABS, ABARES, LMIP
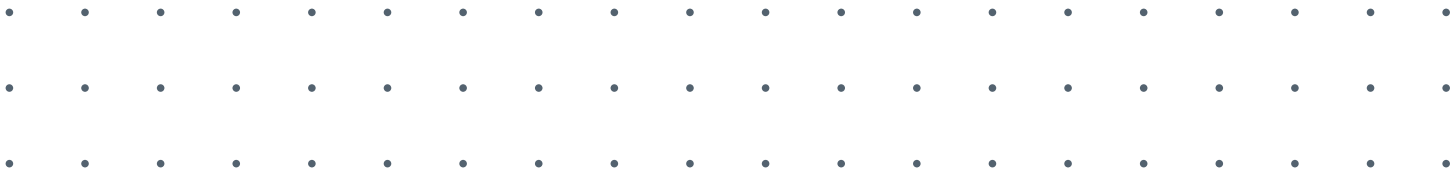
AGRICULTURE MARKET OVERVIEW

Australia's agriculture industry is estimated to be valued at AU$59 billion for the 2019-20 financial year. The industry is large and diverse, covering everything from large-scale cattle and cropping enterprises down to small fruit orchards and nurseries. These diverse enterprises occupy well over half of Australia's landmass.

The size, diversity and growth trajectory of different sectors within the agriculture industry can be hard to grasp. The National Farmers' Federation[4] has set an ambitious growth target for the industry, with an anticipated value of AU$100 billion being achieved by 2030. It is important to understand the key attributes of different components of the industry and how each sector contributes to its total value.

The figure on page 2 of this report summarises some of these characteristics, with further insights added throughout the rest of this report.


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4   https://www.agrifutures.com.au/wp-content/uploads/2019/08/19-025.pdf

THE AGRICULTURAL ECOSYSTEM

Although direct employment in Australian agriculture is estimated at 230,000 people, the producers at the heart of this diverse and complex sector are supported by a highly connected ecosystem. This is indicated in the figure below, which illustrates the relationships between the different actors comprising the agriculture industry and how they relate to primary producers. There is support of producers by the local community and townships, by industry or representative bodies who connect them to trends and opportunities, and by consulting and supply chain services ranging from advice on food types through to delivery to market. Support also comes from an active research and technology sector focussed on continual improvement of both farm operations and the quality and diversity of agriculture products, as well as from

government players who also regulate the sector. Producers have a wide network of relationships to maintain and manage.

Within the figure below, large nodes represent the primary relationship category, with smaller nodes providing examples of the types or organisations belonging within the particular category. This diagram is by no means complete, but does serve to highlight the complex network that covers the agriculture industry in Australia. A key highlight here is that Earth observation, while valuable, is only a subset of one of the smaller nodes within the figure. However, it also highlights that there are many opportunities to provide value to the industry without necessarily needing to work with producers directly.
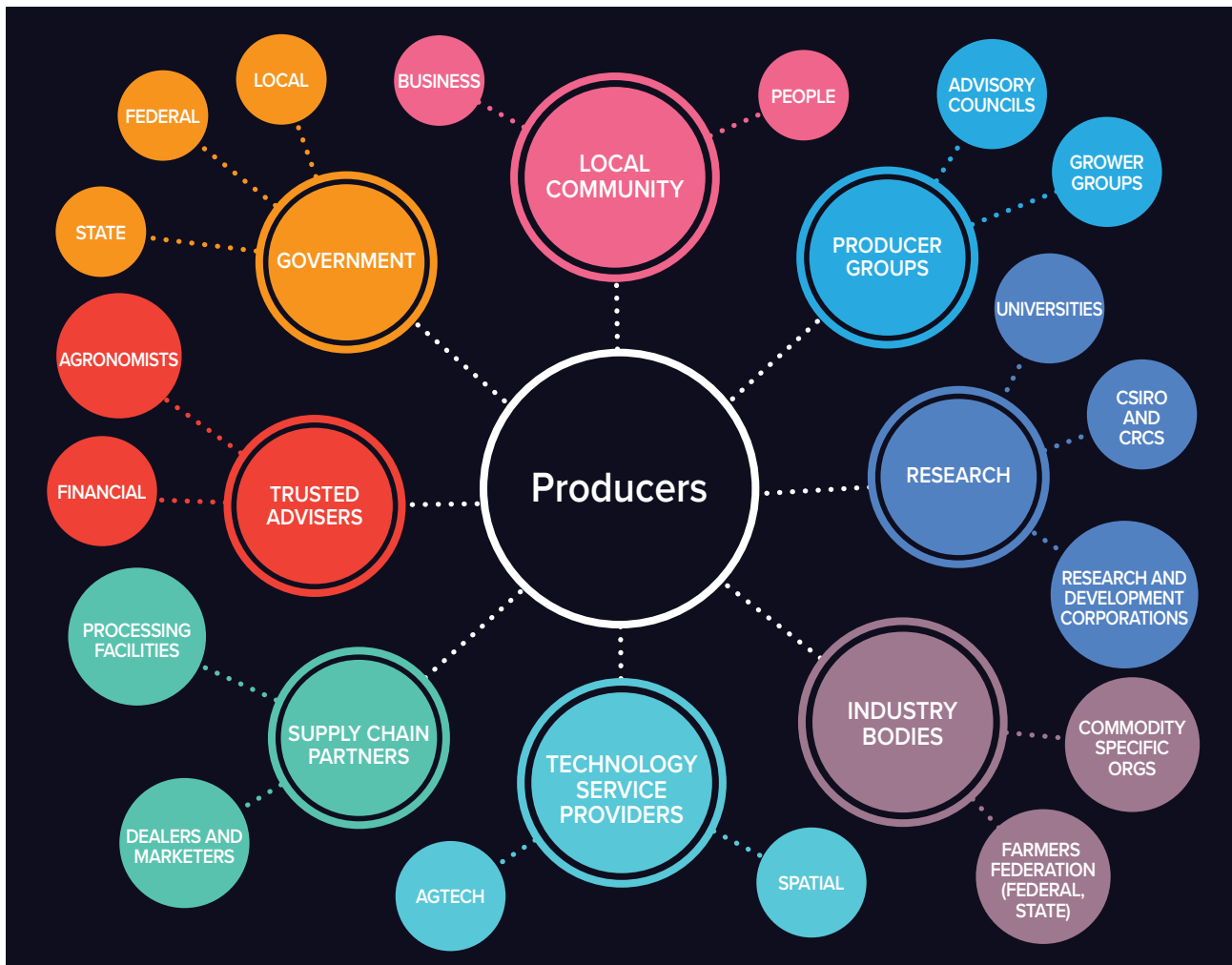
TRAJECTORY

Agribusiness has been suggested by Deloitte as one of the five industry sectors with the potential to take over from mining as the key driver of growth for the Australian economy[5]. The outlook for the agriculture industry is positive and an aspirational target of growing the industry to AU$100 billion by 2030 has been set by the National Farmers' Federation[2]. This is close to a 50% increase on the size of the industry in 2018-19. The growth goal represents both a significant challenge for the industry and a strong driver for it to innovate.

Agriculture is seen as the sector with a strong global competitive advantage in producing food products that the rest of the world increasingly wants to consume. Australia has a trusted global brand, and as ethical, clean, green and nutritional factors increasingly drive consumer behaviour, this brand places the agriculture industry in a strong position to further grow its export revenue. The prospects for growth in export prices for 'Brand Australia' produce are supported by the fact that 75% of Australia's current agriculture produce is already exported.

Breaking Australia's competitive advantage down reveals the following key drivers of global demand:

• increasing global population
• increasing wealth of developing economies and the rise of a global middle class, particularly across neighbouring Asian markets
• the ethics of food and fibre production, and
• increasing the desirability of specific product attributes like food safety and food security.

Australia is well positioned to capture value from increasing global demand. In key exports such as beef, lamb, dairy and oil seeds, Australia maintains a range of production advantages over many other countries. These comprise:

• the large area of arable land available
• the low level of conflicts between agriculture and urban development
• a high bio security status
• technological readiness, an innovative culture and high levels of education, and
• proximity to export markets.

PROJECTED FARM-GATE VALUE BY SECTOR, 2016-17 TO 2029-30
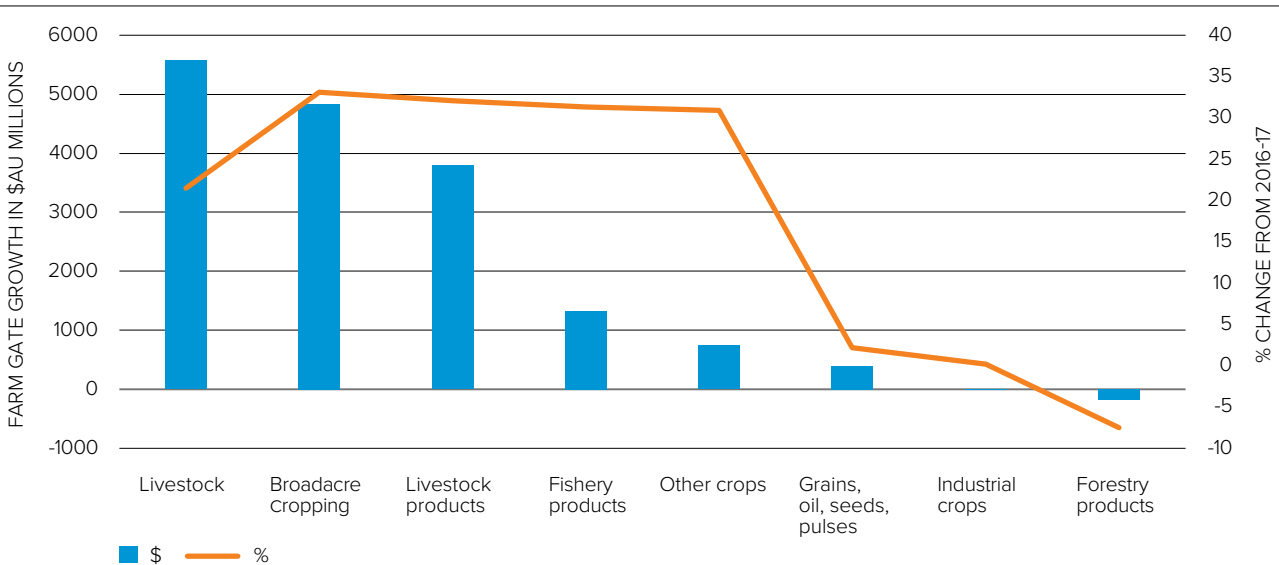
Projected farm gate value change in AU$ and % from financial year 2016-17 to 2029-30, adapted from modelling by Acil Allan in AgriFuture's 'A $100b sector by 2030?' report

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5   https://www.agrifutures.com.au/wp-content/uploads/2019/08/19-025.pdf
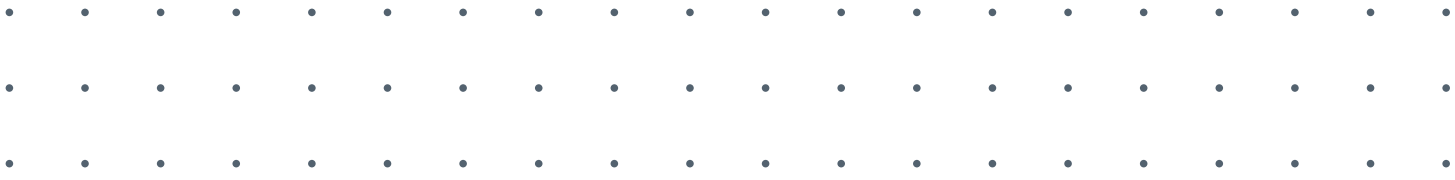
While many barriers to growth are expanded upon later in this report, key high-level barriers to meeting this increased demand can be summarised here as comprising:

- regulatory burden
- rainfall, water availability and reliability of supply
- an increasing frequency of natural disasters
- soil fertility
- an ageing workforce, and
- high labour costs.

Modelling from Acil Allen[5] has projected the growth from 2016-17 to 2029-30 in different agriculture sectors, with the trajectories for each being presented in the figure on page 5 of this report. Horticulture, livestock and livestock products are the current growth sectors in the industry, with forestry products being the only industry expected to contract over the coming years.

In comparing the contributions of each sector to today's industry, as discussed in the Market Overview section of this report, it is interesting to note that the current largest sectors (livestock, broadacre cropping and livestock products) are also those with the largest expected future growth in both absolute and relative terms. Also, it is noteworthy that fishery products and other cropping (such as intensive cropping) will experience a close-to 30% growth by the end of the next decade.

AGRICULTURE AND EARTH OBSERVATION

USAGE

Earth observation has a long history of application in the agriculture sector, due largely to its capability to remotely sense and monitor large areas on a regular basis. The impact of Earth observation in agriculture began with the launch of the Multispectral Scanner System (MSS) aboard Landsat 1 in 1972[6]. The four bands of MSS included both red and near-infrared wavelengths allowing production of the Normalised Difference Vegetation Index (NDVI) that remains a mainstay of Earth observation in agriculture today.

Earth observation data can be used to monitor productivity and efficiency along the agriculture value chain from planting, through growing, to harvesting. More recently, in combination with precision agriculture, it has helped to increase agriculture productivity and sustainability[7]. While there are many private companies who provide Earth observation services, state and federal government agencies have historically provided much of the data, analytical products and services to the agriculture sector. As an example, the Western Australian Land Information Authority (Landgate) worked with CSIRO to provide a Pastures From Space service to farmers that commenced nearly 20 years[8] ago.

Alongside this, Government agencies such as the Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES) have long used Earth observation for ground cover mapping to both monitor farming practices and estimate the area of land in Australia dedicated to agriculture. The Australian Collaborative Land Use and Management Program (ACLUMP), which oversees this work, utilises Federal Government investment in scientific research infrastructure through the Terrestrial Ecosystem Research Network (TERN) to provide nationally consistent time series of Earth observation data for ground cover mapping.

Government remains pivotal in supporting the development of Earth observation capability in Australia. Since the mid 2000s, Government investment in research and development through entities such as Co-operative Research Centres (CRCs) has seen the Earth observation capability in the agriculture sector grow through continued funding of the basic research that underpins new commercial enterprises, these being exemplified by Cibo Labs, FarmMap4D and DataFarming. CRCs that have helped drive Earth observation outcomes into the agriculture industry include the CRC for Spatial Information (2003-2018), the Food Agility CRC (2017-present) and most recently the SmartSat CRC (2019-present).

Rural Research and Development Corporations (RDCs) coordinate research activities for the major production sectors which comprise the agriculture industry, and they work with the research sector, including Universities and CSIRO, towards enabling digital agriculture through increased use of Earth observation.

Established providers of Earth observation satellite data like Airbus and Maxar (DigitalGlobe), and geospatial service providers such as NGIS and SpatialVision have developed applications for agriculture over many years. However, today there is a significant increase in investment into digital agriculture technology, particularly analytics, which has seen the emergence of new start up businesses and Small-to-Medium Enterprises (SMEs) utilising Earth observation. Recent successful examples include Cibo Labs and FarmMap4D, both mentioned above, as well as Flurosat, a recent start up that now has offices in four countries. Other startups, such as Digital Agriculture Services (DAS), are also demonstrating an appetite for the use of Earth observation in agriculture support sectors such as finance and insurance.
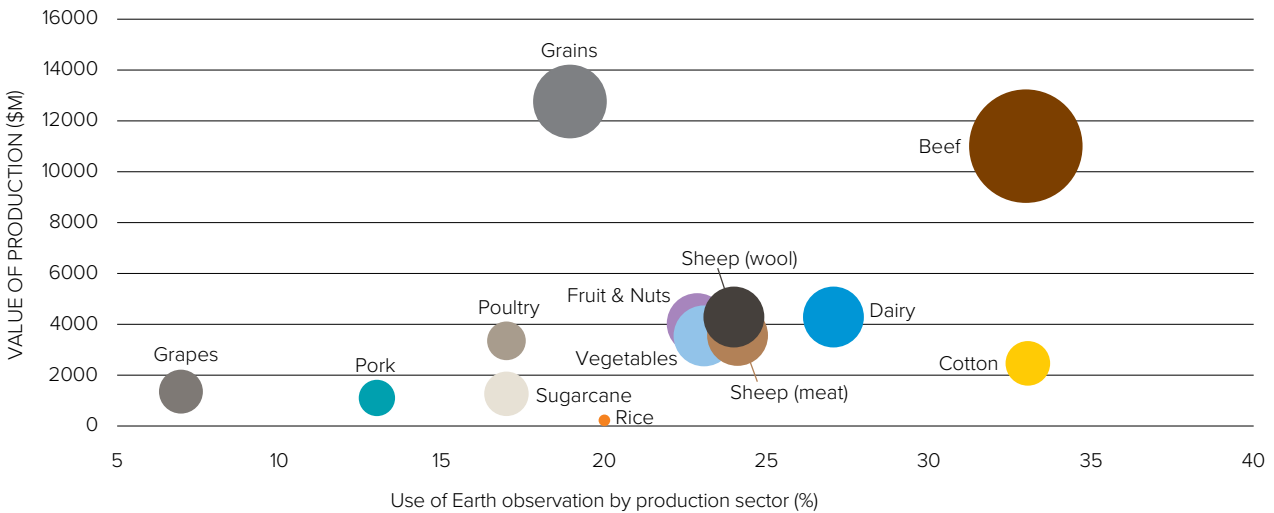
Large agribusiness is also investing in digital agriculture and Earth observation through development of their own digital agriculture platforms. Wesfarmers (Decipher), Elders (AgIntel) and Syngenta (Farmshots), for example, are seeking to derive greater value for both their customers and their own operations through linking Earth observation to agronomic decision making.

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6   https://landsat.gsfc.nasa.gov/landsat-1/
7   http://sparkle-project.eu/precision-agriculture-benefits-from-satellite-based-earth-observation-eo/
8   https://www.publish.csiro.au/SA/pdf/SA0401126

PROJECTED FARM-GATE VALUE BY SECTOR, 2016-17 TO 2029-30

Value of production of selected agriculture sectors, the current rate of use of Earth observation in these sectors, and the potential increase to GDP that digital transformation can unlock. As a guide, the value of digital transformation to GDP from the beef industry is about $4.2b and grains about $1.8b. Value of production taken from ABARES Agricultural snapshot 2017-18[9]. Rates of Earth observation use and impact of digital transformation taken from Precision to Decision report(s)[8,10].

The sensors capturing and delivering Earth observation data have also rapidly evolved over the past 5 years. The commercial exploitation of Unmanned Aerial Vehicle (UAV) technology and constellations of micro satellites, such as Planet's SkySat fleet, has made high spatial resolution Earth observation imagery much more accessible to service providers and product users, though the cost-benefit challenge of providing decision-ready data over large areas of agriculture land remains a barrier to the greater uptake of Earth observation technology across the agriculture sector.

Today, as the agriculture industry undergoes digital transformation, there are significant opportunities for Earth observation to contribute to the delivery of productivity benefits across key production sectors.

The figure above shows the opportunities that exist for Earth observation to contribute to increased GDP from the agriculture sector as digital transformation occurs[9]. The size of each point represents the increased contribution to GDP of production from an agriculture production sector through digital transformation. The y axis shows the value of production from that sector[10], while the x axis shows the current utilisation rate of Earth observation in that sector[11]. Rates of utilisation of Earth observation are currently low, but with significant room for growth and the opportunity to make an increasing contribution to GDP.

Taking the example of beef, although there are over 300 active Earth observation satellites in space, many of which can provide information of use to livestock management, imagery-derived products are predominantly limited to use for pasture and vegetation mapping. The opportunities for Earth observation providers here are twofold: first, an increase in the proportion of producers (33% at present) using current solutions and, second, further development in Earth observation products and services to better support producers who have already adopted Earth observation. The information available from Earth observation could in future make additional contributions to productivity through being used for monitoring infrastructure, soil moisture and climate variability, as well as for improved biomass estimation.

9 Increase to GDP through Digital Transformation (DT) taken from P2D Economic impact of digital ag - AFI Final Report, Table 3.1 p24 (Perrett, E, Heath, R, Laurie, A & Darragh, L (2017), Accelerating precision agriculture to decision agriculture - analysis of the economic benefit and strategies for delivery of digital agriculture in Australia, Australian Farm Institute, Sydney, November.

10 Value of Ag product taken from Value of Agricultural Commodities Produced, Australia, 2017-18 (https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/7503.0Explanatory%20Notes12017-18?OpenDocument)

11 Usage of EO for Crops: Table 6 p24, Livestock: Table 9 p27 (Zhang A, Baker I, Jakku E and Llewellyn R (2017) Accelerating precision agriculture to decision agriculture: The needs and drivers for the present and future of digital agriculture in Australia. A cross-industry producer survey for the Rural R&D for Profit 'Precision to Decision (P2D) project. EP175936, CSIRO, Australia)

EARTH OBSERVATION USER PROFILES

In order to initiate a mature conversation about the problems faced by users of Earth observation in agriculture, the first step is to understand the different types of users who are likely to be involved in agriculture applications. User profiles are intended to help service and product providers to better understand the perspectives, drivers, frustrations and goals for success of the people they will need to work with to grow the Australian agriculture sector.

The user profiles outlined below were developed after engaging with over 60 individuals via interviews, focus groups, conferences and workshops during 2019 and 2020. They have been constructed using a recognised Design Thinking approach. Creating empathy with users is the first stage of the design thinking process, with the ultimate goal being to understand the experiences, motivations, issues, needs and challenges of key stakeholders in order to build competitive and useful products and services.

The outcomes of this consultation have been summarised by way of a series of generic user profiles. These class users into a particular persona, and then explain a range of characteristics about that persona.

An additional lens has been added to this process, through which a view of the maturity of the user's experience with Earth observation technology can be gained.

Recognising that there is no single answer to maturity, typical ranges have been provided for each persona. These maturity levels can then be used to help determine an appropriate detail of information to provide about a given technical solution.

The maturity levels themselves have been adapted from the European Copernicus Programme's Usage Maturity Levels[12], modified to focus more on users, and introducing a Level 0. The explanation of each User Maturity Level (UML) is found in the following table.

EARTH OBSERVATION USER MATURITY LEVELS, ADAPTED FROM THE EC/ESA "THE EVER GROWING USE OF COPERNICUS ACROSS EUROPE'S REGIONS" PUBLICATION

Earth observation User Maturity Levels	Description
UML 0 Non user	The (non) user has never had any interest in Earth observation.
UML 1 Explorer	The user has never really made use of Earth observation but is aware of it and may have planned occasional tests to assess its potential benefits.
UML 2 Ad-hoc user	The user has used Earth observation ad-hoc in some specific cases but without an explicit interest to trial repeated usage.
UML 3 Pilot/Experimental tester	The user has already used Earth observation in one or more trials and is concretely considering its integration within its standard practices.
UML 4 Confident user	The user has confidently used Earth observation and is working to incorporate it as part of operational activities.
UML 5 Operational user	The user has adopted Earth observation operationally and has integrated it within standard operational processes. The related resources such as staff, budget and resources are allocated or readily deployable.

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12 https://www.copernicus.eu/sites/default/files/PUBLICATION_Copernicus4regions_2018.pdf

The user profiles have been created to represent key individuals who are most likely to be involved in the use or promotion of Earth observation within the agriculture sector. The key roles of these users are outlined in the table below, including their place within the agriculture ecosystem map.

Earth observation User Profile	Ecosystem Category	Role in the sector
Producer	Producer	Manage the land and business that grows agriculture produce using mostly traditional means
Early Adopter Producer	Producer	Manage the land and business that grows agriculture produce and is open to using valuable new approaches
Agricultural Consultant	Trusted Adviser	Provides advice to producers as a service to produce the right products and maximise output
Grower Groups	Producer Group	Member based organisations aiming to increase the production and profitability of their members farm businesses
Government Earth observation Data User	Government	State and federal departments implementing policies and programs to support the agriculture industry
Government Earth observation Data Provider	Government	State and federal departments that access, process and analyse Earth observation data to provide to industry and government users
Ag Tech Start Up and SME	Technology Service Provider	Small businesses looking to leverage new technology to provide value to producers, generally with a niche focus area
Large Agribusiness	Technology Service Provider	Large businesses looking to leverage a range of technology to provide value to producers, generally with a diverse focus area
Spatial Providers	Technology Service Provider	Specialist technology companies in Earth observation and spatial data providing analysis products and services to all users

PRODUCER

I am:

hard working, self reliant, and time poor. Getting things done is what matters most. I'll try new things as long as I trust it, or it has been recommended to me by others I trust and there is a clear incentive for me to change how I already do things.

What I like is...

Trusted relationships

Confidence in new technologies and making decisions

Simple, clear examples of where real value is added

Getting things done

What I don't like is...

New technology that is complicated to get started with

Red tape and bureaucracy

People wasting my time with new things that aren't proven

Automation taking over my role

Success is:

financial, environmental, social, sustainability.

What I want is...

To be able to make better decisions

Getting things done to be easier, not harder

Compatibility between all machines and data sources

To manage risk with confidence

Easy access to information which helps basic decision making

The trivial and administrative things to be taken care of

Things I like to hear...

These data will give you more information about your land

These data will help you make better decisions

This will give you more information and options, but you still make the decisions

Things I don't like to hear...

The information from these data is better than your own experience

This will help you make better decisions but you'll need to collect extra data

Don't worry, the algorithms will take care of it all for you

EARLY ADOPTER PRODUCER

0 1 2 3 4 5

I am:
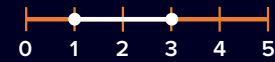
hard working, self reliant, and time poor. Getting things done is what matters most. I am always interested in exploring new ways of doing things which help me be more sustainable and productive in the management of my land and will embrace new technology that works.

What I like is...

To actively look for ways to do things better

Trusted relationships

Confidence in new technologies and making decisions

Simple, clear examples of where real value is added

Getting things done

What I don't like is...

New technology that doesn't work with my other gear

Red tape and bureaucracy

People who think they know my business better than I do

Success is:

financial, environmental, social, sustainability.

What I want is...

To be able to make better decisions

Getting things done to be easier, not harder

Compatibility between all machines and data sources

To manage risk with confidence

Easy access to information which helps basic decision making

The trivial and administrative things to be taken care of

Things I like to hear...

These data will allow you to manage your productivity potential

You need to be doing some self-validation for peace of mind

You can use any software you like to play with these data

Things I don't like to hear...

I'm sure there are some really good ways these data can help you do things better

You don't need to worry about validation, we do this across the country

You can only view these data by subscribing to our service

AGRICULTURAL CONSULTANTS

Typical EO User Maturity Level

0 1 2 3 4 5

I am:
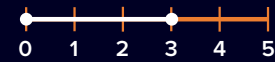
passionate about farming and am dedicated to building prosperous farming communities. I strive to provide the right advice to clients and build trust and confidence, and business outcomes are important.

What I like is...

Farms growing and seeing clients and communities grow

Giving good advice

Helping to solve problems producers can't solve by themselves

Personal development so I am abreast of new practices and the latest technology

What I don't like is...

Having my time wasted

The increasing number of competitors peddling products that don't work

Sales pitches

Success is:

giving producers the right advice they need to make their operations better.

What I want is...

To be a trusted adviser

Clear value to come from projects and advice

To manage risk with confidence

Easy access to information which helps basic decision making

Easy access to the information I want

Things I like to hear...

This technology has been used to provide this specific value to clients like yours

These case studies show where this technology works and doesn't work

This is the data you need to use for these reasons

Things I don't like to hear...

It could be used do this, this, or this

We have done it before, but under different conditions

This data might work for you

This actually replaces xxx part of your job

GROWER GROUPS

Typical EO User Maturity Level

0   1   2   3   4   5
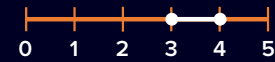
I am:

a person or group that is passionate about farming and is dedicated to building prosperous farming communities. I am a conduit that links growers to the latest research to help them make the decisions that increase profitability. Collaboration and trusted relationships are fundamental to what I do.

What I like is...

Good engagement, interest, extension and adoption

Collaborating with the right partners

Seeing members' farms and communities grow

Providing valuable information

Helping to solve problems producers can't solve by themselves

Connecting with the knowledge that my members need

What I don't like is...

Dealing with so many start ups trying to flog things

Doing great work that stops because the funding stops

Sales pitches

Success is:

producers getting the right information/products/ techniques they need to make their operations better.

What I want is...

Strong collaboration with everyone in the industry

Continuity and sustainability of funding to ensure capacity to allow for adoption and extension

Clear value to come from projects and the information I provide

Easy access to information which helps basic decision making

To help members manage risk with confidence

Interactive, interconnected platforms for accessing data that are also used by others

Things I like to hear...

These data can be shared widely and used by anyone you're working with

These data will be here for you to use for the long term

There is a community of users of these data you can work with

Things I don't like to hear...

These data are for your use only

These data will only be available while the project is running

There is just a service that provides data

GOVERNMENT EARTH OBSERVATION DATA USER

Typical EO User Maturity Level

0 1 2 3 4 5

I am:
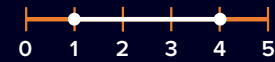
a professional with a background or interest in remote sensing and its applications. I may or may not have agriculture sector experience.

What I like is...

Getting insights from the data

Seeing farmers impressed by what the data can show them

Providing information that users want

What I don't like is...

Limitations on the data I can access

Confusion about the 'right' place to source data

Contributing, but not seeing the outcomes of my time

Success is:

producing meaningful information from Earth observation data that is of value to stakeholders and creates impact.

What I want is...

To be able to support better policy decisions

Easy access to the data I want when I need it

Better access to open data in the cloud

To be able to use tools I have developed on open data

Access to all available data

Things I like to hear...

All the data you need are available here

This is where you'll always be able to get these data from

The data are delivered in standard, commonly used formats

Things I don't like to hear...

There are some data here but some years and locations are missing

There are sometimes system upgrades so you will often need to rewrite your scripts

You need special software to read and analyse the data

GOVERNMENT EARTH OBSERVATION DATA PROVIDERS

I am:

dedicated to producing high quality, scientifically accurate data as openly as possible. I am a professional with a background in remote sensing and its applications. I may or may not have agriculture sector experience.

What I like is...

Getting insights from the data

Seeing farmers impressed by what the data can show them

Providing information that users want

Collaborating with other spatial people

What I don't like is...

Limitations on the data I can access

Indecision between prioritising servicing paying customers against public good

Being told that industry should be doing my job

Success is:

having industry use our data.

What I want is...

Better access to the open data cube in the cloud

To be able to use tools I have developed on the open data cube

To work with more agriculture consultants

Access to all available data

Things I like to hear...

These data can be shared widely and used by anyone you're working with

These data will be here for you to use for the long term

There is a community of users of these data you can work with

Things I don't like to hear...

These data are for your use only

These data will only be available while the project is running

There is just a service that provides data

AG TECH START UPS AND SMEs

I am:

passionate about my idea, and am sure it can help you! I am totally solution and business focused. I want to provide commercial products and services to clients not just here, but globally.

What I like is...

Easy, fast access to whatever data I want

Having reliable partners to work with when I need to

Working fast

Analysis-ready data

What I don't like is...

Too many different data sources

Having to do the learning on the data to produce products

Success is:

creating a large and steadily growing business providing new insights and products to the agriculture sector.

What I want is...

To develop and deliver products and services that customers will pay for

Open access to time series of Earth observation data

A standardised source or set of tools or endorsed methodologies that industry can build on to service agriculture clients' needs

The Earth observation user maturity level of the agriculture sector to be increased

Easy access to the right, analysis ready data I need for clients

Things I like to hear...

You can use an API to automate access to quality controlled data

All the data you need is accessible through an open data framework

The available data have been created using standard methodologies with easily obtainable documentation

Things I don't like to hear...

Automated data access isn't possible and data quality is variable

Data is available but its use is limited by IP restrictions

The data are provided with limited metadata

LARGE AGRIBUSINESS

I am:

focused on providing solutions at a large scale. I want to provide commercial products and services to clients that increase the value of their farming operations, and enable them to grow to run more and more properties.

What I like is...

Easy, fast access to whatever data I want

Having reliable partners to work with when I need to

Analysis-ready data

What I don't like is...

Too many different data sources with different specifications

Confusion over which datasets is best for each application

Success is:

increasing sales of products and services to customers across the agriculture sector.

What I want is...

To develop and deliver market leading products and services that customers will pay for

To be able to demonstrate the effectiveness of my products to clients

Easy access to the right, analysis ready data I need for clients

A clear description of what Earth observation data can and can not do

Things I like to hear...

I can access whatever data I need when I need it

The data I can access are analysis-ready and can be used for clients with minimal extra processing

A clear description of what the data can and can not do so I know they are fit for purpose

Things I don't like to hear...

There are data available but some years and locations are missing

The data are easily accessible but haven't been quality controlled

There are a lot of different data to choose from, you will need to work out which is best for you

SPATIAL PROVIDERS

I am:

passionate about the power of location data and maps. I know that my data is unique, and has quirks and benefits that no one else knows. I want to provide commercial products and services to clients that are based on or derived from Earth observation, delivered on a map.

What I like is...

Easy, fast access to whatever data I want

Having reliable partners to work with when I need to

Working fast

Analysis-ready data

Being able to consult technical literature when I need to

What I don't like is...

Too many different data sources

Having to do the learning on the data to produce products

The time and effort it takes to build customer trust and skill with Earth observation data

Success is:

creating a large and steadily growing business providing new insights and products based on spatial information.

What I want is...

To develop and deliver products and services that customers will pay for

Better customer engagement with Earth observation technology – my business depends on it

Open access to time series of Earth observation data

A standardised source or set of tools or endorsed methodologies that industry can build on to service agriculture clinets' needs

The Earth observation user maturity level of the agriculture sector to be increased

Easy access to the right, analysis ready data I need for clients

Things I like to hear...

You can use an API to automate access to quality controlled data

All the data you need is accessible through an open data framework

The available data have been created using standard methodologies and are provided in standard formats

Things I don't like to hear...

Automated data access isn't possible and data quality is variable

Data is available but the available datasets aren't complete

The data are provided with limited metadata in default formats

USE CASES

Increasing investment into digital agriculture technology has seen the emergence of start up businesses and SMEs delivering Earth observation services to clients which are transforming the industry. A selection of use cases representative of current applications across the industry is presented below. This coverage particularly highlights business use of Digital Earth Australia (DEA).

Use Case: Earth observation is being used to kickstart digital transformation in the agriculture sector through automated paddock boundary delineation.

DataFarming

DataFarming is an Australian precision agriculture company who deliver digital agriculture solutions to clients around the world. One of the biggest barriers to widespread precision agriculture adoption is the fact that most farms in Australia don't have a digital farm map of their field boundaries. Automated paddock boundary delineation is recognised as a key component in unlocking greater value for producers from precision and digital agriculture and is fundamental to starting the digital AgTech revolution. DataFarming are using DEA data with machine learning to automatically detect and regularly update paddock boundaries across the country to unlock the value in digital agriculture for their clients.
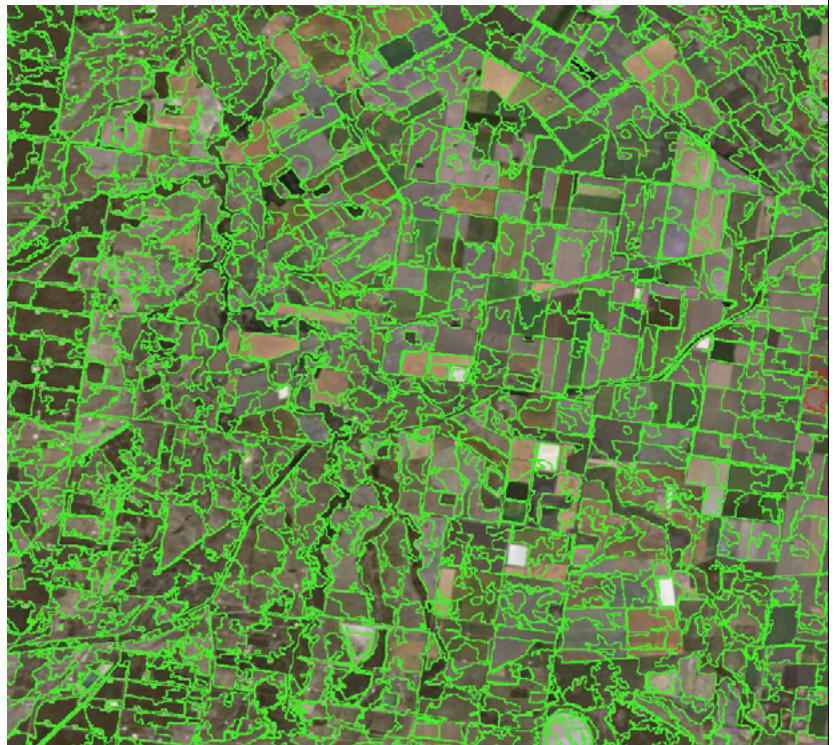
Use Case: Farmers can access crop nutrition information and biomass estimates on mobile devices in order to assess current crop performance, compare it to previous seasons, and make decisions.

NGIS and Decipher

Location technology and mapping solutions provider NGIS working with Decipher, a cloud-based Earth resource management solution provider are transforming crop nutrition practices in Australia and globally using Earth observation. Decipher is used by growers to manage testing and analyse results, and is used by agronomists to consult growers with data driven recommendations to increase productivity. In mixed farming operations, where the Decipher platform can be used for nutrition management and soil sampling as well as pasture analysis, the DEA fractional cover product can be used to both assess groundcover and rangeland feed availability to improve decision making for stock movement and allocation.

Use Case: Remote monitoring of crop stress, and management of nutrition requirements and water usage for real time decision making.

Flurosat

Flurosat is an Australian cloud-based crop management and analytics company which has scaled up its business rapidly over the last few years. The company has developed a platform that allows quick and efficient analysis of Earth observation imagery from multiple sources over cropped agriculture areas. It automatically delivers alerts to growers as crop health issues are detected. Case studies have shown an improvement in yield assessment of 10% through application of Flurosat's crop analytics to early detection of crop stress.
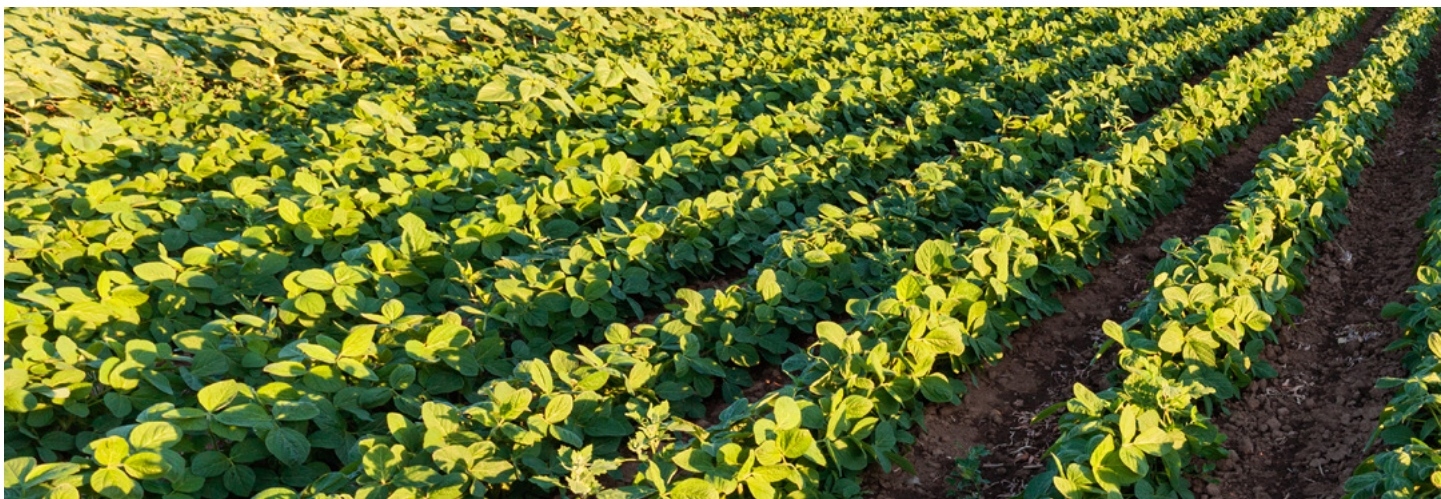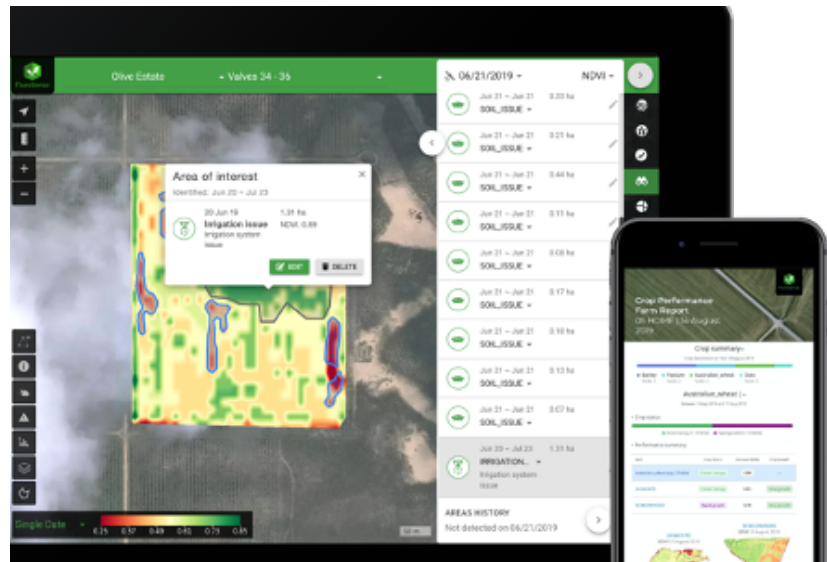
Use Case: Understand farm level productivity and risk for either individual properties, or at a portfolio level for large organisations such as banks and insurance companies.

DAS

Digital Agriculture Services (DAS) is a rural technology company based in Melbourne. The company applies machine learning and artificial intelligence in agriculture. It caters to a growing appetite for AI-powered rural, agriculture and climate risk intelligence that puts science in the hands of decision makers, including farmers, lenders, insurers, commodity traders and rural suppliers. DAS utilises publicly available Earth observation datasets from Sentinel, Landsat and MODIS, as well as from radar imagers. To produce its products and services, DAS utilises Australia's petascale Earth observation Data Cube in combination with CSIRO's Digiscape Future Science software and agriculture production and climate models. The outcomes are used in multiple ways, including for better remote measurement and analysis of risk, so that insurers can underwrite with greater confidence. This allows insurers to offer more competitively priced policies without decreasing their profit margins, allowing savings to be passed on to farmers.

Use Case: Pastures over the vast areas of Australia's rangelands are monitored by remote sensing in near real-time to support decision making regarding livestock stocking rates.

Cibo Labs

Cibo Labs is an Australian agriculture data analytics company which applies remote sensing science and machine learning to bring new levels of understanding on pasture productivity and land condition to livestock producers. Cibo Labs use DEA Sentinel 2 data as an input to biophysical models that predict within-paddock pasture biomass every 5 days across Australia's extensive grazing lands. Producers use this information to monitor land condition and optimise stocking rates for available pasture. Cibo Labs processes more than 10 million hectares of ground cover and pasture biomass on a weekly basis for several of Australia's largest cattle companies. Technologies that improve the management of the feed base for stock have been reported to reduce production costs by about 4% for Northern Beef, 8% for Southern Beef and 9% for Sheep. The underlying figure shows an example of one of Cibo Labs' biomass products, a map of Total Standing Dry Matter, TSDM.
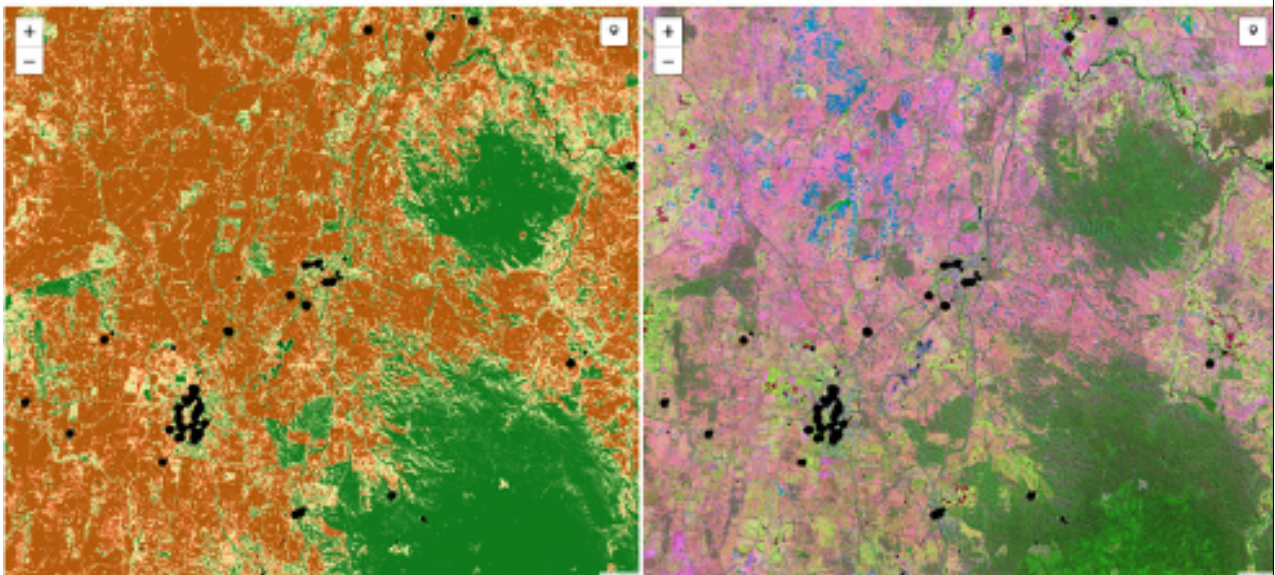
BARRIERS TO USE OF EARTH OBSERVATIONS

Trust is at the heart of relationships, investments and decision making within the agriculture sector. At present, there is a deficit of trust of Earth observation data across the sector. Three fundamental ways in which the lack of trust in Earth observation data manifests itself within the sector are shown in the figure below.
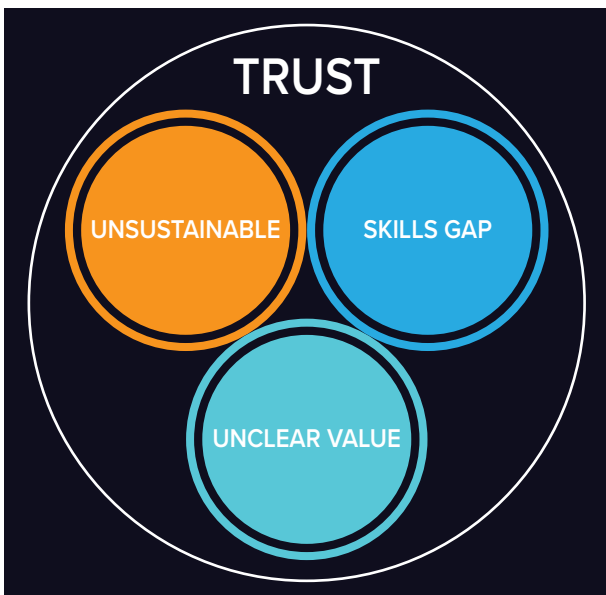
UNCLEAR VALUE

For Earth observation data to become a trusted source of information for decision making and risk management, the value of Earth observation data usage needs to be clearly and simply defined through case studies and testimonials, and the incentive to use Earth observation data-derived products and services needs to be made very clear. Currently, this is often not the case and as a result there is a lack of trust in the value of Earth observation data to the industry.

UNSUSTAINABLE SOLUTIONS

Financial, social and environmental sustainability are core values of agriculture producers and communities. To increase investment (time and money) in, and use of Earth observation data, systems or ways of working need to be put in place where there is trust in their sustainability over the long term as well as confidence that any value from any investment will not just fade away once the project funding ends. The experience of many users to date has been that externally funded projects they have been involved in have been designed to help demonstrate how Earth observation data can be used, and how its use can be embedded within work practices, and benefits have been demonstrated. However, these benefits can quickly erode once the project ends. As a result, there is a lack of trust in the Earth observation data as a sustainable source of information for making decisions and managing risk.

SKILLS GAP

Producers in the agriculture sector will take advice from others they trust. Other successful farmers, agronomists and agriculture consultants and grower groups are trusted advisors with a desire to see farming operations and communities grow.

However, at present few agronomists and consultants are proficient users of Earth observation data products, and resource constraints mean that it has been difficult for grower groups to engage skills and provide advice in the use of Earth observation data on an ongoing basis. Accordingly, there needs to be more trusted advisors who have been nurtured and up-skilled up in the use of Earth observation technology so as to increase its uptake and embed its use operationally across the agriculture sector.

OVERCOMING BARRIERS

JOINING USERS OF EARTH OBSERVATION TO PROVIDERS OF EARTH OBSERVATION

Earth observation is recognised as a new technology, which is in the growth phase of its application within the agriculture sector. In leveraging the growth driven by broader digital transformation initiatives, Earth observation has a significant role to play in addressing the challenges the agriculture sector is facing and meeting its goal to reach the $100 billion target by 2030.

Of the findings of the research conducted for this report, it is pertinent to note that users and providers of Earth observation data have very different perspectives on what the key barriers are to increasing its uptake across the agriculture sector.

For users, trust in Earth observation technology is the most significant barrier to greater adoption across the sector, as was discussed earlier in the section Barriers to Use of Earth Observation. From the perspective of providers of Earth observation data, a significant barrier to greater utilisation will be overcome when there is continued, automated, reliable access to real-time and historical Earth observation data. These needs are illustrated below using examples cited from the interviews conducted for this report.

OFF-FARM DECISION MAKING

As farm size continues to increase and the cost of labour becomes a barrier to competitiveness, ways need to be found which permit risk to be managed remotely, whether it be from the farm office, premises in the city, or even overseas.

Earth observation provides the opportunity to manage risk and make operational decisions remotely, however there is still work to do to link the Science of Earth observation to decision making with the high level of confidence that would make use of Earth observation common industry practice.

From the user perspective, there is a gap between the science of Earth observation and the ability of producers to make decisions with a high degree of confidence. This forms a critical barrier to increased use

of Earth observation data across the sector, particularly for users at maturity levels 1-3, who make up over 60% of the potential Earth observation user community. The following scenario from the user interviews for this report illustrates the current low confidence in Earth observation data for decision making:

"The two hour round trip to check something on an outlying part of the farm could be better spent getting things done, but the confidence in the data isn't there yet".

AUTOMATED DELIVERY OF STANDARD EARTH OBSERVATION PRODUCTS INTO VALUE-ADDED SERVICES

The growing Ag Tech sector wants to use Earth observation as an operational input into the value added services they deliver like pasture biomass estimation, agriculture analytics and precision agriculture applications.

Earth observation needs to be easily accessible via Application Programming Interfaces (APIs) with open access to real-time data as well as historical time series. The data need to be analysis-ready with quality controlled specifications so that they flow seamlessly into automated, interoperable, systems without the need for human intervention.

The conducted research has indicated that from the perspective of the established operational users and providers of Earth observation data at maturity level 5, data accessibility issues are limiting their utilisation of DEA data and infrastructure, as illustrated by the description below:

"The role of government should be to provide a standardised source of data and a set of tools, or endorsed methodologies, that allow the commercial market to use the data to value add to the agriculture industry".

Noting that the key users and providers of Earth observation data at different levels of user maturity have different challenges they need to overcome, a focus on joining users to providers is particularly

important to increasing the utilisation of Earth observation data across the agriculture sector. This is the subject of the following section of this report.

WHAT DRIVES GROWTH IN THE USE OF EARTH OBSERVATION?

There are many factors that lead to the decision to trial, then adopt Earth observation products and services within the agriculture supply chain. Comparing different outcomes from across the consultations, the following opportunities that will help Earth observation service providers improve the growth of Earth observation products and services across the industry have been identified:

• Building the user maturity level of key segments of the agriculture supply chain, with a focus on agronomists and agriculture consultants
• Ensuring the long-term provision of Earth observation products to key users and influencers through sustainable business/delivery models
• Making clear links between Earth observation science and data and confidence in decision making and risk management
• Embedding Earth observation in the toolkits of the next generation of agriculture producers and advisors.

THE ADOPTION CHALLENGE

Adoption of new technology can often be at a slower pace than in many other sectors. However, when new technology demonstrates undeniable value, adoption can be swift and widespread. The following generalised statements from producer interviews highlight critical evaluation criteria often used by producers:

• "New technology needs to make what I already do easier."
• "I don't want to have to do more work to get value out of new technology; if I have to do extra things on top of what I already do then any extra value from the new technology is a hard sell."
• "Ideally, any data new technology needs from me should be captured as a by-product of the farm management I already do."

COLLABORATION IS CRITICAL

The barriers referred to can all be overcome. However, as trust deficit is the critical element underpinning all barriers, meaningful and genuine collaboration between technology providers and the agriculture sector is needed. Collaborations warranted in overcoming values, sustainability and skills barriers are indicated in the following table:

Barrier	Key Partners	Early Adopters	Advocates
Clear Value	Grower Groups, Agronomists, Agriculture consultants, Universities	Grower Groups, Trusted Advisers/Influencers, SMEs and Big agriculture companies	Grower Groups, RDAs, RDCs
Sustainability	Grower Groups, RDAs, RDCs Agriculture tech accelerators	Trusted Advisers/Influencers, Agronomists, Agriculture consultants, Grower groups	Grower Groups, RDAs, RDCs
Skilled Up	Grower Groups, Universities eg CSU, Agriculture colleges, Professional associations	Agronomists, Agriculture consultants,	Grower Groups, RDAs, RDCs, Industry Growth Centres

THE PATH FORWARD

KEY PROBLEMS USERS WANT TO SOLVE

As existing users will testify, there is clearly a significant value to be realised through better use of available Earth observation data, tools and services. The key problem to be overcome is communication. If companies experienced with Earth observation can start to explain the value of the technology in terms of the problem being solved, not in technical terms of Earth observation science, growth in the agriculture sector will accelerate.

The critical agriculture problems that warrant solutions, upon which Earth observation companies should focus, can be grouped into three key themes:

1. **Decision making today** – making active decisions regarding current operations.

2. **Managing risk** – reducing short term uncertainty across the agriculture supply chain.

3. **Planning and managing farming operations for the future** – understanding how to make changes today to maximise production and minimise risk into the future.

These themes are expanded below. In each theme, a problem is described as a statement in language typically used in the agriculture sector, with additional information and context provided next to each quote to help translate the statements into a business opportunity or potential Earth observation alignment.

Broadly defined agriculture sectors to which each problem is relevant are denoted by icons in the first column. The second column provides the types of language that could be used to demonstrate the value of a solution without using any Earth observation jargon. The third column is intended as context for technology providers as described above.

Livestock & Livestock Products   **Crops**   **Other**

DECISION MAKING TODAY		
Agriculture Sector	**Problem Statement**	**Additional Context and Information**
🐂	"I want to know how much pasture I have for my sheep right now and whether that amount is increasing or decreasing."	The pasture growth rate needs to be greater than the rate of pasture consumption by grazing animals, otherwise the reduced amount of feed on offer will reduce growth rates and the value of livestock.
🐂	"How much will I be able to sell my livestock for in 6-12 months? Should I sell them today instead?"	Modelling of the value derived through investing in decision support tools in the livestock industry indicates 15% productivity improvement for beef producers, 10% for sheep, and 8% for goats.
🐂 🌾 🥕	"I need to estimate how much of my product I can produce over the next 3 months based on current information."	The ability to be able to track how the current season is unfolding compared to previous seasons provides the opportunity to estimate expected production.
🐂 🌾 🥕	"I must do more with less people."	Some producers are needing to run with two people what once took seven.

DECISION MAKING TODAY *CONTINUED*		
Agriculture Sector	**Problem Statement**	**Additional Context and Information**
	"I need to ensure I am producing the right things at the right time."	There is often a mis-match between produce supply and customer demand, this leads to uncertainty in both prices for goods and pathways to market.
	"I need to better measure and monitor my operations for planning and operations management."	Producers often have limited data on which to base tactical management decisions that can optimise returns. Timely and cost-effective inputs to decision-making allow improved management of crop planting and harvesting, feed and animal turn-off and health.
	"I want to know what is causing the gap between my yield potential and my actual yield."	The Yield Gap is the gap between potential and actual crop yield. It is often hard to understand and measure this gap, as well as to determine the factors that cause the gap. If these can be measured and managed, the gap can be reduced over time.
	"I need to be sure that data collected about my farm reflects on ground characteristics I measure and manage myself."	Information you can trust to make better decisions needs to be presented such that its value is self-evident and builds on what producers already know themselves.

MANAGING RISK		
Agriculture Sector	**Problem Statement**	**Additional Context and Information**
	"I want more accurate predictions of when the best time will be to seed and harvest to make my operations more profitable."	In the Wheatbelt region of Western Australia, a 5% improvement in the accuracy of weather forecasting could increase the region's profitability by $10 million.
	"As conditions change during the season, I need consistent, up-to-date data to help me make decisions about what I should and shouldn't plant."	Australian agriculture producers manage a higher level of seasonal and climatic variability than most other countries.
	"I need to detect crop damage from pests and disease at the earliest possible stage."	The importance of detecting plant disease early is highlighted by annual crop losses due to viruses and fungal attacks being as high as 30%.
	"I want to be able to accurately predict a frost event ahead of time."	Improved pre-season planning for frost will help Growers make optimal decisions on crop choice and placement. Informed in-season management decisions will help Growers optimise type and timing of crop inputs in frost-prone cropping regions to minimise the impact of frost.
	"I need to demonstrate the effectiveness of preventing crop disease through the specific chemistry our product contains."	In 2018 it was estimated that $20.6 billion of Australia's agriculture production was attributable to the use of crop protection products.
	"Where are the most destructive weeds, and where are they likely to be?"	More effective weed control measures could save Australian producers $1.5 billion in costs and increase the value of production by $2.5 billion per annum.

MANAGING RISK *CONTINUED*

Agriculture Sector	Problem Statement	Additional Context and Information
	"I want to be able to make better crop choices based on the expected season to minimise heat/frost loss."	Growers should be able to use accurate information on the pattern and severity of heat stress in their region to guide variety selection and sowing decisions, and to enable rapid response once an event has occurred.
	"I need to regularly and reliably measure water quality through my offshore farm or risk losing my stock, but it's too remote and inaccessible to do it easily."	Water quality can be a major source of pathogens in aquaculture operations. Globally, stock losses due to aquatic animal pathogens exceed $9 billion annually.
	"I want to minimise safety risks for my inexperienced or temporary staff."	It is estimated young backpackers on average make up around 25% of Australia's agriculture workforce, with the percentage being higher in seasonal industries.
	"I need to understand if I am still growing the optimal crop in each paddock based on both environmental and market conditions."	As conditions change between and within seasons, producers need to be able to optimise planning and management of land use to ensure the best financial, environmental and sustainability returns.
	"How can I maintain my social license to operate?"	Monitoring of sustainability outcomes such as land cover, biodiversity, water quality and animal welfare, so as to demonstrate sustainability status and outcomes.
	"I need to automatically determine which quality standards I meet in order to receive a higher price for my produce."	Automated quality control and traceability of fresh produce during production will assist producers in setting and defending prices for their produce in the marketplace as the agriculture value chain becomes more automated and integrated.
	"I want to manage financial risks by making my returns more predictable."	Volatility in markets makes future prices for agriculture products more unpredictable. Time series of Earth observation data can assist in improving predictions of future prices.

PLANNING AND MANAGING FARMING OPERATIONS FOR THE FUTURE

Agriculture Sector	Problem Statement	Additional Context and Information
	"I need to manage a bigger farm with fewer people to stay competitive and profitable."	The trend towards aggregation of farm holdings means today 60% of agriculture production comes from the largest farms.
	"I need a clearer appreciation of climate impacts and trigger points so I can plan for it and adapt my farming systems."	Over the last two decades, 42% of broad-acre farms have generated an average income of $50,000 pa. The percentage can be as high as 66% in good years and as low as 28% in drought years.
	"I need to optimise farm planning and management to get the best commercial, environmental, and sustainability returns I can."	The Organisation for Economic Co-operation and Development (OECD) has stated that to meet the challenge of feeding 10 billion people by 2050, agriculture globally will need to improve the efficiency with which inputs are turned into outputs as well as conserve natural resources and reduce waste.

Agriculture Sector	Problem Statement	Additional Context and Information
	"An estate manager needs routinely collected historical and real-time data so they can target management and yield quantity and quality land practices."	Internet-based services for provision of crop data to help growers make better decisions can lead to improved crop yield, better management practices and efficiencies in planning for harvest and handling grain, all of which benefit the national economy.
	"Degraded farms need a revegetation plan to improve and retain soil, lower the water table, provide habitat for wildlife and sequester carbon so they can recover soil carbon and general health."	The global cost of land degradation is about $450 billion per annum, but every dollar spent on land restoration returns $5.
	"Should I buy that property or not?"	The price of an agriculture property is based on the area of arable land it contains. Earth observation imagery can be used to assess the area of arable land within a property to ensure the price is fair.
	"How can I differentiate my brand and products?"	In 2018 it was estimated that $20.6 billion of Australia's agriculture production was attributable to the use of crop protection products. A strong brand is needed to capture market share.
	"Can I help to avoid food fraud abroad by proving my exported product is Australian?"	Provenance of agriculture products is increasingly important to consumers. Producers need to meet the evolving ethical, environmental, and nutritional demands of consumers to receive the best prices for their goods.
	"I need a tool that can help detect changes in land management practices."	Information on land management practices is needed for reporting on the effectiveness of programs for natural resource management, water, climate change, and biosecurity.

ALIGNMENT TO DIGITAL EARTH AUSTRALIA INDUSTRY STRATEGY

In 2019, Geoscience Australia published the DEA Industry Strategy[13]. The strategy aims to allow Geoscience Australia to invest program funding in a way that both maximises the benefits realised across the Australian economy and ensures that the market for Australian made Earth observation products and services grows significantly both domestically and internationally. The DEA Industry Strategy proposes three areas of focus: Data and technology, Education and training, and Awareness.

Each area of focus contains a range of activities to accelerate the adoption and impact of DEA Earth observation data, products and services across Australia.

Further to the actions identifies within that strategy, the following agriculture industry-specific activities are suggested to specifically lower the barriers to adoption of Earth observation technology.

DATA

- Further supporting applied R&D, with a focus on the transition from Earth observation data to decision making.

- Ensuring uptime of Earth observation data services and continuity in delivery and improvement of products that do not require additional user intervention before integration into existing business systems or workflows.

- Creating and promoting contributions to a repository of in-situ validation data so as to build the confidence necessary for greater uptake of Earth observation data.

EDUCATION

- Investing in education and training within the sector, targeting unique sessions that cater to the maturity level and aims of each of the key user profiles covered within this report.

- Improving discoverability of information regarding the DEA program, particularly highlighting elements that build trust across the ecosystem.

- Advocating for the inclusion of DEA content within agriculture tertiary education courses.

AWARENESS

- Fostering the development of a community of Earth observation users within the agriculture sector, which will drive collaboration, build champions in grower groups and RDCs.

- Advocating for improved internet connectivity in rural areas.

- Establishing partnerships with key representative bodies across the agriculture ecosystem in order to raise awareness and improve trust.

- Expanding Earth observation technology presence and awareness at influential agriculture events, including conferences, grower group meetings and field days.

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13 http://frontiersi.com.au/dea
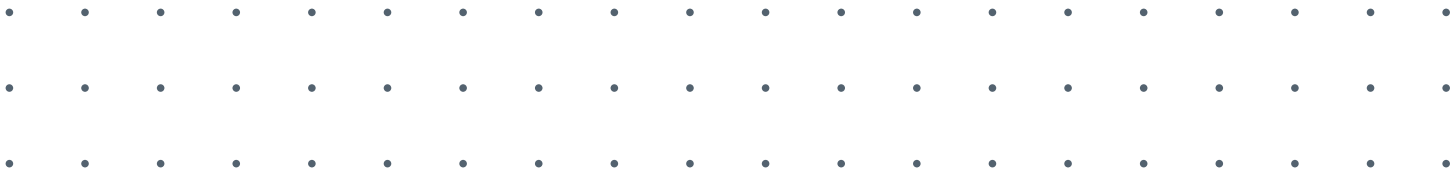
CALL TO ACTION

Australia is at a major acceleration point in the development and provisioning of fundamental, next generation Earth observation data, services and insights. Users are demanding precision data and services delivered in near-real time, customised to their needs at any location. If implemented properly, Earth observation technology can help support both the fully integrated supply chains so as to realise optimal value creation at the national level for systems managers and end users, and ultimately growth of the agriculture industry to AU$100 billion by 2030.

This report has set out some ideas to help accelerate the growth of Earth observation product use across this sector, but it will be technology organisations, research providers and government agencies across Australia who need to drive change.

If you, the reader, or your organisation would like to help drive this transformation, you are encouraged to:
- Get involved in the adoption of Earth observation products and services by contacting earth.observation@ga.gov.au
- Discuss the key elements of this report within your organisation to refocus your organisation's communication style to maximise access to potential users and customers
- Consult the supporting documentation for further information and visit the DEA Industry Strategy website: frontiersi.com.au/dea

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CONTACT

If you would like to know more about Digital Earth Australia please contact the authors of this report at FrontierSI via DEA@frontiersi.com.au or visit frontiersi.com.au/dea