COTTON AUSTRALIA

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

AUSTRALIAN COTTON SUSTAINABILITY UPDATE 2023

AUSTRALIAN COTTON SUSTAINABILITY FRAMEWORK

PLANET. PEOPLE. PADDOCK.

Photo: Ali Kuchel courtesy of Cotton Australia

IMPROVING AUSTRALIAN COTTON'S SUSTAINABILITY

Sustainability for the Australian cotton industry means running profitable and productive businesses in balance with natural and human resources. It also means being accountable to stakeholders for the industry's actions and impacts.

Since becoming the first Australian agricultural industry to independently assess its environmental impacts in 1991, the Australian cotton industry has been consistently working to improve its sustainability. The industry is proud of long trends of improvement in many areas and knows more can be done in others. Managing sustainability, like growing cotton, is a complex process. The Australian cotton industry doesn't pretend to be perfect, but it will continue to strive to be a global leader in sustainable cotton production.

ABOUT THIS UPDATE

Time frame: 12 months to 30 June 2023.

Boundary: Australian cotton farms.

Frequency: We have produced comprehensive sustainability reports every five years, from 2014. In farming systems, where seasonal variations can make a single year look much better or worse than average, a five-year period gives a better picture of change over time. Between five-year reports, these concise annual updates give a summary of actions, progress and trends. For each topic, 2022/23 annual change and the 5-year trend is shown by:

- Positive annual change or five-year trend, e.g. greenhouse gases reducing or yield increasing
- No significant change or generally flat trend
- Negative annual change or five-year trend, eg, injuries increasing.

Transparency: An online data pack has links to data sources, explanations of methodologies, and assumptions for all data in this update > MORE DETAIL: AUSTRALIAN COTTON SUSTAINABILITY DATA PACK.

Links to other online documents to give more detail to readers are provided throughout this update, wherever you see > MORE DETAIL.

New sections or restatement of previously reported data is clearly marked NEW in this update.

The Australian cotton industry acknowledges Australia's Indigenous people as the traditional custodians of our country, and recognises their continuing connection to lands, waters and culture. We pay our respect to Elders past, present and emerging, and extend that respect to all Indigenous people.

COVER IMAGE

Photo taken by Jasmin Morrison, courtesy of Cotton Australia.
"Standing amidst the cotton plants, I feel like an astronaut exploring a new world."

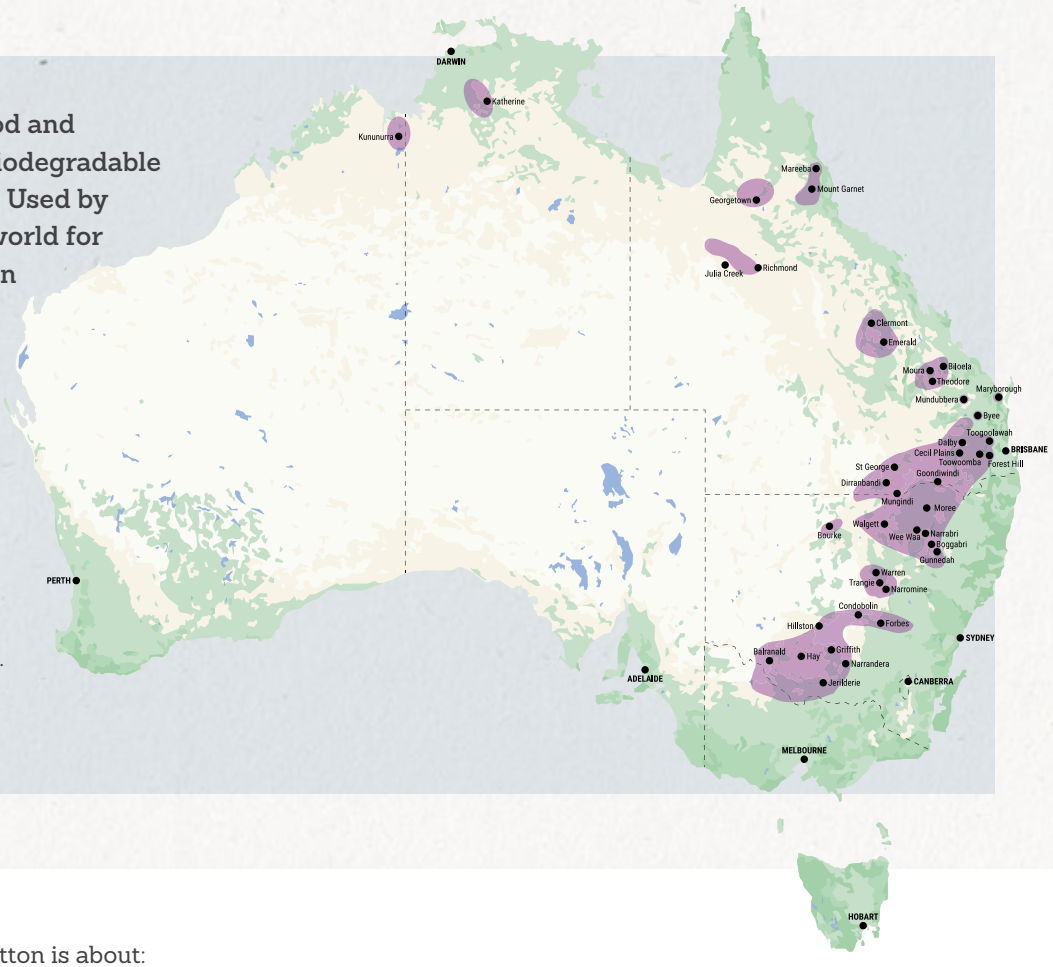
Many images in this Sustainability Update are from Cotton Australia's Click 24 Photography Competition, including this one of Jasmin's son Teddy, three, from Moree. > MORE DETAIL

ABOUT THE AUSTRALIAN COTTON INDUSTRY

Cotton is a renewable food and fibre that is recyclable, biodegradable and 100 per cent natural. Used by civilisations around the world for thousands of years, cotton grows on a leafy, green shrub in the same family as the hibiscus species of plants.

Cotton is grown mainly on family farms in inland eastern Australia.

After picking, cotton is sent to a gin where lint (fibre) is separated from seeds (food).



Map: CSD

Each kilogram of picked cotton is about:

40 per cent **lint**

Lint is spun into yarn to make a wide range of fabrics. Australia is the fourth largest exporter of cotton lint in the world. There are no spinning mills in Australia; all lint is exported.

Australian cotton **lint** has the key attributes of excellent length, strength and fineness, making it highly sought after by international markets.

50 per cent **seed**

Each kilogram of seed yields about 200 grams of cotton seed oil for cooking and food products. The remaining meal and hulls are used for stock feed.

Cotton seed **oil** has the key attribute of being cholesterol free.

Cotton seed **stock feed** has the key attributes of being high in fibre, protein and energy.

10 per cent **leaf**

Leaf and other organic plant matter is composted and added back into soil, under controlled and organised composting systems.

1 kg

OF AUSTRALIAN COTTON LINT CAN PRODUCE...

5.3
T-SHIRTS

19
PAIRS OF SOCKS

1.1
PAIRS OF JEANS

Cotton production matches annual water availability

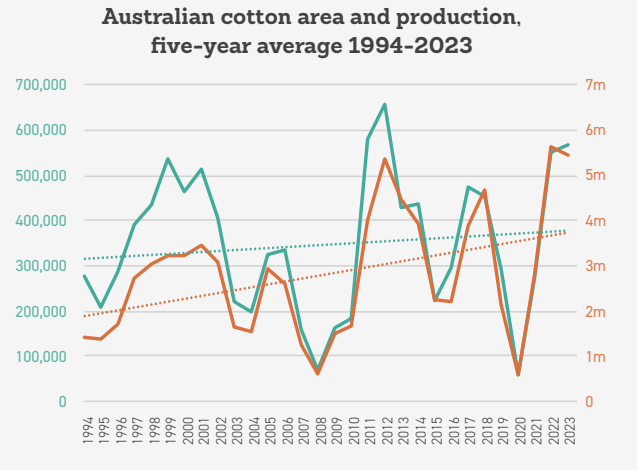
As cotton is an annual crop, growers adjust the area of cotton they plant each year to reflect changing seasonal conditions. As a result, the area of cotton planted and amount of cotton picked each year is closely tied to water availability, which varies dramatically.

2022/23 INSIGHTS: PRODUCTION

Continuing good seasonal conditions saw a large area planted and about 5.5 million bales picked. Australian cotton growers have dramatically improved their productivity over time. The trend lines in this graph show the five-year average area planted to cotton has increased by 19 per cent from 1994 to 2023, while output has increased 94 per cent.

Cotton has been grown in northern Australia in recent years. In 2022/23, 20,500ha was planted representing about four per cent of the national area sown, similar to the previous season. State and Territory regulations are in place to protect the unique environment in these areas. The cotton industry's objective is to comply with all relevant laws and respectfully cooperate with governments and communities in northern Australia to contribute to their stated sustainable development goals.

Photo: Melanie Jenson



Source: Cotton Australia

Cotton is an important part of rural economies

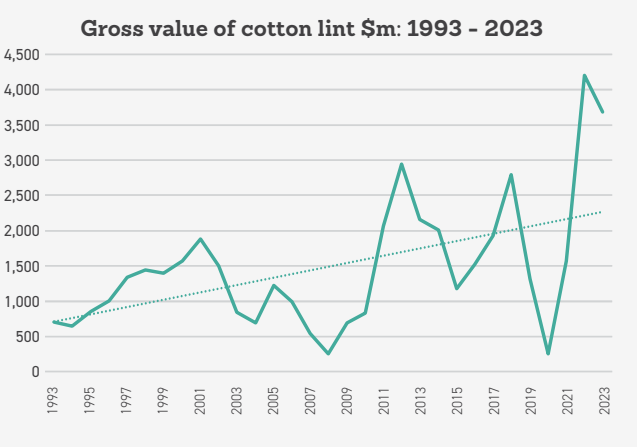
Income earned by cotton growers helps pay wages and taxes that support roads, schools and services right around Australia. Cotton growers support regional economies, in particular:

- About 80 per cent of cotton grower business expenses are spent locally
- The average Australian cotton farm has about six employees. In 2021/22 the Australian cotton industry was estimated to directly employ 7,222 people on farms and in gins; when flow-on effects are considered that figure grows to 21,896 people[1]
- Analysis of mixed farming operations shows irrigated cotton has a much higher return on assets managed than other crops, which provides greater whole-farm resilience and ability to manage through difficult seasons.

2022/23 INSIGHTS: ECONOMIC CONTRIBUTION

The 2022/23 Australian cotton crop's estimated gross value (delivered to gin) was $3.7 billion. While slightly lower in value than the record 2021/22 crop – due to less cotton produced and lower global cotton prices – this is still well above the average cotton crop value and a significant contributor to regional Australia.

Photo: Cotton Australia



Source: ABARES

[1] ACIL Allen research, 2024.

PLANET. PEOPLE. PADDOCK. AT A GLANCE

Australian cotton sustainability: snapshot and trends

PLANET. PEOPLE. PADDOCK. is the Australian cotton industry's framework to achieve its vision of being a global leader in sustainable cotton production. It guides work to:

- identify the environmental, social and economic topics assessed as being most important to industry and its stakeholders
- coordinate a whole-of-industry strategy to manage these topics
- engage with stakeholders on actions and progress.

PLANET. PEOPLE. PADDOCK. is not a compulsory standard or a brand. It is a framework that recognises sustainability is an integral part of doing business, and provides a path for the entire industry to benefit from improving sustainability performance.

> MORE DETAIL: FRAMEWORK OVERVIEW

Australian cotton and the SDGs

The UN Sustainable Development Goals (SDGs) provide a blueprint for humanity to achieve a just and sustainable world. To reach that future, everyone needs to play their part. Each targeted outcome is aligned to a relevant SDG: in this way, the Australian cotton industry aims to play its part to create a just and sustainable world.

> MORE DETAIL: AUSTRALIAN COTTON AND THE SUSTAINABLE DEVELOPMENT GOALS

		Targeted Outcomes	Five-year trend	2023	KEY 2023 TAKEOUT	SDG Alignment
PLANET	**Water**	Increase water use efficiency, within sustainable river & ground system limits	−	✕	About 50% less water is used to grow a bale of cotton compared to 1997 in most seasons. In very wet (like 2022) or dry seasons, that figure is closer to 40%.	6 CLEAN WATER AND SANITATION
	Greenhouse gas emissions	Contribute to the Paris Agreements' aim of a climate neutral world	No trend data		Previous year comparisons can't be made due to new input data used to more accurately estimate emissions. Defining a low emission path is a current priority.	13 CLIMATE ACTION
	Native vegetation	Native vegetation management on cotton farms contributes to regional priorities	−	−	An ambitious and collaborative project to better manage and measure native vegetation on cotton farms continued to progress.	15 LIFE ON LAND
	Pesticides	Support optimal crop production while having no negative impact on human & environmental health	+ Bees ✕ Algae	+ Bees ✕ Algae	The hazard to bees (from insecticides) and algae (from herbicides) has reduced by 91% and 60% respectively since 2004. Wet seasons have contributed to more herbicide use in recent years.	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
	Soil Health	Sustained cotton productivity growth by improving soil health	No trend data		Regenerative practices continue to be commonly used by growers. The cotton industry is collaborating with other sectors on a consistent way to measure soil health.	2 ZERO HUNGER
PEOPLE	**Workplace**	Keep farmers & core employees	No trend data		A new approach is being introduced to identify and measure the impact drivers of keeping and attracting people.	3 GOOD HEALTH AND WELL-BEING
		Attract casuals & contractors	No trend data			
		Keep everyone safe & skilled	Fatalities +	NA	Fatalities declined slightly but serious injuries increased. For the first time, research showed misinformation may be impacting grower wellbeing.	8 DECENT WORK AND ECONOMIC GROWTH
			Injuries ✕	NA		
			Skills +	NA		
PADDOCK	**Productivity**	Increase yield within sustainable environmental boundaries	− Irrigated + Dryland	+ Irrigated ✕ Dryland	The yield gap between irrigated & dryland cotton continued to grow. This shows the key role of sustainably withdrawn water to deliver sustainable intensification.	2 ZERO HUNGER
	Economic contribution	Resilient farms able to invest in their business & community	+	✕	Irrigated cotton is very important to whole farm profitability and resilience, which in turn gives more stability to regional communities.	8 DECENT WORK AND ECONOMIC GROWTH

Photo: Brodie Ryan Cronau courtesy of Cotton Australia

FOURTH INDEPENDENT ENVIRONMENTAL ASSESSMENT

The Australian cotton industry has commissioned an independent assessment of its environmental impacts every 10 years since 1991, the first major Australian agricultural industry to do so. These assessments are used to provide a third-party expert assessment of what the industry is doing well, and importantly, identify what can be done better.

The Fourth Independent Environmental Assessment was conducted from December 2021 to June 2022 by GHD. The assessment includes a combination of desktop research, interviews with industry stakeholders, and visits to farms of all sizes across the major growing regions.

FINDINGS

The Assessment found the Australian cotton industry had delivered fully on four of the six recommendations in the 2012 Third Independent Environmental Assessment and had made significant progress on the other two.

The assessment also provided 16 new recommendations which have been accepted by the cotton industry. More than half of the new recommendations are to continue work already underway during the assessment, while others are initiatives put forward to GHD by the cotton industry during the assessment as actions that were planned for future.

Summary findings of current industry performance include:

- The industry has made great strides in its **environmental management and reporting systems**. GHD found strong alignment and clear signs of collaboration across the respective industry organisations.
- A strong level of **on-farm environmental performance** was observed. Close to 90 per cent of environmental practices observed across all farms were ranked as 'excellent', 'very good' or 'good' across all growers, rising to over 95 per cent for growers who were *my*BMP certified.
- **Water use and management** has been an area of considerable industry research, development and extension investment which has resulted in demonstrable on-farm improvement over many years. GHD observed that water use was monitored thoroughly on farms visited for on-site assessments. Despite this, water remains a highly contentious issue among stakeholders.
- **Pest management** is another area where the cotton industry has made continual progress, with pesticide use reduced and a decrease in overall Environmental Toxic Load (ETL) - a result of the industry's significant investments in a multi-pronged approach to reduce pesticide use and resistance.
- **Storage and handling of agrichemicals and waste management** is an area where improvement is required. Practices were found to be poorer in regions where supporting waste infrastructure, such as drumMUSTER, is unavailable or not accessible or convenient.

> MORE DETAIL: FOURTH INDEPENDENT ENVIRONMENTAL ASSESSMENT AND INDUSTRY RESPONSE

REVAMPED SUSTAINABILITY DATA FRAMEWORK

The global sustainability reporting environment has multiple competing standards and methods. To bring more clarity to its reporting, the Australian cotton industry is revamping its PLANET. PEOPLE. PADDOCK. sustainability data framework to more closely align with the methods we believe customers of Australian food and fibre are most likely to use in future.

Data in our new sustainability data framework is now structured into the condition, dependency, impact, and risk and opportunity indicators contained in new reporting guidance or standards like the International Sustainability Standards Board, Taskforce on Nature Related Financial Disclosures, and Science Based Targets for Nature. The table explains these concepts.

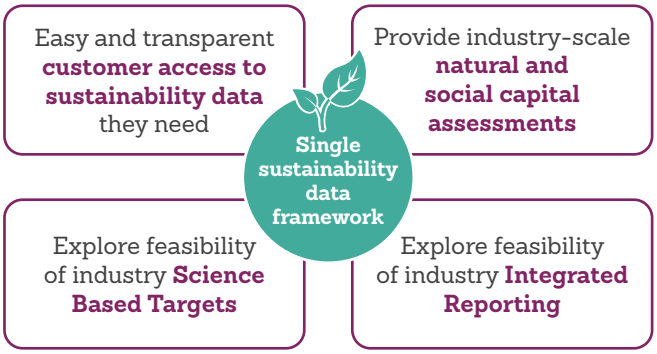
	Summary explanation:	Summary example - soil:
Condition	The quality of an asset.	Soil organic carbon, salinity, acidity.
Dependency	The functions provided by that asset we rely on.	Growing cotton, water infiltration, nutrient cycling.
Impact	Farmer, social or environmental impacts on the asset.	Practices or events that impact soil health.
Risk	Short (< two years), medium (two-five years), long (> five years). Risks may be physical, financial etc. Opportunities may be efficiency, markets etc,	Flooding, reduced yield, reputation.
Opportunity		Climate resilience, reduced input costs.

This is an ambitious project. These reporting standards are complicated, and organisations around the world are grappling with how to efficiently deploy them.

The Australian cotton industry's approach is for customers and other stakeholders to get the data they need from industry, instead of thousands of customers sourcing the same data from hundreds of thousands of farms.

Phase 1 will start with industry average data we use now in sustainability reporting; Phase 2 will provide data from every field that grows cotton, which stakeholders can pay farmers for as the data quality moves from coarse 'information grade' to fine 'investment grade'.

The intended outcome of this work is a single sustainability data framework that can be used for multiple tasks including those pictured.



This project is a proof-of-concept for other Australian agricultural sustainability frameworks and agribusinesses, so sectors can avoid duplication and inconsistency. We are regularly sharing outputs so others can learn from and contribute to our work.

> MORE DETAIL: REVAMPED AUSTRALIAN COTTON SUSTAINABILITY DATA FRAMEWORK

Because this project is a work in progress, stakeholders will see changes to our reporting introduced over the next couple of years, as we understand how best to report to these new approaches and seek feedback from stakeholders on what we are doing.

New additions to this sustainability update	Intended additions in future sustainability updates
Impacts and dependencies described. Some impacts and dependencies measured.	More impacts and dependencies measured. Valuation of priority impacts and dependencies, using the Natural and Social Capital Protocols.
Short - (< two years), medium - (two to five years) and long-term (> five years) risks and opportunities described, and the industry's strategic priorities to manage them.	The effects of risks and opportunities quantified where possible.
Targeted outcomes remain aligned to Sustainable Development Goal targets.	Evidence-based targets set. Industry will consult with stakeholders on measurable, actionable targets informed by science that aligns the Australian cotton industry with earth's limits and societal sustainability goals.[2]

[2] This is based on the Science Based Targets Network definition of science-based targets.

Photo: Ali Kuchel courtesy of Cotton Australia

WATER

CONTEXT

The cotton industry's approach to water use directly aligns to the SDG target of ensuring sustainable withdrawals of freshwater and substantially increasing water use efficiency:

- **Sustainable withdrawals:** In Australia, water is regulated to achieve sustainable withdrawals of freshwater. Governments set sustainable water use limits, where basic environment and human needs must be met before any water is allocated for irrigation. Each year, farmers choose what crop is best to grow with the water available to them.
- **Substantially increase water use efficiency:** From 1997 to 2022, the volume of water used to grow a bale of cotton reduced by up to 50 per cent. Water use efficiency improved significantly in the decade since 1997, but the rate of reduction has lowered since 2007: efficiency gains become harder to achieve over time.

Dependencies

Water availability. All cotton is grown with water stored in the soil and rainfall. Irrigated cotton also uses water from rivers, dams, and aquifers, if farmers determine cotton is the best use of the water they have been allocated. Farmers can't control rainfall or allocations of water made to them by governments; their focus is to reduce water lost through evaporation in soil and storages and to use water more precisely to meet crop needs. The cotton industry supports growers by investing in new plant varieties and research into farm practices that can improve efficiencies and increase yield.

Impact drivers

Freshwater use. Irrigated water use is regulated by governments. The amount of water available to grow crops is determined by governments based on seasonal conditions; farmers then choose what crop to grow with their available water.

Climate change. Climate change appears to be creating more extreme and unpredictable seasons. More frequent water use benchmarking in recent years is showing water use efficiency declines in both very wet and very dry seasons.

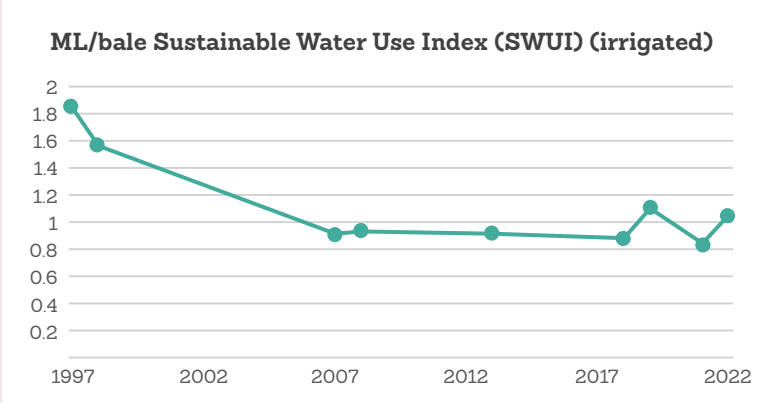
2022/23 INSIGHTS

2021/22 — Five-year trend

The time needed to assess the detailed calculations behind water use efficiency means there is a one-year lag in reporting. Data here refers to the 2021/22 season.

The NSW Department of Primary Industries has been supported by CRDC to benchmark cotton water use for many years. Since 2018, this research has been annual, and this has provided greater understanding of how climate extremes affect water use efficiency.

Very dry (like 2019) and very wet (like 2022) seasons take more water to grow a crop than seasons without climatic extremes. Drought years reduce yields due to increased plant stress and have higher temperatures with more evaporation. Wet years impact water productivity in different ways: there may be more rainfall than the crop can use, floods can destroy a crop or result in the need to replant, and heavy rainfall at the wrong time can negatively impact yield. In seasons that don't experience climatic extremes, it takes about 50 per cent less water to grow a bale of cotton compared to 1997. In climatic extreme seasons, that figure is closer to 40 per cent.



Source: NSW DPI research. SWUI measures all water available to the crop, including soil moisture, water from rivers and bores, rain directly falling on the crop and runoff rainfall harvested, and all water lost through evaporation and seepage during storage. It is the inverse of what is known as the gross production water use index (GPWUI) productivity index.

Photo: Joe Briggs courtesy of Cotton Australia

Compliance

We expect every cotton grower to comply with all environmental legislation. For added transparency, we report the number of farmers in the NSW Natural Resources Access Regulator public register of water use non-compliance who we know grow cotton (although water may have been extracted by these individuals for crops other than cotton). For context, there are about 900 cotton growers in NSW.

Source: NSW Natural Resources Access Regulator public register (date of breach).
No similar data available for water enforcement actions from other states and territories.

Water use non-compliance (NSW): prosecutions or enforceable undertakings

	All NSW	Cotton
2017/18	4	2
2018/19	2	-
2019/20	2	-
2020/21	2	1
2021/22	1	1
2022/23	-	-

OUTLOOK

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Water availability	Short < 2 years	An unexpected increase in rainfall during 2023/24 may benefit crops in 2023/24 and 2024/25 with increased soil moisture (to benefit all crops) and blue water availability (blue water is water within rivers and dams to benefit irrigated crops).	• Continue to support efficient and responsible cotton production.
	Medium 2-5 years	Negative perceptions of water use may impact government or customer decisions, despite the cotton industry being directly aligned to the SDG target of significantly increasing water use efficiency within sustainable withdrawal limits.	• Investigate alignment to Science Based Targets for water quantity, which seek to limit water withdrawals to allow river environmental requirements to be met (which is the approach Australia's highly regulated system has used for many years).
	Long > 5 years	Climate change may further increase temperatures and reduce rainfall. This would reduce inflows to rivers and increase plant stress.	• Implement CRDC 2023-28 Strategic Plan (natural capital) actions to strengthen capacity for adaptation to climate change and make farms more resilient to shocks.

PLANET GREENHOUSE GAS EMISSIONS

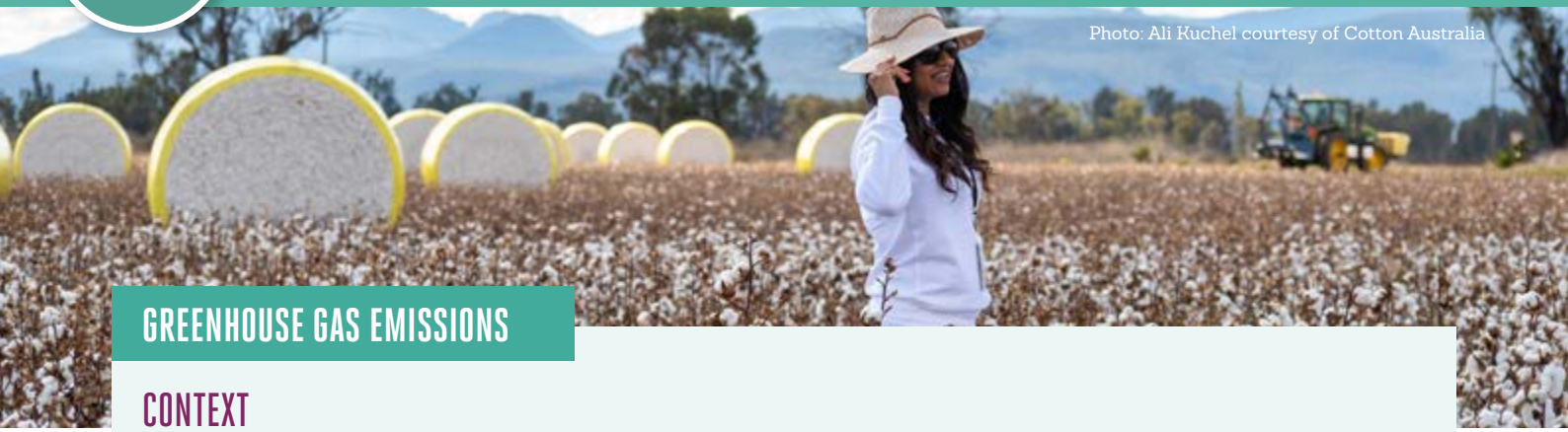


Photo: Ali Kuchel courtesy of Cotton Australia

GREENHOUSE GAS EMISSIONS

CONTEXT

Growing, ginning and transporting cotton to port is estimated to account for about 0.2 per cent of Australia's greenhouse gas emissions (GHGs). The cotton industry is investing in research, development and extension to accurately measure and further reduce GHG emissions. This investment is important to minimise environmental impacts, improve productivity under a changed climate, and ensure growers are well placed to access markets.

Dependencies

Climatic conditions for growing cotton. Ideal conditions for cotton are sunny warm days with maximum temperatures between 27–32°C and overnight minimums of 16–20°C. Temperatures below 11°C or above 36°C will result in a shock to the plant that temporarily arrests development. Extended periods of cloudy weather, too much or too little water, and excessively hot weather can all impact yields.

Impact drivers

GHG emissions. Nitrogen (N) is essential for plant growth, but N fertiliser also accounts for about 60 per cent of irrigated cotton GHG (both on-farm and pre-farm in the manufacture and transport and use of fertiliser). Diesel fuel for machinery and irrigation pumps contributes about 30 per cent of cotton GHGs.

GHG removals. The industry is encouraging farmers to increase and/or maintain woody vegetation to sequester atmospheric carbon. Soil carbon receives a lot of attention, but in Australian cropping systems, permanently storing carbon in soil is very difficult and uncertain.

2022/23 INSIGHTS

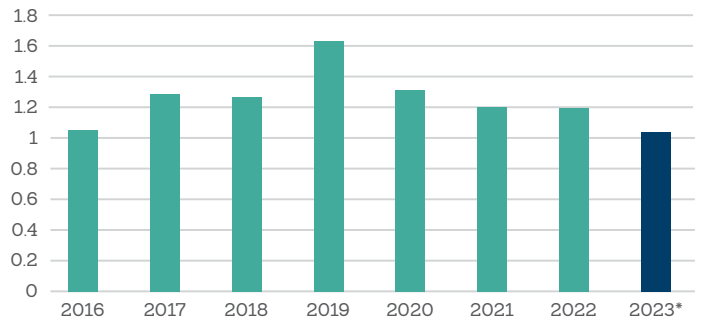
N/A 2022/23 N/A Five-year trend

Average N usage is estimated from CRDC's annual grower surveys. In 2023, the question on N application changed to more accurately assess rates. The change in method makes comparison with previous years difficult: the 2023 decreased N rates per hectare may be due to more accurate estimation, or may be because N did decrease due to high costs. The new method will be used in future years.

The industry's focus for GHG intensity reporting is irrigated cotton. Dryland cotton provides about 10 per cent of total cotton on average, but this yield is highly variable depending largely on rainfall. This means the GHG intensity of rain-fed cotton can be less influenced by grower decisions than irrigated cotton.

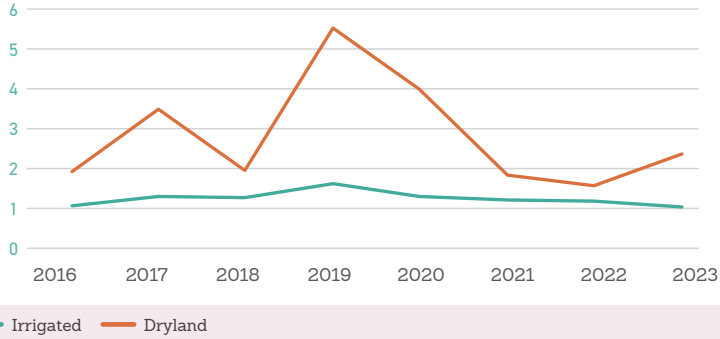
The comparison graph here shows dryland cotton has a larger carbon intensity than irrigated cotton, especially in dry seasons.

Australian irrigated cotton GHG emissions, kg CO2-e / kg lint



Source: Ekonomou A., Eckard R.J. (2024), University of Melbourne C-GAF based on the Australian National Greenhouse Gas Inventory methodology. *Change in N survey question from previous years.

Australian irrigated and dryland cotton farm GHG emissions, kg CO2-e / kg lint



2022/23 INSIGHTS CONT.

Restated data

Emissions are calculated using the University of Melbourne's carbon calculator for the Australian cotton industry, C-GAF. C-GAF is regularly updated to seek more detail in data inputs and as emission factors (the default formula for converting, for example, kilograms of N fertiliser into the volume of GHG emissions it releases) are refined. All previous reported emissions have been recalculated using C-GAF version 1.36, released in 2024, along with refined input data to match its new data requirements.

This table shows emissions in previous years have been over-reported or under-reported.

CO2-e / kg irrigated lint: restated data	2016	2017	2018	2019	2020	2021	2022
Previously reported:	1.2	1.4	1.3	1.6	1.3	1.1	1.4
2023 reported:	1.1	1.3	1.3	1.6	1.3	1.2	1.2
Change 2023 to previous:	-13%	-7%	-5%	+3%	+5%	+6%	-13%

OUTLOOK

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Climate conditions for growing cotton	Short < 2 years	An unexpected increase in rainfall during 2023/24 may benefit crops in 2023/24 and 2024/25 by increasing water stored in soil and in water systems.	• Continue to support efficient and responsible cotton production.
	Medium 2-5 years	Drought or other climatic extremes.	• Assess amount and area of cotton production susceptible to climate change risk • Continue to invest in water use efficiency, soil health practices, and plant breeding to mitigate climate change impacts • Achieve the CRDC 2023-28 Strategic Plan target of demonstrating that by 2028 the cotton industry meets market and community expectations for carbon.
	Long > 5 years	Climate change may further increase extremes in temperature and rainfall. This may reduce inflows to rivers and increase plant stress and pose economic risk (potentially lower planting and yield) ... or create opportunity (potentially increased water storages from floods).	

Pathways for reducing cotton GHG emissions.

Agriculture always has and always will produce GHG emissions. Farming GHGs come from natural processes like livestock rumination, decomposing organic matter, and microbial activity in the soil. GHGs also come from the use of fossil fuels, for example in the energy-intensive manufacture of synthetic fertiliser and diesel for running farm machinery.

There are pathways to reduce GHGs from some sources. The main options available to cotton and other cropping industries to reduce net GHG emissions are:

- Optimisation: increase efficiency of nitrogen (N) fertiliser and other inputs and/or increased yield
- Green fertiliser: make ammonia from hydrogen sourced from renewable energy, rather than fossil fuels. Industrial scale production is possible within a decade and small-scale ammonia production is being developed using surplus solar energy. This will significantly reduce cotton production's scope 3 emissions from fertiliser manufacturing
- Nitrification inhibitors: coat N fertilisers with an inhibitor that reduces GHG emissions from soils associated with their use. This product costs more but does not increase yield; discussions are underway nationally to find a way to reduce the cost for farmers
- Green energy: use more on-farm renewable energy including solar, hydrogen, and bioenergy
- Afforestation: store more carbon in woody vegetation.

PLANET NATIVE VEGETATION

Photo: Ali Kuchel courtesy of Cotton Australia

NATIVE VEGETATION

CONTEXT

On average, about 21 per cent of the area of a cotton farm has remnant native vegetation. The majority of this is grazing land, and some is actively managed for conservation: it is not cropped or normally grazed. This area of native vegetation actively managed for conservation is the current focus of the cotton sustainability framework; remnant vegetation on grazing land is captured by the sheep and beef sustainability frameworks.

Dependencies

Habitat provision. Native vegetation is home to beneficial birds, bats and insects that prey on insect pests in nearby fields.

Carbon sequestration. Woody vegetation on cotton farms, particularly riparian species such as river red gums, sequester and store large amounts of carbon, which offsets agricultural emissions.

Other services provided by native vegetation include regulating water quality, mitigating erosion and cultural services such as visual amenity.

Impact drivers

Land use. Cotton, like almost all plant-based agriculture, requires the removal of existing vegetation to create fields. The impact of this can be reduced by retaining or restoring buffer zones to waterways, corridors for wildlife, and high value ecosystems.

Invasive alien species. Native vegetation requires ongoing maintenance to reduce the impact of weed and animal pests, such as feral pigs.

2022/23 INSIGHTS

2022/23 — Five-year trend

CRDC's cotton grower surveys have reported the mean proportion of a cotton farm's area managed for conservation as three to four per cent for several years. As reported last year, the 2022 grower figure of eight per cent appears to have been an anomaly.

	2020	2021	2022	2023
Mean per cent farm managed for conservation	4%	3%	8%	4%
Average width (m) of riparian area	138	178	186	166

Source: CRDC Cotton Grower Survey.

Cotton industry collaboration: on-farm native vegetation

Managing and reporting the impact of farming on native vegetation has many challenges: improving native vegetation is slow, and can be hindered by drought, floods, or the cost of maintenance or restoration; and native vegetation is best managed on a coordinated regional scale, not on an ad-hoc farm-by-farm basis. There is an amount of confusion about biodiversity and natural capital, particularly around exactly what farmers should do and who they should trust, and native vegetation quality is measured differently by different organisations and jurisdictions.

Despite these challenges, the Australian cotton industry has recognised the increasing market access risks and opportunities around native vegetation on farms, and has collaborated since 2021 with Natural Resource Management (NRM) Regions Australia and the seven NRM regions where cotton is traditionally grown to develop an ambitious model that involves:

- A better coordinated effort to support farmers to preserve or enhance native vegetation.
- Bringing all the advice, financial and other support into regional hubs to make it easier for individual farmers wanting to preserve or increase native vegetation to take action and receive trusted advice from a single source.
- Cost-effective but robust data collection to measure area and connectivity of woody vegetation, using consistent indicators aligned to global sustainability reporting guidance and a method developed by one of the NRM organisations.

We consulted with cotton growers and other stakeholders on this model in 2023 and aim to identify pragmatic on-farm actions in order to finalise and release this work in 2024. Grower consultation has shown cautious support for this model, but also highlighted a strong view that while native vegetation provides some ecosystem services for individual farmers, it also provides public good to society. If society is serious about preserving and enhancing biodiversity, there is an urgent need for farmers, governments and customers to collaborate on new whole-of-society funding models to equitably fund the public good component.

This is ground-breaking work: it's new, it's complex and there are many barriers to success. The Australian cotton industry will not tell growers what to do with their land, but through this project it aims to bring farmers and independent evidence-based environmental groups closer together to collaborate on solutions that benefit the environment, agriculture and society.

OUTLOOK

Impact	Timeframe	Risks & opportunities	Strategic priorities
Land use change	Short < 2 years	Loss of customers or markets if emerging biodiversity goals and frameworks can't be met: • Most sustainability frameworks used by customers are now seeking deforestation-free commitments from 2020 • The Global Biodiversity Framework's first target is to bring the loss of areas of high biodiversity importance close to zero by 2030.	• Finalise the model the cotton industry has been working on since 2021 to support regionally-coordinated management of on-farm native vegetation • Challenge the view that a single goal should apply everywhere for something as diverse as biodiversity. A deforestation commitment is appropriate for many areas of the world, but in the Northern Territory (NT) for example, where there is 99.5 per cent native vegetation in place, a blanket zero deforestation target appears to be inequitable. Cotton Australia's view, as the representative organisation for the industry, is areas like the NT should be recognised as a model for how to deliver sustainable development with strict regulations.
		Reputational damage from illegal land clearing.	• Continue to set an expectation that all cotton growers comply with all environmental laws.
	Medium 2-5 years	Increased financial payments for biodiversity.	• Collaborate with growers, governments, customers and other stakeholders to develop a robust and trusted model for keeping or restoring native vegetation • Finalise a project to assess the value of natural capital, to help inform farm management decisions.
	Long > 5 years	Reputational damage and loss of customers from perceptions of native vegetation management.	• Implement CRDC 2023-28 Strategic Plan (natural capital) actions that help maintain biodiverse ecosystems • Achieve the CRDC 2023-28 Strategic Plan target of demonstrating cotton farms have maintained and enhanced natural capital and are more resilient to shocks by 2028.

Photo: Ali Kuchel courtesy of Cotton Australia

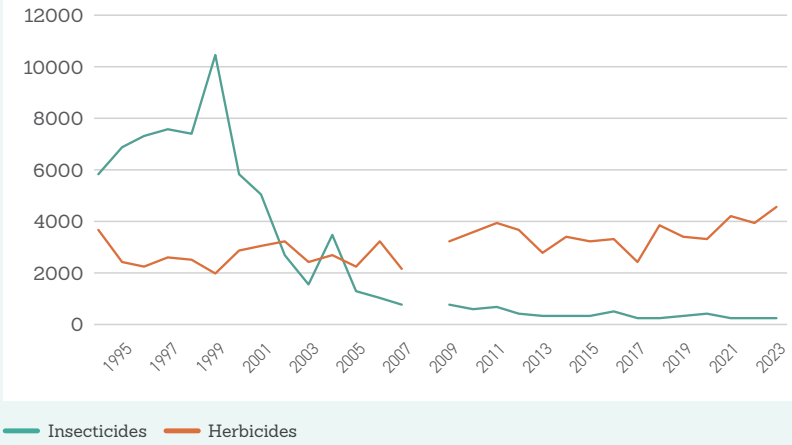
PESTICIDES

CONTEXT

Pesticides (including insecticides and herbicides) are part of a cotton grower's pest control toolbox called Integrated Pest Management (IPM). IPM is a management approach enabling growers to choose the tool that best controls pests with the least risk to human and environmental health. All pesticides in Australia are approved by the government regulator: if a grower chooses a pesticide to control a specific pest, it has been assessed as safe to use as directed by the label.

Pesticide use has changed over time: the five-year average insecticide volume reduced by 97 per cent per hectare between 1998 and 2023 as genetically modified cotton and IPM was introduced.

Average pesticide use grams active ingredient per hectare



In the same period, a move to rely less on tilling the soil to control weeds increased herbicide use by 44 per cent.

However, volume does not paint a full picture of potential impact as it doesn't take into account the differing toxicity of pesticides; Environmental Toxic Load (ETL) is a measure of hazard that does this.

Dependencies

Access to the full range of cultural, mechanical, biological, chemical, genetic and technological crop protection tools needed to support best practice pest, weed and disease control. Pesticides are just one tool used to control pests, as seen in the impact drivers. While reducing pesticide use requires growers to use a range of controls to minimise risk to human and environmental health, it also requires them to have access to all those controls. For example, some pest control tools are not commercially available in Australia.

Impact drivers

Pollution. Farm pesticides have been assessed by the scientific government regulator as having a safe level of impact on human and environmental health, when used as directed by the label.

Use of IPM strategies. IPM strategies include providing habitat for natural predators, crop rotations, GM crops, novel pest controls, tillage, and when appropriate, pesticides.

2022/23 INSIGHTS

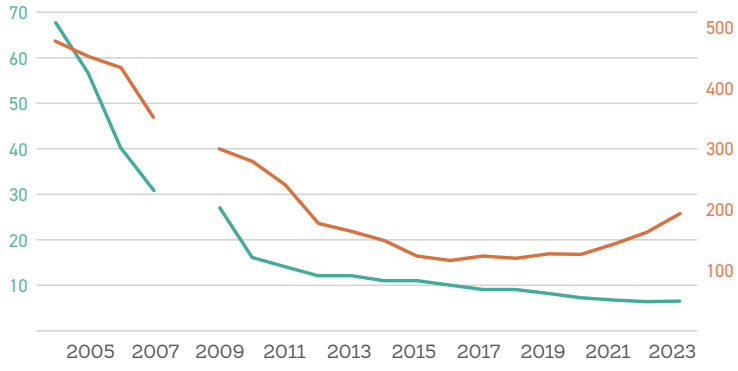
Bees: 2022/23 Five-year trend

Algae: 2022/23 Five-year trend

The five-year average ETL for bees (an insecticide indicator species) and ETL for algae (a herbicide indicator species) has reduced by 91 per cent and 60 per cent respectively over the 19 years from 2004 to 2023. This suggests the pesticide hazard has significantly reduced.

From 2021 to 2022 the five-year average ETL for bees decreased 6 per cent, and the five-year average ETL for algae increased 14 per cent. The increase in algae continues a trend in recent years where higher weed pressure is resulting from above average rainfall. Increased use of residual herbicides – which have a higher toxicity than knockdown herbicides – as part of the industry's coordinated resistance management strategy also contributed to the increase.

Environmental toxic load: five-year rolling average



Source: CRDC commissioned research. No data was collected in 2008 due to drought. Note previous reports have incorrectly plotted 2009 5-year average bee ETL at 27, not 17. That has been corrected here.

The expected increase in algae ETL was flagged last year due to the ongoing impact of wetter than normal seasons in recent years increasing weed pressure. Importantly though, while the hazard has increased, the actual risk to the environment remains low when pesticides are used as directed by the label.

> MORE DETAIL: ENVIRONMENTAL TOXIC LOAD ANIMATED EXPLAINER

OUTLOOK

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Access to full range of controls	Short < 2 years	Negative societal perceptions on the impact of pesticides on waterways.	• Advocate for governments to set consistent guidelines in line with science based targets for water quality, and appropriately monitor pesticides in waterways.
		Negative local community perceptions on the spray drift impact of pesticides.	• Continue CRDC's five-year $5.5 million partnership with the Grains Research and Development Corporation to help minimise spray drift.
	Medium 2-5 years	Adoption of: • Alternative control methods such as biologicals, natural controls, biotechnology, and potentially cover crops • Technology to reduce pesticide inputs, such as robots, and optical sprayers.	• Continue to invest in IPM and novel controls • Continue to advocate to corporations and governments for access to all pest control technologies.
		New diseases and changing spectrum of pests / diseases due to climate change and natural movement of pests.	
	Long > 5 years	Loss of key chemistry due to community/global pressure.	While the Australian regulatory system ensures safe use of pesticides, global pressures mean it is likely some pesticides will not be accepted by customers in future. The cotton industry is preparing for a pesticide limited future by: • Identifying alternatives to pesticides likely to be at risk • Where no alternatives exist, or when the alternative has higher impacts, articulating to customers and sustainability frameworks the steps in place to safely use pesticides in Australia, until an alternative can be found.

SOIL HEALTH

CONTEXT

Healthy soil is a living, dynamic environment, full of microbial and macroinvertebrate life that help to recycle essential plant nutrients, improve soil structure, and control plant disease and pests. Because healthy soil is alive, the Australian cotton industry has been encouraging cotton growers to follow principles essential for a living system: provide food and shelter to the organisms within soil.

Photo: Melanie Jenson courtesy of CRDC

Food is provided through practices including crop rotations, cover cropping, and applying organic fertilisers and nutrients. Practices that provide shelter include minimum tillage, conserving crop stubble, and use of integrated pest, weed and disease management to minimise chemical impacts. These best management practices have increasingly been referred to as 'regenerative', but Australian cotton growers have been using them for many years to protect their ancient soils.

Dependencies

Soil functions that support the production of cotton. Water infiltration, water holding capacity, nutrient cycling capacity, resilience to weather extremes, and pest and disease suppression are just some of the functions farmers rely on to grow crops.

Soil properties that support the production of cotton. These include soil organic carbon, salinity, acidity, sodicity, and soil structure.

Impact drivers

Practices chosen by farmers to manage their land, and which impact soil functions and properties.

Healthy soil practices should aim to give soil:

- Food (for example through the use of diverse rotations and cover crops)
- Shelter (for example by maintaining ground cover, reducing erosion, and minimising disturbance by pesticides and machinery).

> MORE DETAIL: AUSTRALIAN COTTON SOIL HEALTH FRAMEWORK

2022/23 INSIGHTS

Waiting for nationally consistent soil indicators to be developed before baselines and a target can be set.

Soil's complexity and regional differences make it difficult to measure at industry scale. A National Soil Strategy was released in 2021 and will deliver nationally consistent key performance indicators and methods to measure and report soil conditions. The cotton industry supports this strategy.

Until those agreed measures are in place, the industry is encouraging greater adoption of practices to provide food and shelter to soil organisms. CRDC grower surveys in recent years indicate high levels of common soil health practices.

A current research project is investigating cover cropping across different regions. Cover crops can provide many benefits, including retaining soil moisture, reducing weed pressure, and increasing nitrogen.

	2020	2022	2023
% of growers who conserve crop residues	98	98	-
% growers using minimum tillage	92	86	-
% of growers using cover cropping	56	46	54
% of growers using rotation systems including legumes	-	81	-

Source: CRDC grower survey.
NB "% of growers using cover cropping" was incorrectly reported as 56% in the 2022 Sustainability Update. The correct figure is 46%.

They can also provide challenges, including providing habitat for insect pests and using soil moisture in dry periods. The research is looking to measure the positive and negative impacts of different cover crop strategies in different regions, to support their wider adoption.

The Australian cotton industry continues to work closely with the Australian Department of Agriculture, Fisheries and Forestry's National Soil Strategy team to contribute to a pragmatic set of national soil indicators that will underpin better farm management decisions.

OUTLOOK

Impact	Timeframe	Risks & opportunities	Strategic priorities
Soil management practices	Short < 2 years	Adoption of new practices to improve soil health, that will also increase yield.	• Implement CRDC's 2023-28 Strategic Plan (natural capital) actions to progressively improve soil health.
	Medium 2-5 years	Cost of adopting new soil health management practices.	• Cost is largely outside the control of the cotton industry – individual growers will make commercial decisions.
		Accumulating benefits of improved soil health, including potentially reduced input costs, increased customer and community reputation, and increased productivity.	• Support work to develop nationally consistent soil health indicators. • Implement natural capital practices that progressively improve land and soil quality.
		Soil degradation, erosion and loss of fertility.	• Attempt to quantify the impact and trade-offs of different practices in different regions and different farming systems on soil properties and functions.
	Long > 5 years	As for medium term risks and opportunities.	• Achieve the CRDC 2023-28 Strategic Plan target of demonstrating cotton farms have maintained and enhanced natural capital and are more resilient to shocks by 2028.

Creating a common definition for 'regenerative agriculture'.

Regenerative agriculture is an increasingly common term, but there is no agreed definition of what 'regenerative agriculture' is. The rapid increase in regenerative agriculture marketing is adding to confusion for farmers and consumers, and a proliferation in regenerative agriculture programs by multiple individual agrifood companies is seeing farmers asked to provide their farm data – often for no financial reward.

In light of all this, the cotton industry is exploring a definition of 'regenerative agriculture' which is applicable for all Australian agriculture sectors and value chains. The aim of this work is to avoid confusion, and to retain as much value as possible for demonstrating 'regenerative' practices within the industry to reward growers for these practices.

Regenerative agriculture is often thought of as improving soil health. In reality, it is much more than that. A literature review and a 2015 study of regenerative agriculture by O'Donoghue et al from the University of Sydney has generated this definition:

Regenerative agriculture is any farming system that increases product quality and yield reliability, and the natural and human resources agriculture depends on, relevant to the natural complexity and variability of each farm.

CHAP. XVII.

Of Differences *between the* Old *and the* New Husbandry.

IN order to make a Comparison between the Hoeing-Husbandry, and the old Way, there are Four Things, whereof the Differences ought to be very well considered.

I. *The Expence*
II. *The Goodness*
III. *The Certainty*
} of a Crop.
IV. *The Condition in which the Land is left after a Crop.*

This definition has a direct line to the 1730 thoughts of Jethro Tull, who urged his peers to consider more than just yield. Anchoring our definition to this 294-year-old thinking emphasises there is no need to reinvent any more wheels. All that matters are outcomes that increase product quality and yield reliability, and natural and human resources, relevant to each farm.

This approach is directly aligned to the cotton industry's work to revamp its sustainability data framework to measure, value and track stocks of natural and human capital, impacts and dependencies – the expense, goodness and certainty of a crop, and the condition in which land and society is left after a crop. This provides yet another use of the single data framework we are developing: to measure the environmental and socio-economic outcomes of 'regenerative' practices.

Image source:: Tull, J. (1751). Horse-hoeing Husbandry; Or, an Essay on the Principles of Vegetation and Tillage: Designed to Introduce a New Method of Culture, Whereby the Produce of Land Will be Increased, and the Usual Expence Lessened : Together with Accurate Descriptions and Cuts of the Instruments Employed in it. United Kingdom: A. Millar. p254.

WORKPLACE

CONTEXT

People are central to our success. The extent of our human, social and intellectual capital determines how well our financial and natural capital is converted into cotton lint and seed.

NEW: Change of topic name. PLANET. PEOPLE. PADDOCK. previously had two 'social' topics: Workplace and Wellbeing. These have been merged into a single 'Workplace' topic to more accurately reflect how closely integrated the wellbeing of cotton people and communities are to a sustainable cotton industry. 'Workplace' brings together commonly accepted human rights and social sustainability areas of health, safety and wellbeing; training and education; diversity; and labor conditions including fair pay, non-discrimination, child labour, and avoiding the exploitation of vulnerable workers. This change of topic has also been made because our revamped sustainability data framework, combined with industry workforce and wellbeing research in recent years, has made our workplace impacts and dependencies clearer. Social sustainability is often regarded as important but vague; our revamped sustainability framework has sharpened our thinking on the 'so what' of social sustainability in the Australian cotton industry.

Dependencies

Keeping cotton growers and core employees. Farmers and farm managers, and the core skilled employees who farmers value and work hard to keep in the business. A profitable cotton business helps farmers keep core employees year-round.

Attracting casual and contract employees. Growing cotton involves seasonal peaks, especially around harvesting. These peaks are filled by a mixture of contractor (skilled people often with their own equipment and who generally live in regional Australia) and casual labour (often backpackers, students and other people from urban centres or overseas).

Keeping everyone safe and appropriately skilled. Making farm workplaces safer, largely by eliminating unnecessary risks and risk-taking, remains a priority. Ensuring farms have the skills needed to adapt to a changing climate and take advantage of new technologies will be important to maintain our human capital resources.

Impact drivers

Availability of water; management style; investment in automation and technology; workplace culture; connection to community. Workplace and wellbeing research has shown these factors are more important for keeping core people than the number of hours worked.

Human rights and environmental responsibility. These drivers are especially important for casual (eg backpacker or seasonal) employees. Evidence of having safe, inclusive workplaces will make cotton farms more appealing; environmental responsibility is a key driver of broader community trust.

Training and culture. The cotton industry invests in skills and safety training; to further reduce rates of injury and to give our people the future-proof skills they need, more may need to be invested in behavioural science and norms. The industry is increasingly seeking to collaborate with other agricultural industries in managing and measuring training.

2022/23 INSIGHTS

Keeping growers and core employees.

Accurate workforce data is hard to source and is the subject of current cross-sector project proposals the cotton industry is actively contributing to. In the meantime, our revamped data framework gives us a new way to think about the drivers of keeping core employees. We are reporting data we have available on the impact drivers, are working to close data gaps, and will continue to review this in future to test if these drivers do indeed avoid burnout of farmers and permanent employees.

As noted in the impact drivers, availability of water is important to reduce farmer stress. Water availability has been supported by very good rainfall seasons in recent years.

Connection to community	2018	2020	2021
Community involvement (mean 1-7)	4.4	5.3	**4.1**
Volunteering (mean 1-7)	4.4	5.6	**4.4**

Source: Regional Wellbeing Survey, University of Canberra.

Management style, investment to technology; culture
No data available

In future reports, we aim to include the proportion of water allocated to irrigators compared to their annual entitlement, to give more context on water availability and volatility.

The Regional Wellbeing Survey shows cotton growers have much higher-than-average community involvement: cotton growers were much more likely than any other group to regularly volunteer and to attend meetings or events held by local groups in both 2020 and 2021.

Photo: Cotton Australia

Keeping everyone safe and appropriately skilled.

The University of Sydney has updated its five-yearly report into Australian cotton farm's health and safety data, previous conducted in 2019.

This report showed a small decline in the number of fatalities, but a gradual increase in the number of serious injuries since 2012. Further work to address machinery related fatalities and injuries, plus serious injuries from falls on the same level and muscular stress, are identified as priorities for action.

Reporting period:	2009-13	2014-18	2019-23
Total fatalities	5	8	<5
Mean annual serious injuries	35	43	47

Source: University of Sydney research commissioned by CRDC.
Note: ethical considerations prevent stipulating fewer than five fatalities. 'Serious injuries' are five or more lost workdays.

While average wellbeing for cotton growers is relatively high, research shows a large 'wellbeing divide' in which a significant proportion of cotton growers had low wellbeing while others had very high wellbeing. Cotton growers reported higher psychological distress compared to other farmers. These likely reflect the ongoing effects of extended periods of drought in many cotton growing regions during 2019 and 2020, although as noted on page 20, loneliness may also be contributing to this.

	2018	2020	2021
Global Life Satisfaction (mean 0-100)	77	74	64
Metal health (score 6-30 psychological distress; less than 18 is optimal)	12	14	13

Source: Regional Wellbeing Survey, University of Canberra.

Census data shows cotton farm and gin workers are relatively highly educated. However, this is a poor indicator of skills being fit for purpose or future-proof. The cotton industry is encouraging a cross-sector collaboration to collect more regular and meaningful skills data to guide future allocation of resources.

	2011	2016	2021
% post-school qualifications	39	49	52

Attracting casual and contract employees.

The most recent census data shows an increasing proportion of female and Indigenous employees in the industry and a balance of ages.

Diversity	2011	2016	2021
Gender: % female	22	23	28
Age: % <29 years	27	21	24
Age: % 30-49 years	42	41	35
Age: % >50 years	29	38	39
% Aboriginal or Torres Strait Islander	5.1	5.6	6.9

Source: ABS Australian Census.

Cotton misinformation is impacting farmers.

While cotton growers have much higher than average community involvement, the Regional Wellbeing Survey found they were significantly more likely than any other group to report frequently experiencing loneliness. Whereas 11 per cent of adult Australians and 7 per cent of farmers reported often or always feeling lonely, this increased to 43 per cent among cotton growers.

The researchers say this apparent contradiction could be influenced by a number of factors, including physical isolation (remote farms makes it harder to drive to towns) and the younger workforce (loneliness is typically higher in younger people, especially those in young adulthood). For the first time, however, the researchers identified social isolation resulting from low general public acceptance of the cotton industry as a potential driver of loneliness as well.

This is an important and new finding, which shows the frequent and misplaced demonising of cotton growers could be having an impact on their mental health, as well as community trust and acceptance of the cotton industry more broadly (cross-sector research shows trust and acceptance of the cotton industry increases in wetter seasons and decreases in drier seasons).

The industry will continue to robustly communicate to the general public that farmers should be free to grow cotton, crops, cattle, cane or any other commodity on land they legally manage and with water they have legally been allocated, especially when they have the decades-long track record of sustainability improvement the cotton industry does.

The cotton industry welcomes fact-based and constructive feedback to improve where it needs to do so, but also urges everyone to consider the impact of derogatory and incorrect statements on Australian farmers and their families.

OUTLOOK

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Keep growers & core employees	Short < 2 years	Good seasonal conditions improves water availability to reduce grower and core employee stress	Continue to seek opportunities to contribute to regional and whole-of-agriculture wellbeing strategies with growers, governments, communities and other industries.
	Medium 2-5 years	Cost of adopting new soil health management practices	
		Drought or drier seasons reduces water availability and increases stress	
		Widespread adoption of people-focused management style	
	Long > 5 years	Decline of rural population makes connection to community more difficult	

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Attracting casual and contract employees	Short < 2 years	Provide better evidence of human rights on Australian farms to make it easier for customers needing to comply with Modern Slavery to buy Australian cotton	Collaborate with other agricultural sectors to improve human rights data collection. Increase education of growers of the importance of maintaining and increasing human rights and workplace conditions. Continue to support on-farm natural resources management, and to transparently communicate the industry's environmental performance and impacts to stakeholders.
		Negative community perception of cotton's environmental impact reduces ability to attract temporary employees	
	Medium 2-5 years	Enhanced community perception of cotton's environmental responsibility and human rights makes it easier to attract temporary employees	
	Long > 5 years		

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Keeping everyone safe & appropriately skilled	Short < 2 years	Trauma, loss of productivity, and pressure on rural health systems from injuries or fatalities.	Continue to seek opportunities to collaborate with other agricultural industries to improve safety and training data collection, research and development, and adoption of new practices.
		Prioritising formal qualifications limits opportunities for marginalised groups and devalues informal training	
	Long > 5 years	Increasing use of technology to make workplaces safer and more rewarding.	

PADDOCK PRODUCTIVITY

Photo: James Bailey courtesy of Cotton Australia

PRODUCTIVITY

CONTEXT

Farmers have sought to increase crop yields for thousands of years. The cotton industry takes the science of farming to a new level by investing heavily in research to increase yields, and working with innovative cotton growers to adopt research and new technologies. The industry's aim from this investment is to help cotton growers produce more cotton with fewer inputs.

Better water, pest and nutrient management, new cotton varieties, appropriate tillage, and crop rotations are some of the factors that contribute to increasing yields over time. The five-year average irrigated yield of Australian cotton increased from 6.9 bales per hectare in 1993/94 to 10.5 bales per hectare in 2022/23. The cotton industry recognises it is important yield is not increased at the expense of environmental and social sustainability.

Dependencies

Favourable seasonal conditions. Water is normally the main limiting factor for cotton production; with limited water, limited cotton is grown. Hot conditions normally associated with dry seasons put further stress on cotton plants which can further impact productivity.

Impact drivers

Farm management practices. With seasonal conditions outside the control of growers, the practices chosen by individuals to grow cotton (including water efficiency, soil health, pest control and other agronomic decisions) have a major impact on productivity. This is in part determined by having access to technologies.

2022/23 INSIGHTS

Irrigated:

2022/23 — Five-year trend

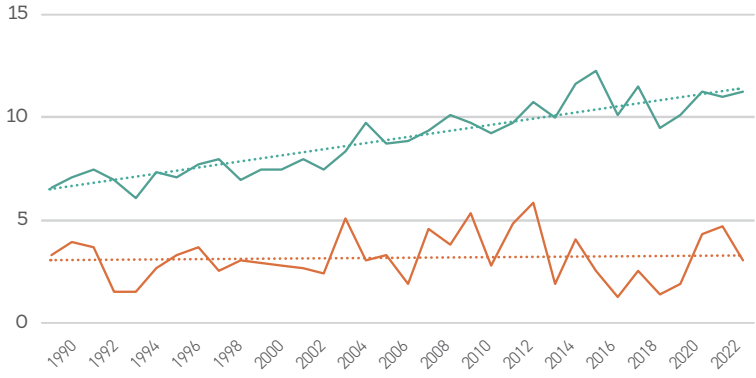
Dryland:

2022/23 — Five-year trend

Average irrigated yield increased slightly to 11.2 bales per hectare. Average dryland (rain grown) cotton yield was 3.1 bales per hectare, a decrease from the two previous high-yielding seasons and in line with the long-term dryland average.

This continues a long-term trend of much higher yield increases from irrigated cotton. The five-year average irrigated yield of Australian cotton increased by 54 per cent from 1994 to 2023 compared to an 11 per cent average dryland yield increase.

Cotton yield, bales per hectare



Source: Cotton Australia

This graph clearly shows the important role of irrigation when water is sourced from a regulated system for sustainable withdrawals, as it is in Australia. The result is to produce far more food and fibre than relying on rainfall alone.

OUTLOOK

The outlook for productivity and economic contribution are closely aligned, and is detailed in the following Economic Contribution section to avoid duplication.

PADDOCK ECONOMIC CONTRIBUTION

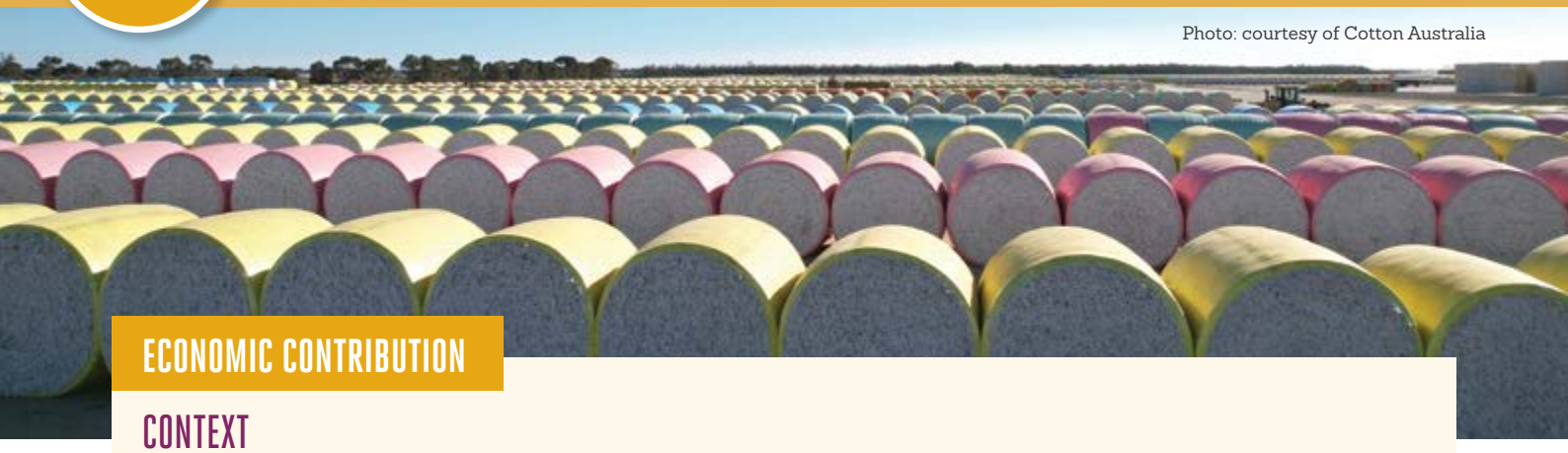


Photo: courtesy of Cotton Australia

ECONOMIC CONTRIBUTION

CONTEXT

NEW: Change of topic name.

'Economic contribution' replaces the previous PLANET. PEOPLE. PADDOCK. 'Profitability' topic. This change has been made for several reasons, primarily:

- To better articulate the economic contribution the industry makes, especially to regional Australia.
- To more closely align with the commonly accepted sustainability indicators of economic value generated (gross revenues) and economic value distributed (procurement, employee wages and benefits, rates and taxes, community investments, and payments to providers of capital).

Australian cotton farms and gins are estimated to directly employ 7,222 people[3], The industry also employs many more people in marketing and export, cotton classing and supports jobs for researchers, agronomists, rural suppliers and other input providers.

Dependencies

Farm profitability. Profitability is essential for all farmers. Profitable cotton growers generate more economic value for society than unprofitable ones and have more resilient whole-of-farm businesses. Importantly though, the industry does not encourage profitability at the expense of other sustainability topics – economic sustainability needs to be balanced with environmental and social sustainability.

Profitability is a function of many drivers; some are outside the industry's control (seasonal conditions, cotton prices, exchange rates, input costs) while others (yield, operating costs) can be influenced by the industry or growers.

Impact drivers

Economic value generated. The factors that influence profitability also impact gross cotton production revenues: seasonal conditions, global cotton prices, exchange rates, yield and operating costs. The factors that can be influenced are the areas industry invests in research and innovation.

Economic value distributed. Multiple factors also influence where the cotton industry has an economic impact. The presence of vibrant local service centres is perhaps most important: these are more likely to have goods and services, have potential labour pools, and provide a hub to attract and retain people to farms.

2022/23 INSIGHTS

2022/23 Five-year trend

Revenues generated by the Australian cotton industry make an important contribution to regional communities in particular.

- Cotton was grown in 65 local government areas according to the 2021 Census
- About 80 per cent of cotton grower business expenses are spent locally
- Cotton farms each employ an average of about six people
- The Regional Wellbeing Survey reported cotton growers were much more likely than any other group to regularly volunteer in 2021/22.

Economic value generated	2017	2020	2022	2023
Gross value (cotton lint and seed) $b	1.9	0.3	4.2	3.7

Economic value distributed	2017	2020	2021	2023
Proportion of cotton business expenses spent locally*	79	76	-	82
Average number of employees per farm*	11	5	7	6
Volunteering rate (mean 1-7)**	-	4.4	5.6	4.4

*Source: CRDC Cotton Grower Survey
**Source: Regional Wellbeing Survey

PADDOCK ECONOMIC CONTRIBUTION

Photo: JB Coppin courtesy of Cotton Australia

Research has revealed additional insights into the contribution a sustainable cotton industry can make:

- **Increased impact in good seasons**: ACIL Allen research shows the relative importance of cotton increases in good seasons because regional economies are much less diversified than state or national economies. For example, in 2021/22 the Moree Plains local government area's Gross Regional Product was $966 million, of which the cotton industry contributed $506 million
- **Increased whole-farm business resilience**: Agripath analysis of mixed farming operations shows irrigated cotton has a much higher return on assets managed than other crops, which provides greater whole-farm resilience and ability to manage through poorer seasons. The important caveat to this positive impact is the cotton farming has to be well-managed; poorly managed cotton delivers a lower return on assets than other crops.

[3] ACIL Allen estimate of 2021/22. The cotton industry needs to estimate workforce numbers because Census data significantly under-represents industry employment: farmers growing other crops or livestock may not choose 'cotton growing' as their primary occupation, and it is done in August when seasonal employment in cotton is lowest. The industry previously estimated employees to be over 10,000, based on 2014-2019 average employees per farm of nine, multiplied by the average number of farms that grew cotton from 2014-2019 according to industry surveys (1,200; up to 1,500 in good seasons). This lower ACIL Allen employee estimate is in line with industry estimates of average employees per cotton farm reducing from nine to six in recent years.

OUTLOOK (economic contribution and productivity)

Dependency	Timeframe	Risks & opportunities	Strategic priorities
Farm profitability and farm management practices	Short < 2 years	ABARES forecasts a moderate increase in cotton prices for 2024/25.	Implement research, development and extension to achieve CRDC's 2023-28 Strategic Plan goal of delivering $1 billion in additional value to the Australian cotton industry across three pillars: paddock, people and planet. Develop and implement an Australian Cotton Strategic Roadmap that enhances the sustainability, market access and value of Australian cotton through five priority areas: 1. Traceability 2. Sustainably certified cotton 3. Human rights 4. Industry data 5. Australian cotton marketing.
		High input costs continue to put pressure on margins.	
		Digital and autonomous technologies give the potential for reducing input costs, increasing productivity, and improving farmer quality of life.	
	Medium 2-5 years	Increasing demand for traceable, sustainable fibres – especially for premium products.	
	Long > 5 years	Unpredictable geopolitical shifts across markets. Adapting to climate change (see Greenhouse Gases section).	

HOW THE AUSTRALIAN COTTON INDUSTRY MANAGES SUSTAINABILITY

Strategy

The Australian cotton industry's strategy to be a recognised global leader in sustainable cotton production has three pillars:

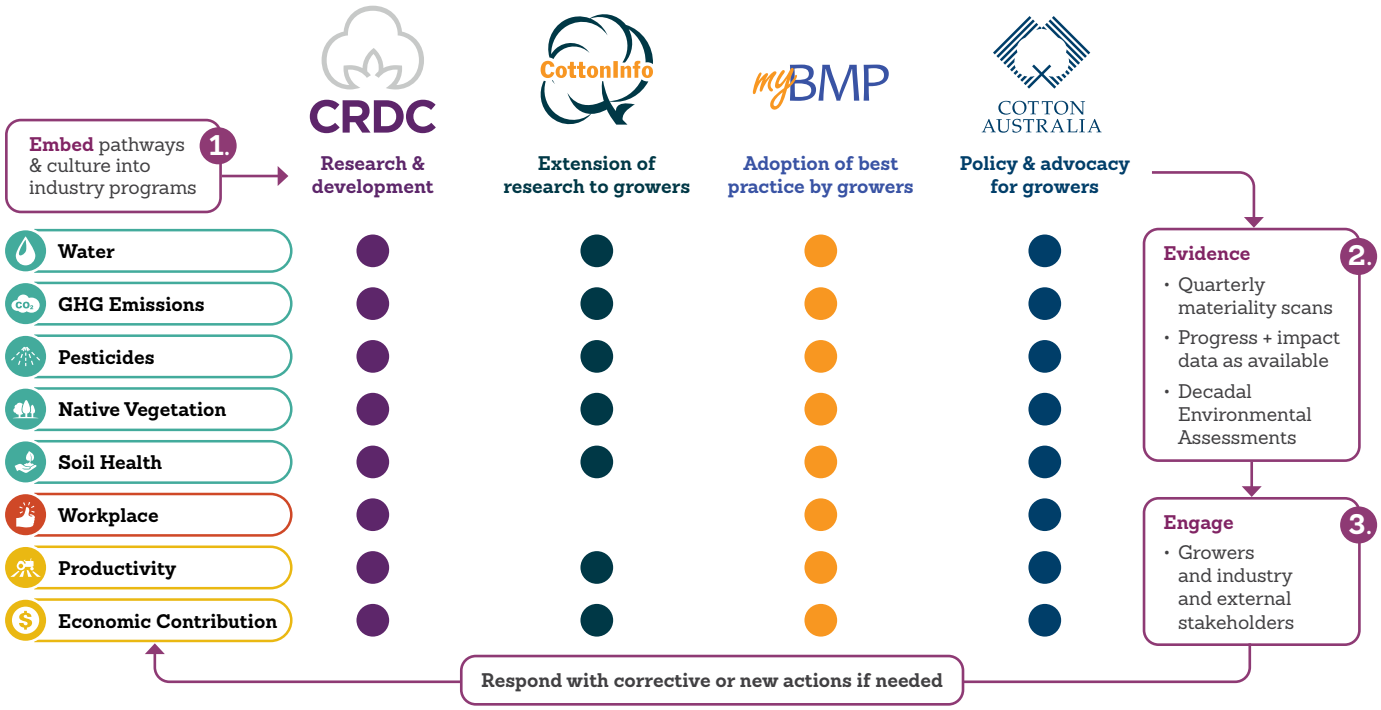
1. **Embed** the systems and culture needed to support effective sustainability management
   > MORE DETAIL: GOVERNANCE SECTION (ON RIGHT)
2. **Evidence** to demonstrate credible progress, to make informed decisions
   > MORE DETAIL: INDICATOR & TARGET SELECTION
3. **Engage** frequently and transparently with internal and external stakeholders.
   > MORE DETAIL: STAKEHOLDER ENGAGEMENT

Governance

The Australian cotton industry's Sustainability Working Group (SWG) coordinates PLANET. PEOPLE. PADDOCK. The SWG is comprised of representatives from Cotton Australia, CRDC, CottonInfo, *my*BMP and the Australian Cotton Shippers Association. The SWG reports to the Boards of Cotton Australia and CRDC.

Risk and opportunity management

Each quarterly SWG meeting includes a scan of potential risks and opportunities. These are identified through sources including stakeholder feedback, peer-based norms, and market and regulatory developments. The SWG assesses emerging issues for materiality and considers the progress of existing actions to achieve targeted outcomes. If new or corrective actions are needed, these are discussed with key personnel in the industry's well-established programs for research and development, extension, adoption, and policy.



2022/23 INSIGHTS

EVIDENCE

See summary at the front of this report for our work to revamp the PLANET. PEOPLE. PADDOCK. sustainability data framework to directly align to the reporting standards and guidance we think customers of Australian food and fibre are most likely to use.

ENGAGE

In addition to ongoing engagement through existing mechanisms including meetings, conferences and surveys, the Australian Cotton Sustainability Reference Group (ACSRG) was formed in 2021. It provides a formal two-way process to help the cotton industry better understand stakeholder expectations, discuss its sustainability performance, and be questioned or guided where needed by a diverse group of experts and thought leaders.

The ACSRG involves representatives from all major cotton stakeholder groups, including cotton apparel brands and retailers, environmental organisations, First Nations peoples, governments, merchants, regulators, community organisations, health and safety, cotton growers, researchers, input providers and other broadacre agriculture sustainability frameworks.

We work hard to provide a format and agenda that meets ACSRG expectations. The ACSRG has asked to meet every six months via an online forum to maximise efficiency and minimise greenhouse gas emissions.

ACSRG #1, November 2021

Agenda

- PLANET. PEOPLE. PADDOCK. overview
- Deep dive on topics ACSRG nominated pre-meeting

Outcome

- More information and discussion sought on human rights and native vegetation.

ACSRG #2, May 2022

Agenda

- Human rights
- Native vegetation

Outcome

- Human rights: clear actions industry can take
- Native vegetation: list of barriers to be built into native vegetation project design.

ACSRG #3, November 2022

Agenda

- Input to revamped data framework project design.

Outcome

- Strong support for concept, suggestions to be built into project design.

ACSRG #4, May 2023

Agenda

- PLANET. PEOPLE. PADDOCK. progress
- Native vegetation

Outcome

- Feedback on progress to date, and future risks and opportunities.

AUSTRALIAN COTTON SUSTAINABILITY FRAMEWORK

PLANET. PEOPLE. PADDOCK.

This Sustainability Report has been developed by the Sustainability Working Group on behalf of the Australian cotton industry.

We encourage you to provide feedback on how we can improve this Report or our management of sustainability.

Email us at: talktous@cotton.org.au

www.cottonaustralia.com.au | www.crdc.com.au

Disclaimer While all reasonable efforts have been taken to ensure the accuracy of this report, use of the information contained herein is at one's own risk. To the fullest extent permitted by Australian law, Cotton Australia and the Cotton Research and Development Corporation disclaim all liability for any losses, costs, damages and the like sustained or incurred as a result of the use of or reliance upon the information contained herein, including, without limitation, liability stemming from reliance upon any part which may contain inadvertent errors, whether typographical or otherwise, or omissions of any kind.

Forward looking statements. This report includes for the first time, forward-looking statements of sustainability-related risks and opportunities. As defined by the European Sustainability Reporting Standard, these are uncertain environmental, social or governance events or conditions that, if they occur, could cause a potential material negative or positive effect on the undertaking's business model, strategy and sustainability strategy, its capability to achieve its goals and targets and to create value, and therefore may influence its decisions and those of its business relationships as regard to sustainability matters.

Because they relate to the future and involve uncertainties that are difficult to predict and largely outside the control of the Australian cotton industry, judgement has been used to identify risks and opportunities the industry thinks are relevant to the decision-making of users of this report, and faithfully represents that sustainability-related risk or opportunity. Actual events, risks and opportunities may differ materially from those implied by these forward-looking statements. Therefore, you should not rely on any of these forward-looking statements. The Australian cotton industry welcomes feedback on the risks and opportunities identified, and their potential likelihood and impact, as we work to improve our sustainability reporting in line with emerging and evolving sustainability reporting requirements.

© CRDC 2024. © Cotton Australia 2024. All rights reserved.