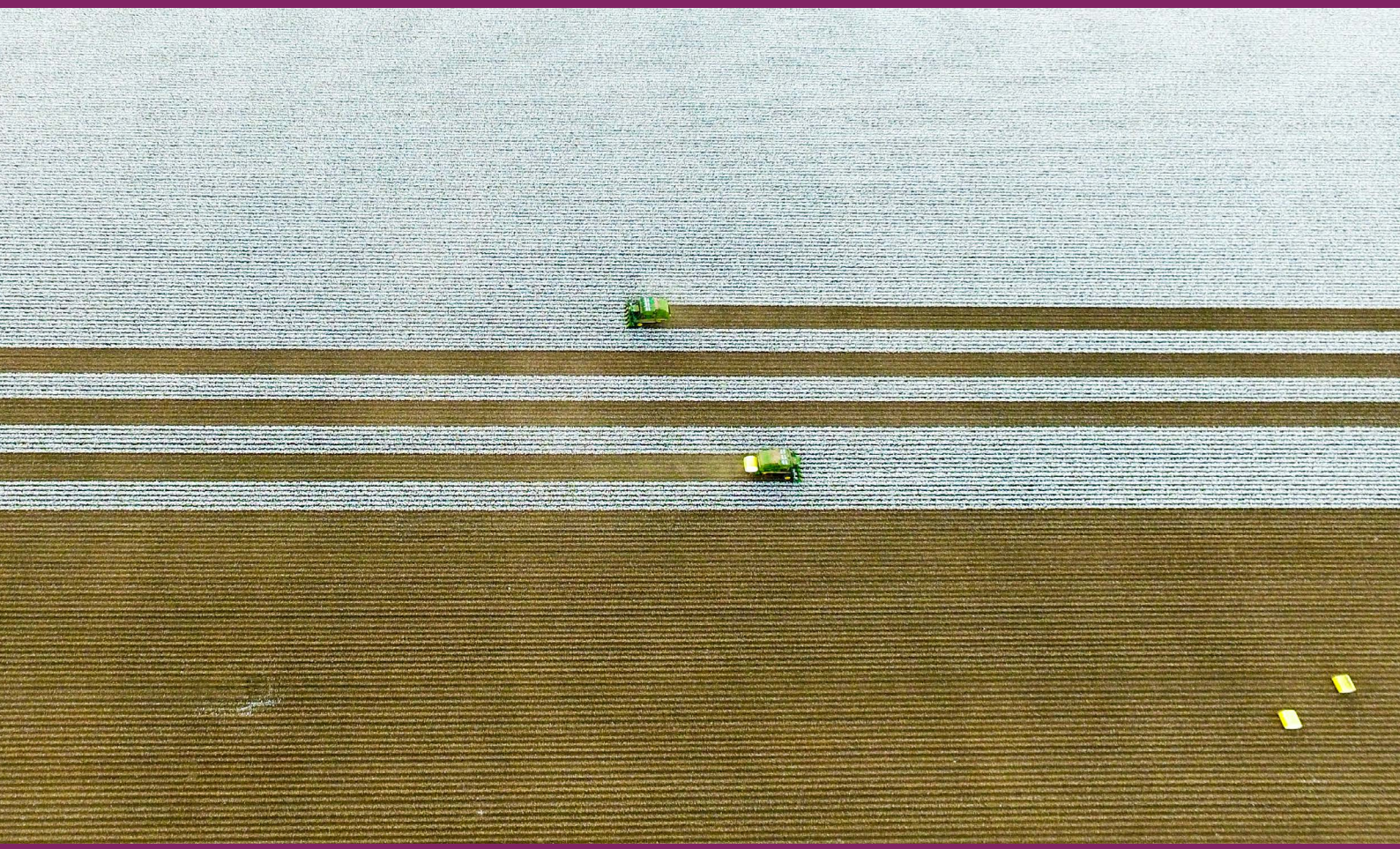
COTTON AUSTRALIA

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION



AUSTRALIAN COTTON SUSTAINABILITY TARGETS

STAKEHOLDER CONSULTATION PAPER - JULY 2020

SUSTAINABLE AUSTRALIAN COTTON
PLANET. PEOPLE. PADDOCK.

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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 set sustainability targets in the areas most important to industry and stakeholders, coordinate a whole-of-industry strategy to achieve these targets, and engage effectively with stakeholders on actions and progress.

This is how the industry is setting targets to achieve its vison:

Manage what matters

Through a process of consultation and technical review, nine environmental, economic and social topics have been assessed as being most important to cotton growers and stakeholders inside and outside the industry.

More detail on the process to choose target topics is here.

Establish a baseline

The Australian Cotton Sustainability Report 2019 is the industry's second five-year sustainability report. By comparing performance against 2014, the report shows the industry is doing some things well and can improve in other areas that impact our success.

You can read industry sustainability reports here.

Set targets

2014 and 2019 data are being used to set five-year targets to 2029 that are achievable but bold enough to make Australia a global cotton sustainability leader. These targets will demonstrate the industry is playing its part to contribute to global and national sustainability goals.

WE ARE HERE. WE NEED YOUR FEEDBACK TO SET THE RIGHT TARGETS.

Achieve targets

The industry will review existing sustainability programs and research and extension plans to ensure they are in line with target aspirations. In addition, PLANET. PEOPLE. PADDOCK. has three pillars to meet targets:
1. ENGAGE frequently with stakeholders
2. EVIDENCE to show progress & make decisions
3. EMBED a sustainability culture.

Targets give us something to aim for. Specific, bold sustainability targets are being set for the Australian cotton industry to:
- Improve performance on the topics we know are important to the Australian cotton industry and it stakeholders
- Have a clear target to make what we want to do more concrete and achievable
- Motivate internal stakeholders, and increase external stakeholder accountability and trust, on the topics that impact the industry's success
- Create a more productive, efficient, and responsive Australian cotton industry that will thrive for future generations.

How draft targets have been set.

There are two important parts to setting sustainability targets: the indicator to measure progress, and the target itself. Small expert groups have assessed the nine priority topics against the criteria below to test indicators and set draft targets.

Indicator criteria

- Is it relevant - will it drive desired change at the farm level, measure impact across the industry, and within the ability of industry to influence?
- Is data readily available?
- Is the data robust?
- Is collection of data replicable over time?
- Is it consistent with peers to avoid duplication and allow comparison?

Target criteria

- Is it consistent with relevant global and national targets?
- Is it sufficiently bold to be a global leader in sustainable cotton production?
- Is it achievable?
- Does it take into account environmental contexts and likely future changes?

A simple colour-coded summary of the assessment is provided in this paper to show how well draft indicators and targets are aligned to these criteria. The number of indicators has been kept to a minimum, to ensure the industry focuses on a small number of indicators that measure meaningful outcomes.

High alignment
Moderate alignment
Low alignment.

This process has shown some priority topics need more time to develop indicators or targets, especially topics that have a high degree of crossover with other Australian agriculture sectors. Having consistency with other agriculture sustainability frameworks is important to the cotton industry to prevent duplication or confusion, especially for farmers.

Rather than wait several months for all targets to be ready, the Australian cotton industry is favouring sustainability action and progress by consulting with stakeholders now. Where we have draft targets ready, we are asking if they are the right level of ambition, and if the indicators are the right ones to drive and measure change. Where targets are not yet ready, we are seeking feedback on our emerging thinking. Where possible, targets will be finalised and published in 2020. It is expected others will not be finalised until 2021.

Draft targets:

	TOPIC	DRAFT FIVE-YEAR TARGETS
PLANET	WATER: less drops per crop.	Increase cotton water use efficiency by 12.5%
	CARBON: acting on climate change.	More time needed: a national agriculture greenhouse gas emissions accounting methodology is being developed.
	BIODIVERSITY: benefitting from biodiversity.	More time needed: indicators focused on riparian zone biodiversity are provided for stakeholder feedback.
	PESTICIDES: efficient, responsible pesticide use.	Reduce the hazard of pesticides by 5%
	SOIL HEALTH: fortifying the foundations.	More time needed: indicators for soil carbon and Visual Soil Assessment are provided for stakeholder feedback.
PEOPLE	QUALITY OF WORK LIFE: safe, inclusive and skilled workplaces.	Targets consistent with Australian agriculture aspirations, when defined.
	WELLBEING AND SOCIAL CAPITAL: vibrant regional communities.	Targets consistent with Australian agriculture aspirations, when defined.
PADDOCK	EFFICIENCY: more cotton per hectare.	Increase irrigated cotton yield by 15%
	PROFITABILITY: growing livelihoods.	Increase profitability by 15%

Scope:

Targets are for the five years to June 30 2024, and the five years to June 30 2029. The baseline year for targets is 2019, unless noted otherwise. Targets are for the on-farm production impacts of Australian cotton only, unless noted otherwise. In future, targets for impacts may be extended further up and down the cotton production value chain.

How you can contribute.

The cotton industry is seeking stakeholder feedback on if the indicators and targets are the 'right' ones, if anything is missing, and suggestions that may help to achieve targets. To provide feedback, please fill in the survey emailed to you. If you haven't received a survey, please contact talktous@cotton.org.au.

How your feedback will be used.

Stakeholder feedback on targets and indicators will be considered by experts and the Sustainability Working Group, a group of industry representatives guiding the development and implementation of PLANET. PEOPLE. PADDOCK, to finalise targets and indicators.

If there is differing stakeholder feedback, the Sustainability Working Group will be guided primarily by alignment with the criteria provided. A report of stakeholder feedback will be made public once targets are finalised.

What happens once the targets are set?

The Australian cotton industry has been actively working to run efficient cotton farms while creating environmental, economic and social value for over 30 years. Setting targets is a continuation of this process. PLANET. PEOPLE. PADDOCK. has been created to coordinate a whole-of-industry strategy to achieve targets.

These targets are genuinely bold, and will stretch the industry to achieve them, especially in areas where dramatic gains have already been made over the past 30 years or where factors outside the industry's control impact targets. There's a very important balance to achieve. The industry understands growers and the industry may face criticism for falling short of difficult targets, and external stakeholders don't want easily achievable targets that require no more than business-as-usual practices.

These draft targets are a starting point to get that balance right. They are based in science, and the Australian cotton industry will seek to frequently and transparently engage with stakeholders on actions and progress towards them. Targets may be refined or new ones emerge in future, in consultation with stakeholders, as the Australian cotton sustainability journey evolves.

PLANET WATER | Less drops per crop

While dryland (rain-grown) cotton crops are successful in some regions and seasons, irrigation enables high-yielding cotton to be grown in a wider range of regions more of the time. Growing more cotton with every drop of water has been a focus for decades and the Australian cotton industry has a long-term trend of reducing water use per bale of cotton grown by 2.5 per cent per year since the early 1990s.

Water is a highly regulated natural resource in Australia, with rules to ensure the basic needs of the environment and humans must be met before any water can be allocated to farmers for irrigation. If water in a river system is scarce in any given year, water available for irrigation is also scarce. In some years, there is no allocation of water to irrigators.

DRAFT TARGET: Increase irrigated cotton water use efficiency by 12.5% every five years

Target check

Consistent with global & national targets?	
Bold but achievable?	
Takes into account likely future changes?	

Sustained research and practice change have delivered a long-term trend in improved water efficiency. As water efficiency improves, maintaining this trend becomes much harder. A target of 12.5% every five years will be a challenging stretch requiring ongoing research and assessment of management practices to improve efficiency.

This target is consistent with SDG Target 6.4: By 2030, substantially increase water use efficiency and ensure sustainable withdrawals of freshwater to address water scarcity.
- The target is an increase in water use efficiency, and builds on a substantial increase in efficiency over time
- The Murray Darling Basin Agreement provides for sustainable withdrawals of freshwater based on annual seasonal flows, and the industry operates within that legislative framework.

Nationally, the National Farmers' Federation's 2030 Roadmap target is to increase irrigated agriculture water use efficiency by 20% by 2030.

DRAFT INDICATOR:

Indicator	2014	2019 baseline	2024 target	2029 target
Gross Production Water Use Index (megalitre/bale) (irrigated cotton)	0.91	0.83	0.71	0.59

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

The Gross Production Water Use Index (GPWUI)[1] is regarded as the best measure for comparing water use between farms or seasons because it takes into account all water available to the crop: irrigation, rainfall and water stored in the soil. GPWUI is measured annually by CRDC-funded research.

GPWUI is consistent with the SDG indicator of a change in water use efficiency over time. A wide range of other indicators are used to measure water use and efficiency, including:
- Total water use. The volume of water used from surface water, ground water and rainwater varies enormously between seasons and between cotton growing valleys. In addition, the amount of water extracted from rivers is dictated by the allocation irrigators are given each season; operating within that regulatory framework, we think the change we want to drive is continued efficiency with available water – which is what GPWUI measures
- Whole Farm Irrigation Efficiency (WFIE), which shows the amount of irrigation water used by the plant as a percentage of total irrigation water inputs to the farm. WFIE increased from around 57% in the late 1990s to above 80% by 2019. It is not used to set a target because it is influenced by other factors, particularly rainfall, which require additional assumptions to be made to normalize the data and allow comparisons over seasons. WFIE is most useful as a tool to identify farms with below average water efficiency, so they in turn can identify ways to reduce water losses.

[1]GPWUI is typically used as a measure of productivity and expressed as bale/ML. The index is inversed here as ML/bale to make it an efficiency indicator – that is, to show less water will be used per bale produced over time.

PLANET CARBON | Acting on climate change

Climate change is expected to impact Australia's cotton growing regions via higher temperatures, increased evaporation and less frequent but more intense rainfall. All of these have potential negative impacts on the efficient production of cotton. Cotton growers are taking steps to adapt to the impacts of climate change by implementing new practices and adopting new varieties of cotton to make farms more resilient.

Cotton production emits about 0.2 per cent of Australia's greenhouse emissions. The main sources of greenhouse emissions to grow and ship to port one bale of cotton in the five years to 2018-19 were nitrogenous fertiliser (58 per cent), on-farm fuel (15 per cent), and ginning energy (10 per cent).

In the five years to 2019 the amount of emissions per bale increased by 12.5 per cent due mainly to an increase in the application rate of nitrogen fertiliser; however, because less bales were grown due to relatively drier conditions, in the same period the industry's total greenhouse emissions actually reduced by 10 per cent. This shows the importance of a per bale indicator to provide meaningful context.

Emissions are one side of the carbon cycle; on the other side, farms sequester and store atmospheric carbon in soil and vegetation. Due to a lack of data on the amount of carbon stored on farms, the industry was not able to report on sequestration in its 2019 sustainability report.

TARGET: More time needed

To give a more accurate picture of its contribution to climate change efforts, the cotton industry is developing with other agriculture sectors a methodology to measure the amount of on-farm greenhouse gas emissions and carbon sequestered. This will give a more complete picture of the net carbon footprint of cotton production.

Because cotton farms also grow other crops and often raise livestock, it's important this work is done with other agriculture industries to develop an agreed and consistent methodology.

When the underlying methodology is finalised, the cotton industry will set a target for its contribution to climate change. In line with the National Farmers' Federation's 2030 Roadmap target to be trending towards Carbon Neutrality by 2030, this is likely to be a carbon neutral target: a target year when the net impact of the cotton industry's emissions to climate change will be zero.

PLANET
BIODIVERSITY | Benefiting from biodiversity

Biodiversity is the variety of life forms found in an environment including animals, plants, bacteria, fungi and micro-organisms, including diversity within and between species and diversity of ecosystems. Biodiversity can provide natural pest control and pollination, control erosion, store carbon and enhance water retention. The major threats to biodiversity on farms are invasive species and habitat loss and degradation.

The 2019 Australian Cotton Sustainability Report stated between three and four per cent of cotton farms are managed for conservation.

TARGET: More time needed.

Measuring biodiversity is a complex and evolving space. In particular, a significant amount of work is being undertaken to measure and value 'natural capital' – the stocks of ecological capital that combine to yield a flow of benefits to people[2]. Companies, governments, and international bodies are all striving to accurately measure and value natural capital so better decisions to manage it can be made.

The area of land managed for conservation outcomes, as reported in the 2019 Australian Cotton Sustainability Report, is one simple indicator of biodiversity. However, it doesn't tell us what condition this land is, or if the land has relatively high ecological value. Outcomes-based indicators can do this, but they are more challenging to measure due to the time, cost and technical expertise. As a result, the industry is proposing to use a mix of area and outcome-based indicators.

Because indicators are complex and will likely require external research to measure, stakeholder feedback is sought now to ensure the right ones are selected before resources are invested in measuring them.

When indicators are finalised, research will be undertaken to identify baselines and set targets. Stakeholders will be consulted on targets when indicators are finalised in 2021.

DRAFT INDICATOR:

Indicator	Measure
Change in area of riparian vegetation with buffers greater than 50m rivers & 20m creeks.	Hectares (or %, or condition change)
Area of riparian native vegetation managed for environmental outcomes (weed and pest management routinely undertaken).	Hectares and % of total
Median proportion of bird and/or insectivorous bat guild on farms.	Median number of bird and/or bat guilds
Area of native vegetation managed for environmental outcomes: healthy groundcover.	Hectares and % of total (defined by Australian Beef Sustainability Framework)

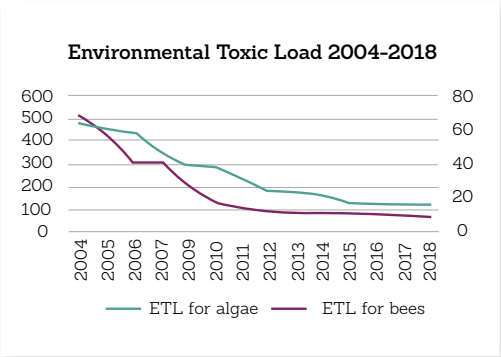
These indicators are focused primarily on the land of greatest ecological importance in the cotton landscape – the riparian zone. Riparian vegetation plays a critical role in river health, sequesters more carbon than floodplain vegetation, and is a logical focal area for improving corridors and connectivity within the landscape. In time, biodiversity indicators and targets will be extended more broadly.

[2] *Natural Capital Coalition*.

PLANET
PESTICIDES | Efficient, responsible pesticide use

Pesticides (including insecticides and herbicides) are widely used in agriculture to control crop losses from pests. Incorrect handling and application or over-use of pesticides can pose human health risks, lead to resistance, secondary pest outbreaks, destruction of natural predators and increase the risk of off-farm movement and environmental contamination. This target measures how much we reduce the potential for negative impact of pesticides on the environment.

Through sustained research and practice change, the hazard of pesticides has reduced significantly over the past two decades. The downside of this success is that further reductions are much harder, or will have negative impacts in other areas. For example herbicide hazard could be reduced by using less herbicide, but this would likely increase tillage, which would have negative impacts on soil carbon, soil moisture and fuel use.



DRAFT TARGET: reduce the hazard of pesticides by 5% every five years

Target check

Consistent with global & national targets?	
Bold but achievable?	
Takes into account likely future changes?	

A five per cent reduction in ETL over five years may not seem bold, but it will be challenging to achieve with the significant reductions that have already been achieved. Further reduction in algae ETL may come through precision application technologies, or changes to some specific herbicide applications.

The main component of ETL for bees is the use of neonicotinoid insecticides as a seed dressing to control soil pests. This is likely to remain a valid part of the industry's Integrated Pest Management system, and as the seeds are buried the likely actual impact on bees is low. A further reduction in ETL is largely reliant on alternative insecticides that are used in addition to neonicotinoids.

The industry's substantial reduction in pesticide hazard is consistent with SDG Target 12.4: By 2020, significantly reduce the release of chemicals and waste to air, water and soil to minimize their impacts on human health and the environment.

DRAFT INDICATOR:

Indicator	2014	2019 baseline	2024 target	2029 target
Environmental Toxic Load score for bees	11	9.0	8.6	8.1
Environmental Toxic Load score for algae	148	119	113	107

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

Environmental Toxic Load (ETL) is an indicator created specifically to assess human health and environmental hazards associated with pesticides used in cotton. ETL monitors the hazard to four different ecological components. For simplicity, the industry is using two of these as a public target – bees for insecticide hazard and algae for herbicide hazard.

ETL represents the average amount of toxic pressure by the pesticide applied on one hectare of cotton in one year, based on the volume sold. It does not account specifically for on-farm management practices. An additional indicator that measures on-farm practice change, for example regarding spray drift, would help drive further change. The ability to measure such practice change accurately is currently low, and may be an area for future collaboration.

ETL is not currently used by other commodities, but is being assessed for use by the cotton industry internationally.

Reducing pesticide volume is an additional simple indicator. For transparency the industry reports changes in pesticide volume, but it hasn't been chosen as an indicator because it may not drive the desired change of reducing the environmental impact of pesticide sprays: if less but more toxic pesticides are chosen, the impact may be worse.

PLANET
SOIL HEALTH

Fortifying the foundations

Soil carbon and organic matter supply nutrients for plant growth, and soil microorganisms stabilise soil structure and improve soil water storage and infiltration.

Soil organic matter levels in many cropping fields, including cotton, have declined since the fields were developed for agriculture many years ago. Common practices used by Australia's cotton growers such as minimising tillage, controlled traffic farming, using rotational crops and optimising fertiliser application including the use of manures and biosolids, are being used to address this decline in soil carbon.

DRAFT TARGET: More time needed.

Soil health underpins cotton production, but targets were not previously developed because of the difficulty of collecting meaningful data at the industry scale. Given the fundamental importance of soil health to agriculture, the industry is taking another look at soil health indicators and targets.

When indicators are finalised, the cotton industry will review baseline data and consult with stakeholders on appropriate targets. We aim to release soil health targets at the same time carbon targets are released, in 2021.

A soil health target will be consistent with SDG Target 15.3: by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

Two possible indicators have been identified for stakeholder feedback.

DRAFT INDICATOR:

Indicator	Measure
Increase the percentage of soil carbon. This is a logical indicator given its importance to a carbon neutral target, and because of the role of soil organic carbon in soil health.	Mean %
Increase the proportion of Visual Soil Assessment (VSA) 'moderate' and 'good' fields. VSA is a UN Food and Agriculture Organisation tool to monitor key soil 'state' and plant performance indicators of soil quality, presented on a scorecard. VSAs are conducted with simple equipment – a shovel, plastic bin, water bottle etc – and a scorecard to visually score each indicator as poor, moderate or good. The 'hands on' nature of VSA makes this indicator powerful for extension and awareness.	% Good, % Moderate

Developing a relevant, practical and robust methodology for measuring soil carbon at the farm level and industry scale is a challenge the cotton industry is investigating.

About 300 VSAs have been conducted on cotton fields in recent years, which provides a baseline dataset. Most cotton soil was rated as good. Extending VSAs across the industry (and ideally to other sectors) and collecting data at the industry scale are challenges to be addressed.

Other soil health indicators considered but not chosen because of limitations in accurately collecting data at the industry scale or driving change on cotton farms included the quantity of fertiliser applied; erosion potential; rooting depth; soil condition (pH, structure, salinity); soil macro and micro biota; soil loss. The relevant SDG soil health indicator measures land degradation, with sub-indicators of organic carbon in soil (proposed here), land cover (a proposed indicator in Biodiversity), and land productivity (an Efficiency indicator).

PEOPLE
QUALITY OF WORK LIFE

Safe, inclusive and skilled workplaces

Attracting employees is a challenge throughout regional Australia. The cotton industry is working with other sectors to improve diversity, training and safety of its people, helping to make agriculture an employer of choice.

DRAFT TARGET - DIVERSITY & TRAINING: to be defined in line with national agricultural aspirations

It's important the cotton industry contributes to a coordinated national approach to improving the quality of work life right across agriculture. Targets are to be developed in consultation with other agricultural sectors.

DRAFT INDICATOR:

Indicator - diversity	2014	2019 baseline	2024 target	2029 target
Age: % <50 years	70%	63%		
Gender: % female	2%	23%		
% Aboriginal or Torres Strait Islander origin	5.2%	5.5%		
% Culturally & Linguistically Diverse background	4.3%	5.7%		

Indicator - training	2014	2019 baseline	2024 target	2029 target
Workforce qualifications and training (% post-school qualifications)	39%	43%		

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

Data for 'Diversity of workforce' and 'Workforce qualifications and training' is sourced from Australian Bureau of Statistics (ABS) Census data and is collected every five years. There are limitations to Census data – in particular, some people working in cotton as well as other agricultural industries aren't counted as part of the cotton industry, and the Census counts people in August when seasonal employment in cotton is low – but it is the best currently available for these indicators.

DRAFT TARGET - SAFETY: Zero fatalities; 30 per cent reduction in serious injuries per five years

Target check

Consistent with global & national targets?	
Bold but achievable?	
Takes into account likely future changes?	

The 30 per cent injury reduction target per five years mirrors the Australian Work Health and Safety Strategy 2012-2022. The National Farmers' Federation's 2030 Roadmap has a target of zero fatalities. This target contributes to SDG Target 8.8: Promote safe and secure working environments for all workers.

Agriculture contributes disproportionately to workplace health and safety incidents across Australia. From 2014 to October 2019, the agricultural sector had one of the highest rates of fatalities and serious injury. During this period, 399 people lost their lives on an Australian farm (based on provisional data including unintentional work-related and non-work-related farm injury deaths).

DRAFT INDICATOR - SAFETY:

Indicator	2014	2019 baseline	2024 target	2029 target
Total fatalities in five-year reporting period	5	6	0	0
Mean annual serious injuries (5+ days lost time) in reporting period	44	38	27	19

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

Safety is normally measured as a rate to provide comparability; eg, injuries per 1,000 workers. Cotton's seasonal workforce and changing number of growers makes it difficult to provide an accurate number of workers, so the indicator is total numbers per year. This restricts the ability to directly compare injury rates with peers, but our view is the assumptions needed to estimate the workforce would make a standard injury rate indicator unreliable.

PEOPLE
WELLBEING & SOCIAL CAPITAL

Vibrant regional communities

The cotton industry is an important part of cotton growing communities, but it is only one part. The wellbeing of individuals and communities is the sum of many aspects, some of which the industry can influence to a degree, and many of which are outside its control. By examining these aspects the industry is seeking to better understand where there are opportunities for it to contribute to the broader wellbeing of the communities its members live and work in. Improving wellbeing will require collaborating with other industries, government and communities.

DRAFT TARGET: to be defined in line with national agricultural aspirations

The Australian cotton industry reported on wellbeing for the first time in its 2019 Sustainability Report. It is a starting point, and more work is needed to understand the context, the impact of drought, and other factors on these baseline numbers. More work is also needed to confirm if these are the right indicators to be monitoring: indicators need to help the industry understand if and how it can do more to work with government, communities, other industries and individuals to improve the welling and social capital of people and communities where cotton is grown.

The cotton industry intends to work with NFF and other broadacre sectors towards a consistency of wellbeing indicators.

When indicators are confirmed, the industry will set targets that ensure it contributes to national wellbeing aspirations.

Relevant global and national targets to be taken into account include:
- SDG 3. Ensure healthy lives and promote well-being for all at all ages
- SDG Target 17.17: Encourage and promote effective public, public-private and civil society partnership.
- The National Farmers' Federation's 2030 Roadmap has targets for wellbeing and to close the gap between psychological wellbeing of farmers and the broader community.

DRAFT INDICATOR:

Indicator	2014	2019 baseline	2024 target	2029 target
Individual and community wellbeing of cotton industry				
Global Life Satisfaction (mean 0-100)	na	77		
Physical health (% reporting very good or excellent health)	na	34		
Mental health (mean 6-30 Kessler 6 psychological distress scale)	na	12		
Community wellbeing (mean 1-7)	na	5		
Contribution to social capital in regional communities				
Community involvement (mean 1-7)	na	4		

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

Data from the University of Canberra's national Regional Wellbeing Survey gives a snapshot of key indicators as of 2018.

Because measuring wellbeing is new to the industry, education and collaboration is needed to make these indicators understood and relevant in the cotton industry and in cotton growing communities.

PADDOCK EFFICIENCY | More cotton per hectare

With the world's population forecast to increase from 7.7 billion in 2018 to 9.7 billion in 2050, farmers all around the world need to produce more food and fibre with the same or fewer resources. This target tracks our efforts to sustainably grow more cotton fibre, and by extension more cotton seed, per area of land.

A long-term trend of increasing irrigated yields is the result of significant effort by the industry. 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.

DRAFT TARGET: Increase the amount of cotton grown per hectare by 15% every five years

Target check

Consistent with global & national targets?	
Bold but achievable?	
Takes into account likely future changes?	

Targeting a 15 per cent increase every five years is consistent with the CRDC Strategic Plan of a three per cent yield increase per year. This is an ambitious but achievable stretch to 2029, taking into account expected climate change, technology and plant breeding changes. Yield can't keep increasing at the same rate indefinitely, so the target will need to be monitored and refined in future.

Increasing production efficiency is consistent with SDG Target 2.4: By 2030, implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, and that progressively improve land and soil quality.

DRAFT INDICATOR:

Indicator	2014	2019 baseline	2024 target	2029 target
Irrigated crop yield (bales/ha)	9.9	10.9	12.5	14.4

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

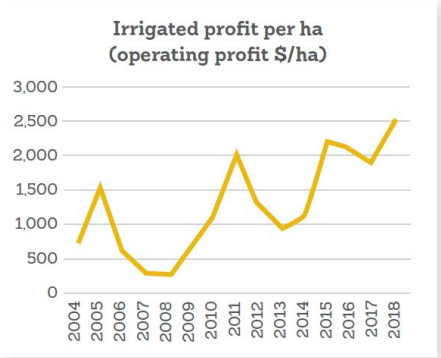
Sixteen economic indicators for Australian cotton production were identified in the 2014 Sustainability Report. Of these indicators, crop yield was considered the best surrogate for all other indicators. It is relatively easy to collect accurate data at the industry scale and the industry has excellent long-term data sets. Crop yield is also a key driver of crop gross margins and farm profitability, and it directly impacts the performance of several other priority sustainability areas.

Dryland cotton yield is highly dependent on rainfall, which is extremely variable and makes future targets more difficult to influence. For that reason, we monitor dryland yield but have not set targets.

PADDOCK PROFITABILITY | Growing livelihoods

Profitability is a fundamental sustainability indicator for growers. Profitable cotton growers can re-invest in their own business, and contribute to local communities, economies and the environment.

Many factors influence the profitability of cotton production. In 2018, most of the key profitability drivers – including high world cotton prices, favourable AUD-USD exchange rates, very high yields and low operating costs – were all in growers' favour. This unusual confluence of events combined to deliver record profits in that year. Drought conditions in the two seasons after 2018 will almost certainly see a significant reduction in profitability in those years.



DRAFT TARGET: Increase irrigated cotton profitability by 15% every five years in real terms

Target check

Consistent with global & national targets?	
Bold but achievable?	
Takes into account likely future changes?	

A targeted 15% increase every five years in operating profit is consistent with the targeted 15% increase in yield. Profitability increased by 76 per cent over the five years to 2019, but the impact of drought will make a 15 per cent increase in profitability from that historical high a real challenge over the next five years. Impacts of COVID-19 on global demand for cotton are at the time of writing uncertain; a severe or prolonged economic downturn may decrease lint prices and put further pressure on the ability to achieve this target.

Because cotton is a high-input crop, profitability varies greatly depending on seasonal conditions.

Improving the profitability of cotton growers is consistent with SDG Target 8.2: Achieve higher levels of economic productivity through diversification, technological upgrading and innovation.

DRAFT INDICATOR:

Indicator	2014	2019 baseline	2024 target	2029 target
Irrigated profit per ha (operating profit $/ha)	$1,090	$1,916	$2,203	$2,534

Indicator check

Is it relevant - will it drive desired change?	
Is data readily available?	
Is the data robust?	
Is it replicable over time?	
Is it consistent with peers?	

Operating Profit is a common indicator of profitability. Data is sourced from a comparative analysis of the financial performance of a sample of cotton growers, funded by CRDC.

Return on Assets is another common financial indicator, but because it is heavily influenced by land value operating profit is a more appropriate indicator.

Dryland cotton profitability is important to many growers. However, we have not included dryland profitability as an indicator because it is subject to much greater seasonal variability than irrigated cotton.

Many sustainability frameworks don't include profitability at all. We have, because of its fundamental importance to the long-term sustainability of growers. Profitability also has potential positive impacts on many other priority sustainability areas.

WATER

GPWUI

Gross Production Water Use Efficiency. Typically used as a measure of how productively all water potentially available for cotton crops water is used (bale/ML), we are inversing the index as ML/bale to make it an efficiency indicator to show less water will be used per bale produced over time. It accounts for all water from rivers and bores, plus any rain falling directly on the crop and all rainfall runoff harvested, plus all soil moisture used by the crop. It also includes all water lost through evaporation and seepage during storage and delivery to the field. GPWUI is the preferred metric for comparing water productivity across regions and seasons, as it takes into account all the water available to the crop.

$$GPWUI = \frac{cotton\ yield}{irrigation\ water + rainfall + soil\ moisture\ change}$$

WFIE

Whole Farm Irrigation Efficiency. A measure of how efficiently irrigation water is used (Tennakoon and Milroy, 2003). A high WFIE indicates that storage, transmission and field losses are low and the crop used most of the water brought onto farm. WFIE values are, however, also influenced by rainfall, and will be higher in drier years because a greater proportion of crop water-needs are met by irrigation. Any comparisons of WFIE across years needs to, therefore, take rainfall into consideration before making interpretations. WFIE is calculated by first identifying how much irrigation water was used by the crop. This is done by subtracting the effective rainfall and soil moisture from crop water use. The volume of irrigation water used by the crop is then divided by all irrigation water used and lost across the farm and throughout the season.

$$WFIE = \frac{crop\ water\ use - effective\ rain - soil\ moisture}{irrigation\ water\ used\ on\ farm} \times 100$$

Methodology

Grower records are used to conduct a water balance of 57 farms across Australia's major cotton growing areas to measure GPWUI and WFIE. This accounted for more than 200 fully irrigated fields, representing around 8 per cent of fully irrigated cotton in Australia. To calculate water inputs, data is collected on all water accessed (brought onto farm), changes in dam storage volume, changes in stored soil moisture, in-crop rainfall and rainfall runoff harvested during the growing season. To calculate outputs, seepage losses in dams, channels and fields based on soil type are estimated, and weather data from the Australian Bureau of Meteorology is used to identify evaporation in conjunction with satellite imagery, which allowed us to: identify crop growth phases to estimate crop water use, and measure the surface area of water in storage-dams and irrigation-channels to estimate losses due to evaporation.

ML

Megalitre; one million litres.

Baseline data

Benchmarking Water Productivity of Australian Cotton, NSW DPI, October 2019.

CARBON

Definitions, methodologies and assumptions will be provided as indicators and targets are developed.

BIODIVERSITY

Definitions, methodologies and assumptions will be provided as indicators and targets are developed.

PESTICIDES

ETL

Environmental Toxic Load. The ETL provides an indication of hazard to four different ecological components: terrestrial insects (endpoint toxicity based on bees); aquatic vertebrates (fish); aquatic invertebrates (Daphnia); and aquatic primary producers (algae). It was developed specifically to assess and compare pesticide use in cotton industries worldwide (de Blécourt et al., 2010), including Australia.

Methodology	Calculated on five-year rolling average pesticide applications across the Australian cotton industry from Crop Consultants Australia data. Information on the volume/mass of each pesticide used was converted from the applied commercial formulation to the active ingredient. The total mass of active ingredient applied was then scaled by the area over which it was applied, to give an application rate in g ha-1. Importantly, this data source has incomplete data for seed treatments. Additional data on seed treatments (specifically for the neonicotinoid insecticides imidacloprid and thiamethoxam) were sourced from Cotton Seed Distributors. These data included the total amount of seed distributed, the percentage of seed treated with particular products, and the rate and concentration of active ingredient applied per 100 kg of treated seed. Seed treatment data were only available for the seasons 2015/16, 2016/17 and 2017/18, and will be calculated for future seasons.
Baseline data	Environmental Toxic Load for Australian Cotton, 2000-2018. NSW DPI, April 2020.

SOIL HEALTH

Definitions, methodologies and assumptions will be provided as indicators and targets are developed.

QUALITY OF WORK LIFE: DIVERSITY & TRAINING

Baseline data	Age, gender, Aboriginal and Torres Strait Islander, Cultural and Linguistic Diversity (proficiency in language other than English), post-school qualifications: ABS Census, cotton growing and cotton ginning Industry of Employment. The Census is held every five years, with the most recent being 2016. The next Census will be in 2021.
Cotton community	A Local Government Area where cotton contributes 10% or more of its local crop value. Based on 2016 ABS Census data (employment) and 2016 ABS Agricultural Census (volume and value of production, 2015-16).
Cotton employees	Accurately counting the number of people working on cotton farms is difficult. The number of farms growing cotton changes each year based on seasonal conditions, farms will grow other crops and often raise livestock, and there is a significant temporary workforce. For the five years to 2019, it is estimated Australian cotton farms collectively employed an average of 10,740 full-time, part-time and casual employees per year. This is based on the 2014-19 Cotton Annual average of the reported number of farms (1,200) multiplied by the average number of full time (5.5), part-time (1.0) and casual (2.5) employees in 2017 and 2018 Grower Surveys.

QUALITY OF WORK LIFE: SAFETY

Serious injury	An injury resulting in five or more days lost from work.
Methodology	Fatalities: The National Coroners Information System (NCIS) is the sentinel repository of all deaths in Australia. Determining events that have occurred on a cotton property is via: identifying postcodes where cotton is grown; assessing records on a case-by-case basis; cases that were clearly not cotton-related (eg, livestock or grains-related) were excluded.
Methodology	Serious injury: Workers compensation data accessed through Safe Work Australia. Data is provisional in nature; it is expected further cases will be added in time.
Baseline data	Sentinel Health and Safety Data for Australian Cotton Farms. AgHealth Australia Safety, The University of Sydney, November 2019.

WELLBEING AND SOCIAL CAPITAL

Baseline data	CRDC-funded analysis of the University of Canberra's Regional Wellbeing Survey 2018.

EFFICIENCY

Methodology	A five-year average from Cotton Australia's data, based on a compilation of industry sources.

PROFITABILITY

Operating profit	Gross profit minus operating expenses, before deduction of interest and taxes.
Methodology	A rolling five-year average from Boyce Chartered Accountants' annual Australian Cotton Comparative Analysis. Due to a one-year delay in data availability, the indicator is measured as the five years to the second-last year in each reporting period. ie, 2014 indicator is for the five years to 2012/13; 2019 indicator is for the five years to 2017/18.

COTTON AUSTRALIA

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These Sustainability Targets have been developed by the Sustainability Working Group on behalf of the Australian cotton industry. *Cover photo courtesy Mark Middendorff.*

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