

Gap Analysis

Building Emissions Knowledge for the Australian Cotton Industry

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Client: Cotton Research and Development Corporation

Prepared by Brendan O'Keeffe, Jon Welsh
Ag Econ
Namoi Valley, New South Wales
admin@agecon.com.au
Jon Welsh +61 458 215 335

Chris Cosgrove
Sustenance Asia
Battery Point, Tasmania
chris@sustenanceasia.com
+61 481 381 666

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Table of Contents

Executive Summary	4
Purpose and context	4
Evidence base	4
What the evidence said	4
What this means for the cotton industry	5
1. INTRODUCTION	6
2. METHODOLOGY	7
2.1. Investment Portfolio Analysis	7
2.2. Grower and Adviser Engagement	7
2.3. Vertical Supply-Chain Collaboration	7
Targeted interviews with post-farmgate organisations	8
Australian Cotton Sustainability Reference Group	8
Cotton Sustainability Roundtable	8
2.4. Horizontal Cross-RDC Collaboration	8
3. FINDINGS	9
3.1. CRDC Emissions-Relevant Investment Portfolio	9
Comparison with GRDC investment landscape	10
3.2. Stakeholder Engagement	12
Grower workshops	12
Survey Responses	16
3.3. Horizontal and Vertical Collaboration key findings	21
Horizontal Collaboration	21
Vertical Collaboration	22
3.4. GHG emissions matrix of current vs stakeholder needs	22
4. CONCLUSIONS AND RECOMMENDATIONS	26
4.1. Key Findings	26
3.1. Priority Actions	26
APPENDICES	29
Appendix A.1. Workshops	29
Appendix B.1. Growers survey	30
Appendix B.2. Vertical collaboration survey	31
Appendix D. CFOP Training Package Contents and Resources	32
Appendix E.1. Output of first cross-RDC GHG Gap Analysis workshop	36
Appendix E.2. Output of second cross-RDC GHG Gap Analysis workshop	37
Appendix E.3. Summary of emerging themes in GHG information knowledge and delivery gaps for each RDC	39
Appendix E.4. Summary of December 3 Cotton Sustainability Roundtable	41

Executive Summary

Purpose and context

This report presents a gap analysis of greenhouse gas (GHG) emissions knowledge and information delivery for the Australian cotton industry. It has been undertaken to support Cotton RDC's (CRDC) role under the Australian Government's Carbon Farming Outreach Program (CFOP) in strengthening emissions capability across the industry at a time when expectations around climate disclosure and sustainability are increasing across global cotton supply chains. The gap analysis is diagnostic in nature, with the aim of identifying where current information and delivery mechanisms do not align with the needs of growers or downstream stakeholders.

Evidence base

The analysis is drawn on the following sources of evidence:

- Review of current CRDC investment portfolio
- Survey of cotton growers on current information use and preferences
- Regionally distributed workshops, field days, and demonstration activities
- Horizontal consultation across Research and Development Corporations
- Vertical consultation with brands, financiers, and policy stakeholders

With the exception of the investment portfolio review, the evidence underpinning this analysis is based on primary data collection and direct engagement. This approach ensured the findings reflect the lived experience, information needs, and emerging pressures facing growers, advisers, supply-chain actors, and policy stakeholders, rather than relying solely on secondary literature or desktop analysis.

What the evidence said

Cotton growers are at various stages of engagement with emissions. Interest is strongest in understanding where emissions occur on farm and how to quantify them, with demand focused on practical, step-by-step guidance rather than conceptual explanations. This suggests that most growers are at the initial stages of familiarity with emissions-related information.

Information delivery preferences are clear and consistent. Growers primarily access information online, but continue to rely on field days, demonstration sites and trusted advisers to interpret information and assess its relevance to local soils, climates and farming systems. In-person extension also enables peer-to-peer learning, which growers consistently value as a trusted and efficient way to share practical experience with those facing the same issues in the same conditions.

While relevant emissions information exists, it is fragmented, especially across emissions calculation tools which each provide different results, creating confusion and undermining confidence. Across both grower and supply-chain engagement, consistency of methods and assumptions emerged as more important than technical precision.

Downstream expectations are sharpening rapidly. Brands, financiers and policy stakeholders are increasingly aligned around the need for emissions data that are standardised, verifiable and suitable for disclosure and market-access purposes. These expectations are being driven by regulation and risk management rather than consumer price premiums.

Across RD&E investment and practice, emissions reduction is being pursued primarily through productivity and efficiency improvements, particularly nitrogen and energy management. Offset and market-based mechanisms remain secondary, higher-risk, and less relevant to most growers at this stage.

Emissions information is increasingly dependent on enabling systems beyond the farm gate. Traceability has emerged as a foundational requirement for credible emissions and sustainability claims, yet current approaches are costly, uneven and difficult to scale without coordinated action.

Finally, broader natural capital and biodiversity considerations are emerging alongside emissions. While growers show some interest in biodiversity, understanding of natural capital measurement and reporting remains in its infancy. Measurement costs, evolving policy settings, and uncertainty about future requirements are acting as barriers, even as downstream stakeholders increasingly view biodiversity and nature-related risk as part of the same sustainability and disclosure landscape as emissions.

What this means for the cotton industry

These findings indicate that the main constraint facing the cotton industry is not a lack of research or grower interest, but a lack of coordination, clarity, and confidence in the information being provided. Emissions data and sustainability information now function as industry infrastructure, underpinning market access and risk management. Grower engagement depends on information that is practical and regionally relevant. At the same time, enablers not directly related to cotton production such as traceability systems and advocacy in international policy settings, are increasingly required to shape outcomes alongside on-farm practice change.

The recommendations below have been developed directly from the evidence presented in this report and are intended to address the key gaps identified across information, delivery, and enabling systems for the cotton industry.

1. Establish a single, fit-for-purpose emissions measurement pathway for cotton.
2. Focus RD&E on productivity-led emissions outcomes.
3. Adopt an online-first extension model supported by place-based delivery.
4. Strengthen coordinated advocacy across the supply chain and policy settings.
5. Align industry messaging and marketing around credibility and continuous improvement.
6. Invest in adviser capability as a multiplier of impact.
7. Tailor extension to regional emissions literacy while developing foundational emissions knowledge
8. Support active monitoring of emerging biodiversity and natural capital developments, alongside low-cost and scalable measurement approaches.
9. Strengthen strategic engagement with banks and buyers to translate evolving requirements.

1. INTRODUCTION

Under the Australian Government's Carbon Farming Outreach Program (CFOP), Cotton RDC (CRDC) secured investment to deliver the project *Integrated Approaches to Building On-farm Emissions Knowledge: Gap Analysis*. CFOP is a six-year national program running from 2022-23 to 2027-28 designed to help farmers and land managers reduce emissions and sequester carbon by improving access to clear, consistent information and trusted advice on low-emission practices and technologies. As the Research and Development Corporation (RDC) for cotton, CRDC is well-placed to lead this work for its sector, given its institutional role in supporting leading research and best-practice adoption in Australian agriculture.

The Australian cotton industry has already developed a sustainability framework that recognises greenhouse gas emissions as one of several interconnected environmental risks and opportunities alongside water, soil health, biodiversity, productivity and economic resilience. Current evidence shows that the majority of cotton's emissions profile is driven by nitrogen fertiliser manufacture and use, as well as on-farm energy use, with material differences between irrigated and dryland systems and high sensitivity to seasonal conditions. At the same time, emissions data are increasingly required beyond the farm gate to support climate-related financial disclosures and market access. While the industry has made substantial progress in measuring and reporting emissions at an industry scale, translating this information into practical, consistent and grower-usable guidance remains a key challenge, particularly in an environment of evolving standards, methodologies and disclosure expectations.

To respond to these pressures, CRDC has initiated this cotton-specific gap analysis to identify what information already exists and where the key gaps are. It also seeks to determine how best to package and deliver emissions knowledge so that it is usable by growers and their trusted advisers, and credible for downstream supply-chain partners. The work will inform how cotton-specific materials feed into the Department of Agricultural, Fisheries and Forestry's (DAFF's) proposed national CFOP "knowledge bank", intended to provide a central, freely available point-of-truth for emissions reduction and sequestration information across commodities.

The objectives of the project are to:

- Identify current gaps in publicly available and accessible, cotton-specific information relating to emissions reduction, emissions intensity and carbon sequestration at the farm level.
- Determine the most appropriate and functional formats and delivery channels for cotton-specific information, including how it should be organised within the proposed national knowledge bank.
- Assess opportunities for horizontal collaboration with other RDCs and commodity groups, and vertical collaboration along the cotton supply chain to address information gaps efficiently, avoid duplication, and ensure consistency with broader CFOP and Environmental Accounting Platform (EAP) developments.

These insights will help guide future sustainability RD&E investments in cotton and ensure that cotton's on-farm emissions information keeps pace with international policy, finance and market expectations.

This report documents the execution and findings of the cotton GHG emissions gap analysis. Section 2 outlines the methodology, including desktop review, grower and adviser engagement, roundtable activities, and cross-RDC collaboration. Section 3 presents the main findings on existing information, key gaps and stakeholder needs across the core CFOP themes. Section 4 translates these findings into recommendations, followed by supporting appendices.

2. METHODOLOGY

The methodology for this gap analysis follows the multi-layered approach set out in the CFOP Grant Opportunity Guidelines. It brings together four core components: (1) a desktop review of cotton-relevant emissions materials, (2) stakeholder engagement with growers and advisers, (3) vertical consultation with supply-chain partners, and (4) horizontal coordination with other Rural Research and Development Corporations (RDCs). This combined approach allows the project to identify gaps in existing cotton emissions information, understand the needs of its end-users, and ensure alignment with whole-of-sector initiatives.

2.1. Investment Portfolio Analysis

The aim of the investment portfolio analysis was to understand how existing CRDC and Grains Research and Development Corporation (GRDC) investments contribute to on-farm GHG emissions outcomes, and to identify areas of alignment where collaboration could lead to mutual benefits. Grains were included in the analysis because they are a key rotational component of most cotton farming systems, exposing cotton growers to RD&E investments made through both CRDC and GRDC. The analysis focused on the intent and functional contribution of investments rather than on project performance or impact.

The analysis was based on a structured review of existing investment documentation, including:

- CRDC Strategic Plan
- CRDC confirmed projects from Spotlight 2023, 2024 and 2025
- CRDC planned projects from Spotlight 2025
- GRDC RD&E Plan
- GRDC Sustainability Initiative from May 2023
- GRDC confirmed relevant projects

Only investments with a clear or plausible link to on-farm emissions outcomes were included. This included projects that directly addressed emissions, as well as those where emissions reduction was an indirect outcome.

Rather than categorising investments according to their formal investment area, program, or project code, investments were classified according to their primary emissions-related function. This functional approach was used to allow meaningful comparisons with GRDC investments.

For each RDC, investments were synthesised at the portfolio level to identify where investment effort is concentrated. The analysis also examined the extent to which emissions outcomes are pursued directly or delivered as a co-benefit of other investment objectives. In addition, areas of relative strength relevant to emissions outcomes were identified.

A comparative analysis was then undertaken to assess similarities and differences between the CRDC and GRDC portfolios. This focused on identifying common areas of investment, sector-specific differences arising from production systems or market exposure, and potential areas of duplication or opportunities for coordination across commodities.

2.2. Grower and Adviser Engagement

Grower and adviser engagement is a central pillar of the methodology, ensuring that the gap analysis reflects knowledge needs, on-farm decisions drivers, and practical barriers to action experienced directly by industry participants.

Engagement included:

- Cotton Carbon Tour workshops delivered across key growing regions. These sessions explored growers' and advisers' baseline GHG literacy, their motivations for emissions information, perceptions of emissions and sequestration opportunities, and preferences for content and delivery formats.
- Facilitated group discussions, where participants were asked about their interest in emissions accounting, their understanding of the link between yield and emissions intensity, and their familiarity with available mitigation options.
- Structured notetaking and synthesis, ensuring that insights from each location were captured consistently.

2.3. Vertical Supply-Chain Collaboration

Vertical engagement targeted organisations and stakeholders operating beyond the farm gate, including brands, retailers, sustainability platforms, and supply-chain participants who use Australian cotton emissions information for reporting,

procurement, and strategic decision-making. This component of the methodology consisted of three structured activities: targeted interviews, the Australian Cotton Sustainability Reference Group (ACSRG) meeting, and the Cotton Sustainability Roundtable.

Targeted interviews with post-farmgate organisations

Cotton Australia identified ten priority organisations that either purchase Australian cotton or significantly influence its market positioning. Of these, five agreed to participate in interviews: Hanes, ELK the Label, Caprice, Country Road, and Textile Exchange. Given these organisations are not involved in cotton production, interviews were designed to determine what attributes cotton GHG emissions data must have to be fit for purpose for downstream users. Interview questions centred on data requirements, reporting standards, assurance needs, and compatibility with existing sustainability frameworks.

Australian Cotton Sustainability Reference Group (ACSRG)

Vertical perspectives were further tested during the ACSRG meeting in November 2025. At this meeting, the three emerging themes from horizontal stakeholder engagement were presented to supply-chain representatives, and feedback was sought on whether these themes aligned with industry expectations for cotton GHG emissions reduction and reporting. This process provided an additional validation step across a broad group of vertically connected stakeholders.

Cotton Sustainability Roundtable

A dedicated Cotton Sustainability Roundtable was convened in December 2025, bringing together major organisations involved in cotton sustainability, including industry bodies, researchers, financiers, brands, and retailers. Presentations and facilitated discussions were used to elicit stakeholder expectations for cotton sustainability information and to understand how emissions data would be applied within supply-chain decision-making. Presentations covered:

- global sustainability and trade policy settings,
- regulatory and market access requirements for natural fibres, particularly in the EU,
- climate-disclosure and sustainable finance expectations,
- retail consumer preferences for sustainability,
- industry engagement, grower incentives and adoption, and
- future farming systems, in particular the use of digital technology to improve input use efficiency.

Insights from the Roundtable were incorporated into the vertical engagement process to ensure the gap analysis reflected collective value-chain perspectives.

2.4. Horizontal Cross-RDC Collaboration

To identify opportunities for horizontal collaboration across Rural Research and Development Corporations (RDCs), the project team initiated and chaired a series of cross-sector workshops. The process for horizontal collaboration consisted of two meetings with the aim of:

- initiating and facilitating cross-RDC workshops,
- gathering insights on emerging needs,
- synthesising common challenges, and
- refining cross-sector themes with input from government and national program partners.

The first meeting, held on 7 October 2025, brought together all RDCs undertaking a Gap Analysis under CFOP. The purpose of this session was to enable each RDC to share the status of its member consultations and the emerging needs and gaps identified within each commodity. This collective sharing was designed to uncover common challenges and potential areas for collaboration across sectors.

A second meeting, held on 13 November 2025, was initiated to refine the initial themes by capturing any new insights from RDCs following further grower engagement. In addition to RDC representatives, the meeting included other horizontal stakeholders, namely DAFF, the Department of Climate Change, Energy, the Environment and Water (DCCEEW); Agriculture Victoria; the CRC for Zero Net Emissions in Agriculture / CFOP, and Agriculture Innovation Australia (AIA). These stakeholders were invited specifically to help stress-test and strengthen the emerging themes.

3. FINDINGS

3.1. CRDC Emissions-Relevant Investment Portfolio

A review of CRDC projects indicates that investments are occurring in a range of activities that are relevant to on-farm GHG emissions, either directly or indirectly. Overall, the portfolio reflects CRDC's traditional strength in funding applied research and development that delivers productivity and profitability outcomes for growers, with emissions impacts embedded within these broader goals.

To better understand how the current portfolio contributes to emissions outcomes, projects were reviewed and classified according to their primary emissions-related function, rather than their formal investment area or project title. Table 1 below shows where investments are currently concentrated.

Table 1. Mapping of CRDC investments to emissions-related functions

Emissions-related function	Relevant investments
Mitigation through efficiency	- Nitrogen use efficiency and fertiliser optimisation projects across irrigated and dryland production systems. - Projects focused on improved nutrient management, crop response functions, and economically optimal nitrogen rates. - Research into enhanced efficiency fertilisers (EEFs) and nitrogen loss pathways. - Technologies and systems to enhance resource efficiency under future climates, including cover cropping, soil polymers, plant hormones and synthetic biology. - Yield stability and agronomic optimisation projects aimed at reducing variability-driven over-application of inputs.
Enabling systems and decision support	- Data and analytics projects supporting agronomic decision-making. - Production modelling and systems analysis projects designed to improve input efficiency and production planning. - Digital tools and platforms supporting whole-farm management and performance tracking. - Leadership of industry data standardisation and sharing initiatives. - Deployment of best-practice data sharing and privacy agreements for industry use. - Automated on-farm data collection solutions through strategic partnerships and shared-value models.
Adaptation and resilience	- Development of integrated cotton, grain and cattle farming system programs for Northern Australia. - Research focused on strengthening system resilience to climate variability. - Investments in irrigation performance and water-use efficiency.
Value-chain reporting and market requirements	- Engagement with global sustainability forums to influence definitions of sustainable cotton production. - Ongoing memberships and participation in initiatives such as Better Cotton Initiative, Textile Exchange, Cascale/Sustainable Apparel Coalition, SAI and Zero Net Emissions CRC. - Work to ensure myBMP meets the needs of growers, brands, retailers, communities and investors. - Investments in sustainability reporting, life-cycle assessment critique, recyclability and durability, and integration of supply-chain information needs into industry data systems.
Social licence	- Community trust in cotton and rural industries initiatives. - Sustainability communication and industry engagement support. - Human rights risk assessment for the Australian cotton industry.

	Assessment of socio-economic resilience in rural and regional communities.
Natural capital	- Development of better data to show how cotton farms create, preserve or erode natural capital value over time. - Collaboration with NRM bodies to align industry sustainability targets and indicators with regional NRM plans. - Identification of pesticide and nitrogen movement pathways and mitigation strategies.
Measurement	Carbon and biodiversity benchmarking in native vegetation on cotton farms.

The classification in Table 1 highlights several areas where the current CRDC investment portfolio demonstrates strengths in supporting emissions-relevant outcomes.

- Emissions reduction embedded within productivity-focused R&D.** Investment is strongly concentrated in agronomy, input use efficiency and yield optimisation, particularly through nitrogen management and system performance. This reflects a consistent approach in which emissions outcomes are delivered as a co-benefit of improved productivity, profitability and risk management rather than as a standalone objective.
- Depth of investment in enabling systems and data capability.** The portfolio shows a clear strength in data, analytics and decision-support systems, including leadership in data standardisation and data sharing. These investments provide a robust foundation for improving the quality and consistency of information that underpins emissions reduction decision-making.
- Established engagement across the value-chain.** Ongoing participation in global sustainability initiatives and reporting frameworks positions the cotton industry to respond to evolving market expectations. Investment in myBMP, sustainability reporting and life-cycle assessment-related work supports alignment between on-farm practices and downstream information needs.
- Broader incorporation of natural capital and social licence.** The portfolio integrates emissions-relevant work within a wider sustainability context, including natural capital, social licence, community trust and socio-economic resilience. This breadth strengthens the credibility of emissions outcomes by situating them within broader environmental and social performance frameworks.

Comparison with GRDC investment landscape

A review of the GRDC RD&E Plan and associated sustainability initiatives indicates that emissions-relevant investments are embedded across a broad range of grains research priorities. As with cotton, relatively few projects are framed explicitly around emissions reduction or sequestration as a primary objective. Instead, emissions outcomes are largely pursued through improvements in resource-use efficiency, system performance and resilience.

Table 2. Mapping of GRDC investments to emissions-related functions

Emissions-related function	Relevant investments
Mitigation through efficiency	- Low Emissions Intensity Farming Systems (LEIFS). - Enhanced efficiency nitrogen fertilisers in the grains industry to reduce GHG emissions and improve nitrogen use efficiency. - Predicting nitrogen cycling and losses in Australian cropping systems to enhance modelling and decision-making. - Quantifying greenhouse gas emissions from decomposition of crop residues. - Productivity-focused farming systems research where emissions reductions occur through improved input efficiency.
Soil carbon and sequestration	- Options to increase soil organic carbon in grain production systems. - Farming systems research addressing soil constraints, rotations and residue management with implications for carbon storage.
Measurement	- Updating grains sector greenhouse gas accounting and life-cycle assessments. - Modelling and analytics investments supporting emissions estimation, scenario

	analysis and system trade-offs. • Integration of emissions measurement within broader system modelling.
Adaptation and resilience	• Whole-of-system farming systems research addressing climate variability, drought and heat stress. • Investments in risk management, yield stability and systems resilience that indirectly reduce emissions intensity.
Natural capital	• Opportunity analysis for enhancing biodiversity and valuing natural capital. • Ecosystem services – markets and opportunities for Australian grain growers. • Broader research into landscape-scale outcomes and co-benefits beyond carbon.
Value chain reporting and market requirements	• Life-cycle assessment and emissions accounting updates to support market and reporting requirements. • Exploration of biodiversity and ecosystem service markets relevant to grains value chains.

A comparison of the CRDC and GRDC investment portfolios shows strong alignment in overall intent and approach, alongside important differences in emphasis that reflect the structure, maturity and market context of each sector.

Similarities across the investments include:

- **Emissions reduction as a co-benefit of productivity and efficiency.** Emissions reduction is treated as a consequence of better agronomic decision-making rather than as an end in itself.
- **Strong emphasis on nitrogen management.** Both portfolios place significant weight on understanding nitrogen cycling, losses and fertiliser efficiency, recognising nitrogen as a major driver of on-farm emissions and profitability.
- **Systems-based and resilience-focused research.** Both portfolios demonstrate a strong commitment to integrated farming systems research, including responses to climate variability, drought and heat stress. The systems focus supports emissions outcomes by reducing inefficiencies associated with risk-driven input use and production volatility.
- **Growing attention to natural capital and biodiversity.** While still emerging, both sectors are investing in natural capital, biodiversity and ecosystem services, signalling recognition that emissions performance sits within a broader environmental and market context.

The portfolios diverge in several important ways, reflecting the characteristics of each industry.

- **Market and value-chain orientation.** The cotton portfolio places substantially greater emphasis on engagement with global sustainability frameworks, downstream brands and value-chain reporting requirements. In contrast, the grains portfolio is more heavily oriented toward production systems, with less focus on brand-driven sustainability reporting.
- **Emissions measurement and accounting maturity.** GRDC investments show a more explicit and technical focus on emissions measurement, modelling and life-cycle assessment within the production system, including dedicated projects on greenhouse gas accounting, crop residue emissions and soil carbon dynamics.
- **Data systems.** CRDC demonstrates a stronger emphasis on industry-level data governance, standardisation, privacy and trusted data sharing across the value chain. These investments reflect the need to support credible, auditable sustainability claims in global markets.

This comparative analysis highlights several areas where investment objectives overlap across cotton and grains, suggesting benefits from coordination.

- **Nitrogen use efficiency and fertiliser-related emissions.** Both portfolios include substantial investment in nitrogen cycling, losses, enhanced efficiency fertilisers and decision frameworks.
- **Emissions measurement and accounting methodologies.** Both sectors are investing in greenhouse gas accounting, benchmarking and emissions modelling. Without coordination, there is a risk of parallel development of methods, assumptions or tools that could otherwise be shared or harmonised across commodities. While this has

been a concern, a standardised approach is being developed through the Voluntary Emissions Estimation and Reporting Standards (VEERGs). There is also work underway to improve the consistency of greenhouse gas calculators, and several calculators are available that use the current national standard (GAF Tools).

- **Natural capital research.** Investments in soil carbon, biodiversity and ecosystem services appear in both portfolios. These areas face common challenges around measurement, permanence, additionality and valuation that are not commodity specific.
- **Extension efforts and resourcing across RD&E investments.** While the analysis has identified R&D clearly, the extension component of emissions-related investments is not explicit across both investment portfolios. As a result, it is difficult to assess the resourcing and form of extension associated with the investments. Further investigation is required to clarify extension capability and confirm where gaps may exist.

3.2. Stakeholder Engagement

Grower workshops

A total of fourteen in-person workshops were delivered across key cotton-growing regions, involving several hundred growers, advisers and industry stakeholders. A synthesis of the qualitative findings from these engagement sessions is presented in Table 3, organised per workshop location.

Across the fourteen locations, baseline carbon literacy was generally very low to low, with only Moree, Narrabri and Goondiwindi demonstrating high literacy. Regions were categorised based on growers' ability to:

- interpret concepts such as sequestration, scope 1-3 emissions, and carbon mechanisms, and
- engage confidently with calculators, datasets, or sustainability frameworks.

In low-literacy regions, growers were typically encountering emissions concepts for the first time. Participants were often unsure where emissions occurred on farm, unfamiliar with calculators or data requirements, and uncertain about nitrogen's role in emissions intensity. Many also expressed confusion about sequestration rates, biodiversity metrics and the relevance of bank or buyer reporting expectations.

In high-literacy regions, growers had greater exposure to sustainability programs due to the presence of large corporate farming businesses, active banks and carbon project developers. These groups were more familiar with emissions assessments, nitrogen management implications and vegetation or soil carbon methodologies. However, even among these high-literacy participants, there remained significant confusion about key assumptions into carbon calculations and what specific information supply-chain actors will require in future.

Participants across nearly all workshops requested simple, practical guidance on how to undertake a farm-level GHG assessment. Questions commonly focused on nitrogen use efficiency, the relationship between emissions intensity and yield, the role of native vegetation and riparian zones, and the implications of emerging reporting needs from vertical supply chain actors. Interest in biodiversity and natural capital was consistently strong, though many growers were uncertain about how these concepts integrate with carbon accounting or market opportunities.

Engagement levels were generally high, with many regions requesting follow-up workshops, one-on-one support, slide decks, or links to online assessment tools. Overall, the workshops revealed a clear need for trusted, independent, farm-relevant information, delivered locally and supported by trained advisers who can help growers navigate emissions concepts and apply them in practice.

Table 3. Summary of workshop insights from each location

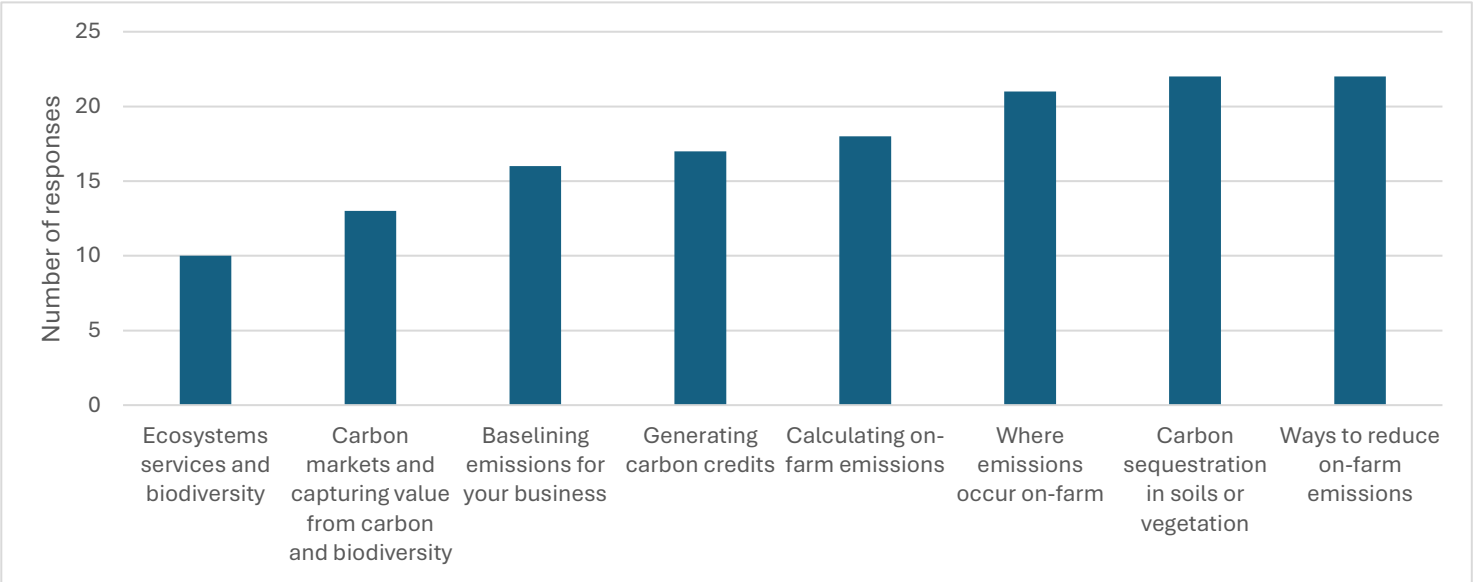
Location	Understanding & carbon literacy	Knowledge gaps	Other notes
Emerald	Very low	- Which tools/calculators should we use? - Need for independent research from RDCs, CSIRO and other non-commercial scientific bodies. - Broad questions on irrigation and broadacre emissions.	- Highly engaged with many taking photos and following up requesting slides. - Minimal bank and carbon developer activity.
Banana	Very low	- Overwhelmed by the volume of new information. - Interest in enhanced efficiency fertiliser. - Questions about nitrogen's role in emissions. - Confusion about Ruminati (carbon accounting platform) use.	- Very enthusiastic group. - Robust post-session discussion. - Limited QR code for survey uptake. - Slides requested.
Nevertire	Very low	- Questions about sustainability schemes and declarations. - Carbon system basics. - Interest in on-farm green nitrogen	- Link made to the previous workshop. - Grower seeking independent review of green nitrogen plant.
Condobolin	Very low	- Whole-of-system questions including livestock interactions. - Need for broader carbon knowledge.	- Very long evening event (4 hrs.). - Region considered an extension "gap". - High enthusiasm and engagement.
Blighty	Low	- Livestock vs cropping emissions. - Nitrogen use and nitrogen-use-efficiency. - Solar integration for irrigation. - Scope 3 numbers banks are looking for.	- Requests for green nitrogen analysis. - Interest in renewable irrigation options. - Slides requested.
Griffith	Low	- What is there are no non-cropped areas? - Scope 3 requirements.	- Request for AIA tool "how-to" video. - Interest in improving footprint vs carbon neutrality.
Moree	High	- Crop-type sequestration data. - Biomass assumptions. - Tree density impacts. - Riparian offset potential. - Bank Scope 3 numbers.	- Corporate-grower presence increases literacy. - Active carbon developers and banks. - High engagement with sensitivity of sequestration results in changes in parameters.

Narrabri	High	• EEF effectiveness. • Carbon neutrality vs footprint improvement. • Interest in green nitrogen. • Biodiversity quantification questions.	• Very long event (5.5 hrs.). • Heavy interest in biodiversity slides. • Active bank/developer presence.
Walgett	Medium	• Biodiversity opportunities. • EEFs and nitrate mobility. • Native vegetation sequestration assumptions and plant densities.	• Concern about cotton's social licence. • Interest in western biodiversity opportunities.
Gunnedah	Low	• Need for follow-up sessions. • Certification scheme requirements. • Basic carbon literacy questions	• Low attendance due to rain. • Mild bank and developer engagement.
St George	Mixed	• Online GHG assessment support. • Forest and riparian sequestration. • Scope 3 relevance for buyers.	• High interest where native veg abundant. • One grower exploring premium negotiations using emissions intensity data.
Goondiwindi	High	• Biodiversity data needs. • Sequestration yield questions. • Desire for deeper analysis. • Interesting Biodiversity Conservation Trust pathways.	• Very long session (6 hrs). • Concerns about carbon projects unravelling. • Strong interest in logging flora and fauna for stewardship claims.
Dalby	Low	• How to complete a farm GHG assessment. • Which calculators to use. • Irrigated vs dryland emissions intensity differences. • Scope 3 emissions for nitrogen.	• The QR code is unfamiliar to some. • Good industry turnout.
Kununurra	Very low	• How to use calculators. • Optimal planting window for emissions intensity. • Nitrogen management questions.	• Gravity-fed irrigation = low energy use. • Hydro-powered gin. • Awareness of local carbon-farming project bankruptcy. • 35 attendees, indicating strong interest.

Survey Responses

The results presented below are based on 46 digital survey responses collected from workshop participants. This represents a relatively low conversion rate compared to the 335 in-person attendees across workshops. As a result, the survey findings should be interpreted alongside qualitative insights gathered through in-person workshops and facilitated discussions. Taken together, these sources provide a more robust picture of grower understanding. The experience suggests that data collection is best achieved through a combination of paper-based surveys to accommodate for those with lower digital literacy levels, supported by digital tools to capture feedback from non-attendees.

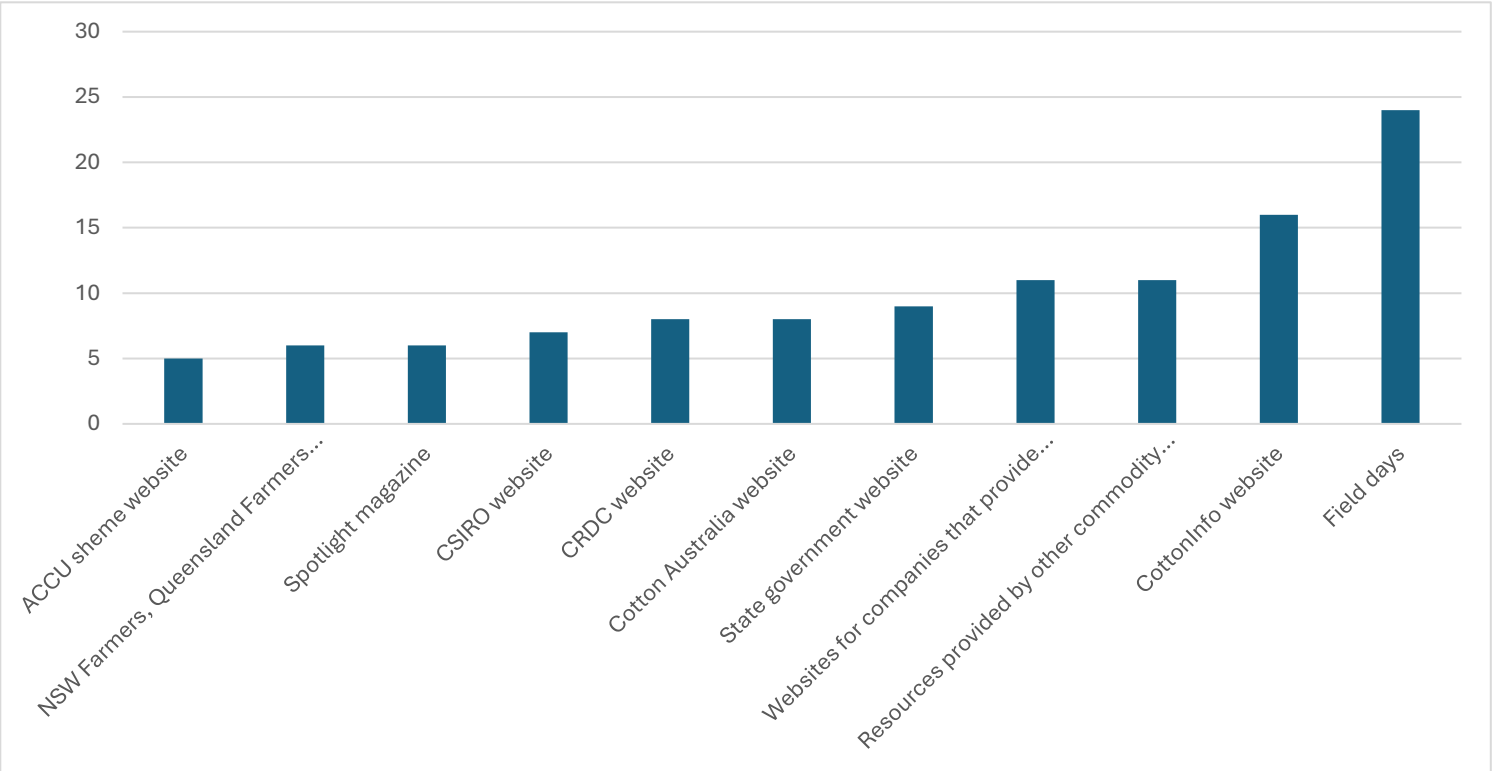
Q1. Prior to today, had you obtained information on any of the topics below for cotton production systems?



Most respondents had obtained information on more than one topic. Two-thirds of growers selected multiple categories, with an average of three topics per respondent. This suggests that while awareness is not consistently deep, many growers have begun exploring emissions-related information from multiple angles. Approximately 10% of respondents did not answer the question, which likely reflects having no prior exposure to GHG or carbon-related content.

Knowledge is strongest in practical emissions topics including where emissions occur, carbon sequestration and ways to reduce emissions. Awareness is the lowest for broader environmental and market concepts, including ecosystem services and carbon markets. This signals a clear capability gap: growers understand operational emissions topics more readily than market-based mechanisms and environmental co-benefits.

Q2. Where do you go to find information about the topics listed in question 1?

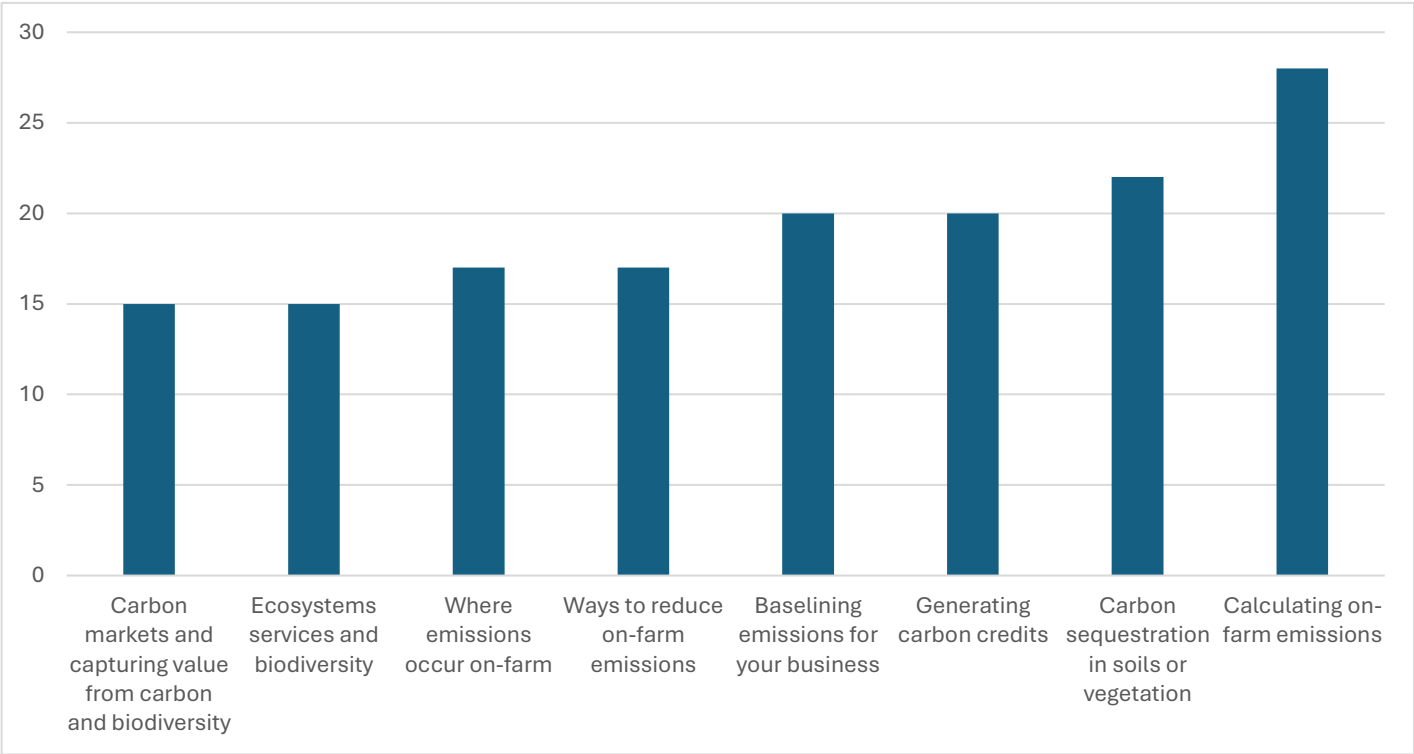


Nearly all respondents (all but three) listed at least one information source, indicating broad engagement with emissions content across the industry. A small number of sources (Google, known networks, Better Cotton, university training, and banks) were only selected once, signaling they are not widely used for emissions information.

Field days are the dominant source of information, with more than half of respondents selecting them. This underscores the value growers place on face-to-face, practical, and regionally contextualised information.

CottonInfo, Cotton Australia, and CRDC form the core industry-related channels. These entities represent the most influential levers for delivering content. Cross-commodity resources (MLA, GRDC, GrainGrowers) and commercial providers also feature, reflecting the mixed enterprise structure of most cotton farms. Government sources are used moderately.

Q3. Which topics would you like more information on?

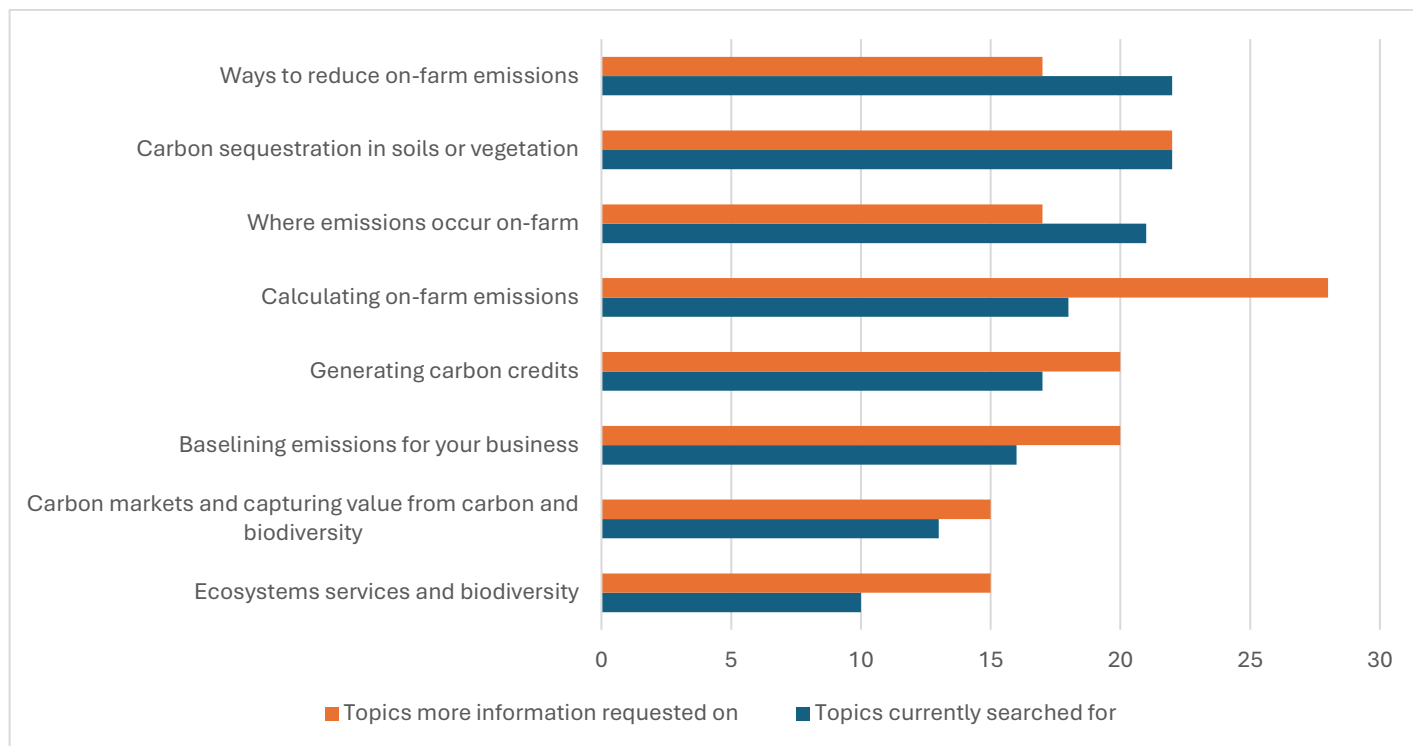


Calculating on-farm emissions is the highest-demand topic, significantly above all others. This indicates growers are most interested in building foundational capability in quantifying their emissions profile before engaging with reduction strategies or market opportunities. Strong demand also exists for baseline emissions, generating carbon credits, and carbon sequestration. These reflect growers’ interest in both measurement and value pathways, suggesting they want clarity on what is required to participate credibly in carbon-related programs.

Notably, the relative ordering of topics is similar to Q1: interest is highest in operational, on-farm emissions concepts and lowest in market-facing or biodiversity-linked mechanisms. This consistency reinforces the developmental stage of GHG understanding across the cotton sector.

The spread of responses reflects a broad appetite for information across the emissions spectrum. Even the lowest-scoring topics still received 15 responses, signaling there are no areas of clear disinterest.

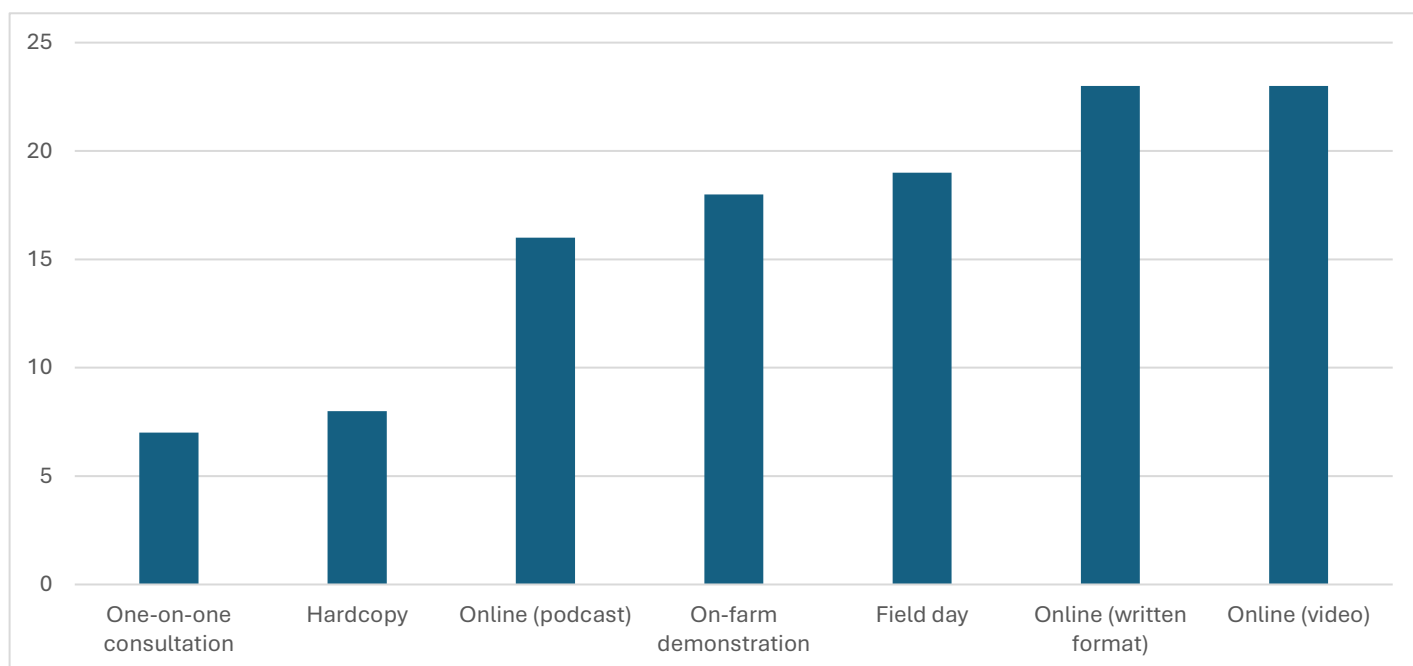
The figure on the next page compares the results for Q1 and Q3 to identify any knowledge gaps.



Only two topics showed lower demand for future information than their current search frequency, indicating that broadly growers want more information than they currently have access to actively seek out.

The largest gap is in calculating on-farm emissions, which had 18 respondents reporting prior exposure and 28 respondents requesting more information. This difference highlights a significant capability of need. The next largest gaps were baselining emissions and ecosystem services and biodiversity.

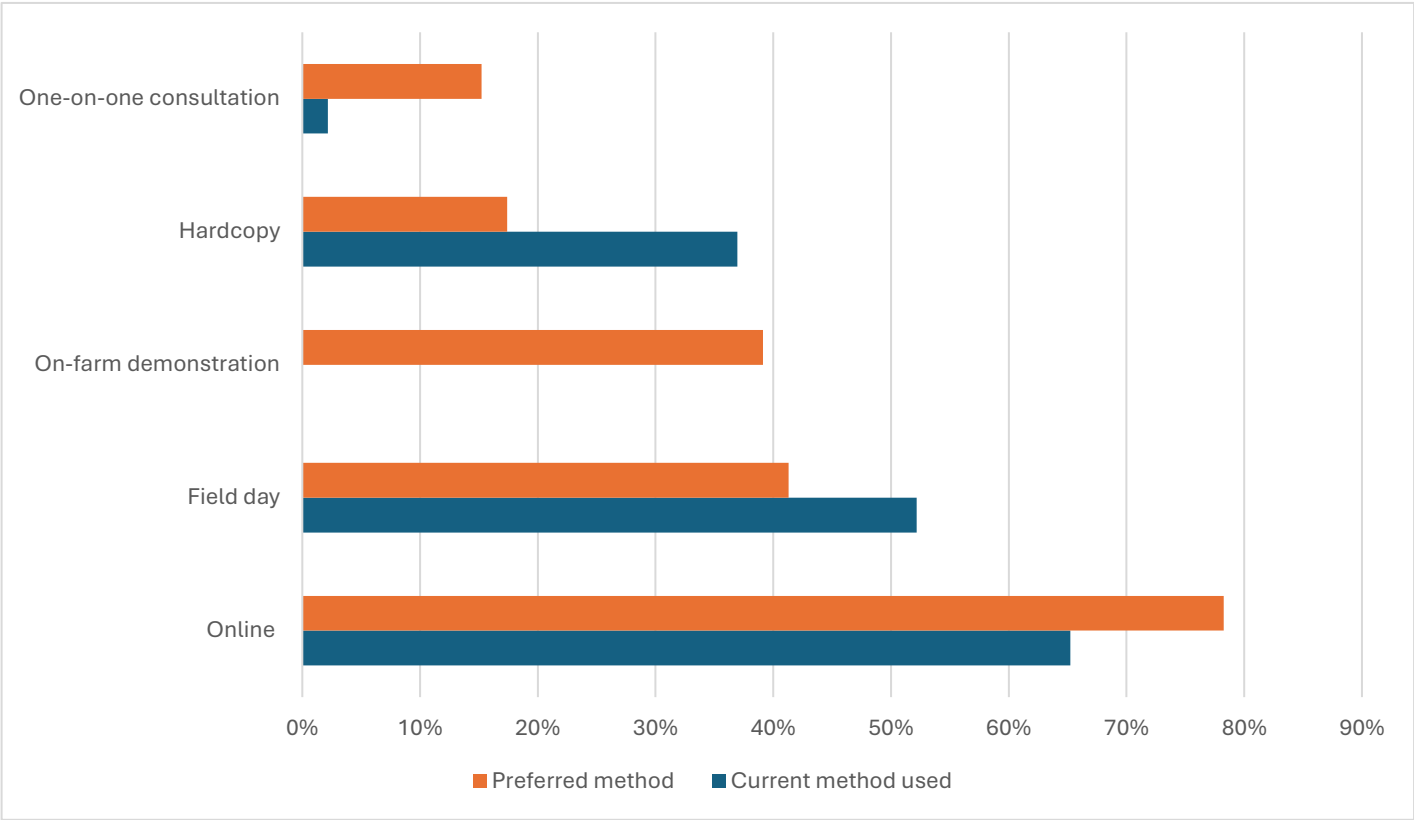
Q4. How would you prefer information on GHG emissions and carbon to be delivered?



Online formats dominate overall preference. The three online categories of podcast, written, and video total 62 selections when combined, with 36 respondents choosing at least one online option.

Field days and on-farm demonstrations remain highly valued, closely matching the results in Q2, where field days were the most commonly used information source.

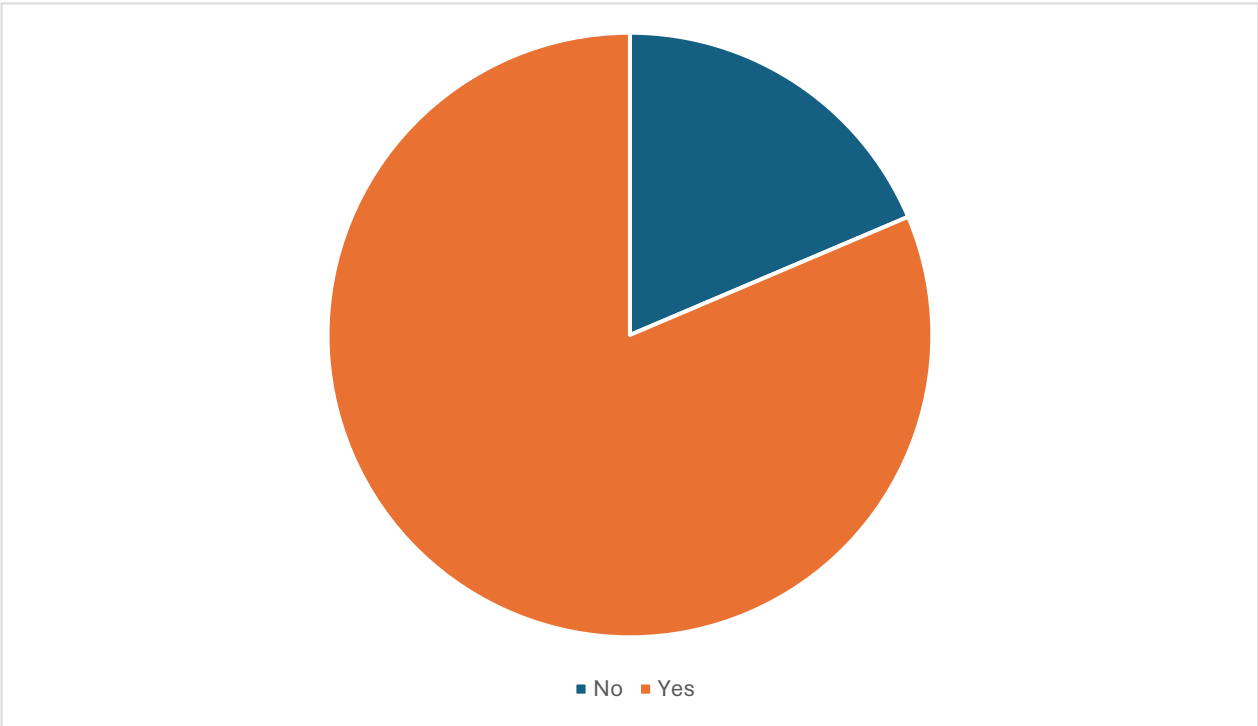
To understand how growers want information delivered, and how this differs from how they currently access it, the responses from Q2 (current information sources) and Q4 (preferred delivery methods) were aggregated into comparable categories.



Online delivery shows the largest positive gap, meaning growers want significantly more online content than they currently utilise.

Hardcopy is clearly not valued as a current or preferred method. Preference for hardcopy (8 responses) is low, and its current-use counterpart in Q2 (Spotlight magazine, printed materials) is also minimal. This suggests printed formats should be deprioritised in future extension planning.

Q5. Would you like information on GHG emissions and carbon to be applicable to your broader farming system?



A clear majority of respondents (35 out of 43) indicated that they want GHG and carbon information to apply not only to cotton but to their broader farming system. This reflects the reality that most cotton enterprises operate as mixed farming systems, integrating crops such as wheat, sorghum, and chickpeas, as well as livestock enterprises. The result also signals that extension resources, tools, and emissions calculators developed for the cotton industry will be most impactful if they reflect systems interactions and support decision-making at the whole-farm scale.

3.3. Horizontal and Vertical Collaboration key findings

Horizontal Collaboration

Three clear, cross-sector collaboration themes emerged from the two RDC workshops. The horizontal collaboration process revealed strong alignment across sectors: similar challenges, similar literacy barriers, and similar needs for foundational knowledge, trusted calculators, and capable advisers. The three themes of Measurement, Knowledge and Delivery, represent areas where coordinated national action would significantly enhance the effectiveness, credibility and consistency of emissions extension activities across Australian agriculture.

1. Measurement

There was strong consensus that growers face confusion due to multiple calculators, inconsistent emissions factors, and varying levels of methodological transparency. Participants recognised that measurement consistency is foundational for credibility and essential for growers who operate multi-commodity businesses. Stakeholders noted the need for:

- A nationally aligned calculator methodology, so that growers who operate mixed farming systems receive consistent answers regardless of the RDC or calculator they use.
- Standardised emissions factors, ideally through the AIA Environmental Accounting Platform (EAP), so that nitrogen, fuel and sequestration factors are consistent across regions and commodities.
- Increased transparency in calculator assumptions, including system boundaries, data sources, treatment of sequestration and the handling of mixed-farming systems.
- Verifiable data produced by calculators, enabling growers to meet emerging audit and disclosure requirements without rework.

2. Knowledge

Growers are generally at the early stages of their emissions learning journey, and most require clear, foundational information before engaging with more detailed or technical content. Discussions highlighted the need for:

- A shared “GHG 101” foundational resource that all commodities can use, ensuring growers receive consistent explanations of emissions, sequestration, scope 1-3 concepts and the purpose of GHG accounting. This will ensure simple and accessible messaging is provided initially, with highly technical material reserved for later stages.
- Compelling messaging on the “why”, framing the benefits in terms relevant to growers such as cost savings, input efficiency, market access and future compliance requirements.
- Practical examples and case studies show how emissions information translates into farm decisions, input management and productivity improvements.
- Coordinated messaging across commodities, particularly in mixed-farming regions, to avoid contradicting advice that can undermine grower confidence.
- Clear explanations of emerging supply-chain requirements, including why brands and banks are beginning to ask for emissions information and how growers can respond proactively.

3. Delivery

There was unanimous agreement that effective delivery hinges on the presence of trusted intermediaries. Most growers prefer learning through local, face-to-face engagement, and rely on advisers to interpret emissions concepts in practical, farm-specific terms. Key points raised included:

- Adviser capability is a critical bottleneck, with many agronomists, consultants and service providers lacking confidence in emissions, sequestration and carbon market topics.
- Shared adviser training across RDCs could rapidly lift capability and ensure advisers present consistent information across commodities, reducing confusion for growers.
- Growers overwhelmingly prefer face-to-face, place-based learning, delivered through trusted intermediaries rather than online modules or self-directed learning.
- Shared delivery models across commodities would allow RDCs to bundle training, reduce duplication and maximise

reach.

- Coordinated extension materials and templates would allow advisers to provide follow-up support after workshops, reinforcing learning and improving adoption pathways.

Vertical Collaboration

Vertical engagement showed clear alignment across interviews, ACSRG and the Roundtable. Downstream users require standardised, transparent and verifiable emissions data. Market and finance drivers of sustainability are accelerating, and biodiversity and nature performance are becoming part of this broader sustainability landscape in addition to emissions. Together, these insights reinforce the need for coordinated action across measurement, messaging, delivery and broader environmental reporting to maintain market access and competitiveness.

1. Emissions data requirements must meet existing standards

All interviewed companies emphasised that cotton emissions data will be increasingly used in formal, audited climate-related financial disclosures. As such, downstream users highlighted the need for:

- Full alignment with the Australian Accounting Standards Board's climate-related financial disclosure standards. Any data inconsistent with these standards cannot be incorporated into corporate reporting.
- A single, industry-wide emissions factors for Australian cotton, updated annually to support fibre comparisons and procurement decisions.
- Clear documentation of system boundaries, data sources and calculation methods so that emissions claims can be defended in regulatory or investor scrutiny.

2. Market and finance pressures are rapidly increasing

Vertical stakeholders described strong and increasing commercial pressures that shape what cotton must demonstrate to remain competitive. Stakeholders highlighted:

- Tightening EU sustainability and trade requirements, including deforestation-free rules, due-diligence obligations, supply-chain transparency and fibre-level emissions disclosures.
- Banks incorporating emissions data into lending, meaning growers will need credible emissions numbers for loan assessments or sustainability-linked finance.
- Emerging international disclosure systems such as Digital Product Passports, which will require richer, more traceable and more defensible environmental data.

3. Nature and biodiversity are emerging as important for broader environmental performance

Insights from the Cotton Sustainability Roundtable in particular showed that downstream actors are beginning to look at broader environmental performance, not just emissions reductions. Roundtable sessions focused on:

- The Taskforce for Nature-related Financial Disclosures (TNFD) will require businesses to report dependencies and impacts on nature alongside emissions.
- Integration of emissions with broader sustainability metrics, reflecting how retailers and brands now consider water, biodiversity, soil condition and climate risk together in sourcing decisions.

3.4. GHG emissions matrix of current vs stakeholder needs

Table 4 presents a matrix of GHG emissions current information vs. stakeholder needs. It shows the priority level and recommended actions for the industry to address each gap.

Table 4. Matrix of current stakeholder knowledge against knowledge needs for the Australian cotton industry

Category/ Priority	Current Knowledge Status	Stakeholder Needs	Identified Gaps	Recommended Actions
Emissions measurement tools and data systems Very High Priority	Multiple tools exist to estimate farm-level emissions, but uptake is uneven and confidence is low. Growers report uncertainty over which tools to use and concern about being “locked in” to early methodologies. Data requirements and boundaries (LCA vs GHG accounting) are poorly understood.	Growers want a tool that is simple, low-cost, voluntary, and useful for decision-making. Brands and banks require standardised, verifiable data that meets audit and disclosure requirements, ideally without increasing grower reporting burden.	• Fragmentation across calculators and methodologies. • Lack of automation and remote data sourcing. • Mismatch between grower usability and value-chain requirements. • Privacy concerns around farm-level data.	• Support the work of ZNE CRC into emissions calculator standards and guidelines, to then assist with the development and promotion of a single fit-for-purpose calculator for cotton. • Allow voluntary farm-level refinement only where benefits are clear. • Clearly communicate data ownership, privacy, and use limitations. • Work is underway to standardise tools through VEERGS • Resources and info can be found here
Extension and delivery Very High Priority	Face-to-face, independent extension is consistently preferred by growers. Knowledge levels vary widely by region, with some growers highly engaged and others starting from a very low base. Survey results indicate that growers already access emissions and sustainability information through a mix of online sources and in-person channels.	Growers are seeking practical, on-demand information that can be accessed online, complemented by periodic face-to-face engagement to contextualise information and build confidence. There is also clear demand for information that applies to the whole farming system, rather than cotton in isolation.	• Adviser capability varies. • The largest knowledge gap relates to calculating on-farm emissions, followed by emissions baselining and ecosystem services/biodiversity. • Limited “how-to” guidance that bridges calculators, interpretation, and management action.	• Prioritise online delivery as the default, supported by face-to-face workshops for context, discussion, and confidence-building. • Focus content development on the highest-identified gaps: calculating emissions, baselining, and understanding where emissions occur on-farm. • Ensure all extension materials emphasise continuous improvement and practical actions, not perfection.
Traceability High Priority	Traceability systems exist within the cotton supply chain but are fragmented, costly, and inconsistently applied. Traditional paper-based or transactional traceability is increasingly insufficient for emerging regulatory and market requirements. Physical traceability solutions (e.g. isotopic or forensic testing) are credible but expensive and blending at multiple stages of the supply chain undermines verification.	Brands, retailers, and regulators require credible, defensible proof of origin and supply-chain integrity to meet forced labour, due diligence, and product passport requirements. Growers need traceability systems that do not impose excessive cost or administrative burden, and that clearly link effort to market access or reduced risk.	• Australia has relatively positive environmental and sustainability performance, but it is difficult to receive any premiums from this. • High cost of end-to-end traceability relative to product value. • Supply-chain blending that breaks provenance claims. • Lack of integration between traceability systems and emissions or sustainability data.	• Position traceability as a system-wide requirement, not a grower-only responsibility. • Prioritise lower-cost, scalable traceability solutions that align with emissions and sustainability reporting to reduce duplication.

Advocacy <i>High Priority</i>	Australian cotton operates in a global regulatory environment shaped by foreign policy, trade agreements, and international sustainability frameworks. Emerging EU regulations (e.g. forced labour, eco-design, digital product passports, deforestation rules) are developing rapidly, often without strong representation of Australian agricultural production systems.	The cotton industry needs coordinated advocacy to ensure that international regulations, accounting rules, and sustainability standards fairly recognise Australian cotton's production systems, environmental performance, and social credentials. This advocacy must occur up the supply chain and within trade and foreign policy forums, not just domestically.	- Limited visibility of cotton-specific issues in international policy design. - Methodologies that disadvantage natural fibres relative to synthetics - Fragmented representation across government, industry, and supply-chain actors.	- Strengthen coordinated advocacy between CRDC, Cotton Australia, government, and global forums. - Actively engage in international methodology development (e.g. LCA, PEF, sustainability standards). - Use robust emissions and traceability data to support trade negotiations and market access.
Nitrogen management <i>High Priority</i>	Nitrogen is widely recognised as the largest contributor to cotton's emissions profile and a major driver of profitability. Research demonstrates significant potential to reduce emissions intensity through improved nitrogen use efficiency (NUE), enhanced efficiency fertilisers (EEFs), and site-specific management.	Growers want practical, regionally relevant guidance on reducing N inputs without increasing yield risk. Supply-chain stakeholders view nitrogen as the most credible lever for emissions reduction at scale.	- Limited translation of NUE research into practical decision tools. - Grower risk aversion leading to "insurance" over-application. - Mixed confidence in EEF value propositions. - Weak linkage between N management, emissions outcomes, and financial returns.	- Prioritise nitrogen as the primary mitigation focus for cotton. - Invest in site-specific response curves and economically optimal N rates, to quantify emissions and profit impacts of improved NUE. - Integrate N management into emissions extension and benchmarking.
Marketing <i>Medium-High Priority</i>	Australian cotton has strong sustainability credentials, but translating these into effective market narratives is challenging. Consumer willingness to pay premiums is inconsistent, and brands are increasingly driven by compliance and risk management rather than consumer-led sustainability demand.	Brands and retailers need clear, defensible sustainability stories that avoid greenwashing risk and resonate with their target customers. Growers want assurance that sustainability efforts are communicated accurately and do not create unrealistic expectations or reputational risk.	- Tension between sustainability claims and price sensitivity in retail markets. - Risk of oversimplification or misleading claims.	- Focus marketing on credibility, transparency, and integrity. - Emphasise Australian cotton's strengths, such as low social risk and ethical labour.
Energy use and irrigation <i>Medium-High Priority</i>	Energy use, particularly for irrigation pumping, is a significant emissions source in irrigated cotton systems. Solar and energy-efficiency opportunities are well understood but unevenly adopted.	Growers want clarity on where energy interventions make sense, including solar, pump efficiency, and system optimisation. Financiers are increasingly interested in energy investments linked to emissions reduction.	Survey the solar provider landscape in each cotton valley to measure adoption.	- Refresh economic studies where technology fits in various domestic, on and off-grid settings. - Targeted extension in valleys with high suitability first e.g. bore irrigators.
Carbon	There is basic awareness of carbon markets	Growers want clear, realistic	Confusion between emissions reduction, sequestration, and credit	Provide clear, evidence-based guidance on ACCU eligibility, risks, costs, and long-

markets <i>Medium Priority</i>	and ACCUs within the cotton industry, but understanding is uneven and confidence is low. Experience with soil carbon projects in broadacre systems has been mixed, with concerns about permanence, additionality, transaction costs, and exposure to policy and price volatility. Carbon markets are often conflated with general emissions reduction or sustainability requirements.	guidance on whether carbon markets are relevant to cotton systems, what participation would involve, and the financial and operational risks. Supply-chain stakeholders do not currently view carbon credits as essential for market access and place greater value on credible emissions intensity data than on offsets.	generation. • Limited cotton-specific examples of successful carbon projects. • Overestimation of revenue potential relative to risk and administrative burden. • Low trust following volatility in ACCU prices and project performance.	term obligations. • Emphasise emissions reduction and efficiency gain ahead of credit generation.
Natural capital and biodiversity <i>Medium Priority</i>	Awareness of biodiversity on cotton farms is growing, particularly where growers manage significant areas of native vegetation. Measurement of biodiversity and natural capital outcomes has historically been costly and complex, limiting participation. Emerging technologies and policy developments (e.g. Nature Repair Market, TNFD) are increasing interest but remain poorly understood.	Growers want recognition for existing stewardship of native vegetation and clearer information on how biodiversity values can be measured, reported and potentially rewarded without jeopardising productive land use. Brands, financiers, and regulators are increasingly interested in biodiversity and nature-related risk, but require scalable, credible metrics.	• Limited understanding of how natural capital relates to farm risk, value, and market access. • Regulatory environment still evolving so difficulty to make decisions at this stage. • High cost and complexity of biodiversity measurement.	• Provide clear explanations of natural capital, biodiversity, and their relevance to cotton systems. • Emphasise stewardship, risk management, and reputational value over credit trading. • Align biodiversity messaging with future disclosure frameworks (e.g. TNFD) and traceability systems and make it timely to keep up with policy changes.

4. CONCLUSIONS AND RECOMMENDATIONS

This gap analysis shows that the Australian cotton industry is not constrained by a lack of interest in emissions and sustainability, but by a disconnect between the information that exists, the information growers can practically use, and the information required by supply chain actors, markets, financiers, and regulators.

4.1. Key Findings

Growers are looking for “how-to,” not “why”

Survey responses show the strongest unmet demand is for practical guidance on calculating on-farm emissions, establishing baselines, and understanding where emissions occur. Conceptual information is not the constraint; usability is.

Online rather than hardcopy is now the default

Growers already rely primarily on online sources for information on emissions, with face-to-face delivery valued as a complement to discussion and confidence-building. Hardcopy formats are consistently low in value. A note of caution, however, as observations at grower workshops showed that there were some reluctance and difficulty with filling out online surveys through a QR code.

Consistency matters

Across growers, brands, and financiers, confidence is undermined less by uncertainty in numbers than by inconsistent methods, emissions factors, and boundaries. Fragmentation itself has become a risk.

Downstream requirements are being driven by compliance, not premiums

Supply-chain stakeholders are converging around the need for standardised, verifiable emissions data to meet disclosure and regulatory requirements. Price premiums are uncertain; market-access risk is not.

Emissions reduction beats offsetting

The most credible and scalable emissions improvements in cotton lie in nitrogen and energy efficiency. Carbon markets and sequestration are peripheral and, for many growers, high-risk.

Traceability is becoming non-negotiable

Emissions and sustainability claims increasingly depend on credible traceability, yet current systems are costly and uneven, with unresolved questions around who bears the burden.

Non-technical factors now shape outcomes

Advocacy and messaging increasingly determine whether emissions efforts reduce risk or create new complexity. These factors are no longer secondary to technical RD&E.

Field days and demonstration sites remain vital for regional relevance

Field days and demonstration sites continue to play a critical role in building trust, translating research into practice, and showing how emissions-related decisions perform under local soils, climates, and systems. Grower value seeing outcomes in comparable environments before changing practice.

Productivity-led R&D delivers environmental co-benefits

Field days and demonstration sites continue to play a critical role in building trust, translating research into practice, and demonstrating how emissions-related decisions perform under local conditions. In addition to observing research outcomes, growers place high value on the peer-to-peer learning that occurs at these events, where experiences, challenges and practical insights are exchanged among people operating in comparable environments.

3.1. Priority Actions

1. Establish a single, fit-for-purpose emissions measurement pathway for cotton

Support alignment around a consistent emissions accounting approach that is usable by growers and credible for supply

chain and regulatory needs. This pathway should build on CRDC's existing investments in enabling systems, data capability, and industry data infrastructure, and prioritise reducing duplication, clarifying assumptions, and improving confidence. Importantly, any emissions calculator or accounting approach must be capable of reflecting the whole farming system, recognising that cotton is often produced within mixed enterprises. This will require collaboration with other RDCs to ensure cross-commodity consistency and avoid fragmented, crop-specific tools. Evidence from growers, advisers, and supply-chain stakeholders shows that fragmentation across calculators and methodologies is undermining confidence and slowing action.

2. Continue to focus RD&E on productivity-led emissions outcomes

Continue to prioritise investments that improve system performance, recognising emissions reductions as co-benefits of productivity, profitability, and risk-management gains rather than as stand-alone objectives. This approach is well aligned with CRDC's existing investment portfolio, mirrors the approach taken by the Zero Net Emissions CRC, and aligns strongly with GRDC's investments in nitrogen-use efficiency, creating opportunities for coordination and shared learning across cropping systems. The investment portfolio review demonstrates that this framing is more credible to growers and more likely to drive adoption than emissions-first research.

3. Adopt a blend of online and in-person regional extension model

Prioritise practical digital resources that address the highest-identified information gaps, complemented by workshops, field days, and demonstration sites to build regional relevance. Survey results show growers primarily access emissions information online, while valuing face-to-face engagement for interpretation and confidence-building. Aligning digital and in-person delivery leverages both reach and credibility and builds on established CRDC-supported extension channels rather than creating new ones.

4. Strengthen coordinated advocacy across the supply chain and policy settings

Work with industry bodies and government to engage upstream actors in international policy, standards, and methodology development, ensuring Australian cotton is fairly represented and not disadvantaged by poorly fitted frameworks. International policy, accounting standards and sustainability methodologies are increasingly shaping outcomes for Australian cotton. Without coordinated advocacy, there is a risk of being disadvantaged by frameworks not designed for cotton production systems. Cotton RDC has already begun this work with critiques of the EU Life Cycle Analysis method which advantages synthetic fibres, but more action is required by more voices.

5. Align industry messaging and marketing around credibility and continuous improvement

Support consistent narratives that emphasise transparency, defensible claims, and progress over time, reducing greenwashing risk and improving trust with brands, financiers, regulators, and the community. This recommendation should leverage existing CRDC investments in engagement channels and social licence, ensuring emissions and sustainability messaging aligns with broader industry communication and community trust objectives. Supply-chain consultations highlight the importance of credible, non-misleading narratives that support market access and compliance without overstating outcomes or creating unrealistic expectations.

6. Invest in adviser capability as a multiplier of impact

Prioritise training and support for advisers and extension personnel so they can confidently interpret emissions information, guide growers and reinforce consistent industry messaging. Advisers play a critical role in translating emissions information into practice. Building adviser capability acts as a multiplier of extension efforts and reduces grower confusion.

7. Tailor extension to regional emissions literacy while developing foundational emissions knowledge

Extension should be deliberately designed and targeted to reflect regional differences in emissions literacy, production systems and prior exposure to sustainability concepts, rather than adopting a one-size-fits-all approach. While a consistent baseline of "GHG 101" content is required across all regions to build shared understanding, grower engagement shows that more advanced and applied content is appropriate in regions such as Narrabri, Moree and Goondiwindi, whereas introductory and confidence-building material is more suitable in regions such as Central Queensland and Kununurra, where baseline understanding is lower.

8. Support practical engagement with biodiversity and natural capital as part of whole-farm sustainability

Build on CRDC's broader investments in natural capital, environmental stewardship and landscape-scale sustainability as a starting point for engagement with biodiversity and natural capital. Evidence from grower engagement, the Sustainability Roundtable and vertical consultation shows growing interest in biodiversity and natural capital, driven by finance and policy expectations rather than immediate market returns. However, high measurement costs, evolving frameworks (e.g. TNFD,

Nature Repair Market) and uncertainty about future requirements are limiting action. Actively monitoring emerging policy and market developments, alongside supporting low-cost measurement approaches, can build industry readiness without exposing growers to undue risk.

9. Strengthen strategic engagement with banks and buyers to translate evolving requirements

Establish more structured and proactive engagement with banks, buyers and other downstream stakeholders to ensure their evolving requirements are clearly understood and appropriately translated for growers. As disclosure expectations change, and as natural capital considerations emerge, this engagement will be critical to avoiding misalignment and unnecessary burden at the farm level. CRDC can play a coordinating role in helping align expectations across the value chain.

APPENDICES

Appendix A.1. Workshops

#	Activity	Stakeholders	Date	Location
1	Emerald, Qld	Irrigators, dryland farmers, agribusiness bankers and farm advisors (37)	28 July 2025	The Star Hotel, Emerald
2	Banana, Qld	Irrigators, dryland farmers, and farm advisors (42)	29 July 2025	Sutherland Hall, Banana
3	Nevertire, NSW	Irrigators, dryland farmers, agribusiness bankers, carbon developers and farm advisors (28)	18 August 2025	Nevertire War Memorial Hall
4	Condobolin, NSW	Irrigators, dryland farmers, and farm advisors (9)	18 August 2025	Condo Memorial Club
5	Blighty, NSW	Irrigators, dryland farmers, and farm advisors (39)	19 August 2025	The Blighty Inn, Blighty
6	Griffith, NSW	Irrigators, dryland farmers, and farm advisors (18)	19 August	The Gem Hotel, Griffith
7	Moree, NSW	Irrigators, dryland farmers, agribusiness bankers, carbon developers and farm advisors (17)	8 September 2025	Moree Country Club
8	Narrabri, NSW	Irrigators, dryland farmers, and farm advisors (28)	8 September 2025	The Tourist Hotel, Narrabri
9	Gunnedah	Irrigators, dryland farmers, and farm advisors (18)	9 September 2025	Gunnedah Bowling Club
10	Walgett, NSW	Irrigators, dryland farmers, and farm advisors (14)	9 September 2025	The Barwon Inn, Walgett
11	St George, Qld	Irrigators, dryland farmers, and farm advisors (19)	10 September 2025	Balonne Shire Civic Centre
12	Goondiwindi, Qld	Irrigators, dryland farmers, and farm advisors (27)	10 September 2025	O'Shaes Royal Hotel, Goondiwindi
13	Dalby	Irrigators, dryland farmers, and farm advisors (31)	11 September 2025	Country Club Hotel, Dalby
14	Kununurra, W.A	Irrigators, dryland farmers, and farm advisors (35)	6 November 2025	Kununurra Ag Research Station

Appendix B.1. Growers survey

Greenhouse Gase Emissions and Carbon Farming. A Survey for cotton growers

1. Prior to today, had you obtained information on any of the topics below for cotton production systems
2. Where do you go to find information about the topics listed in question 1
3. Which topics would you like more information on
4. In general, how would you prefer information on GHG emissions and carbon to be delivered
5. Would you like information on GHG emissions and carbon to be applicable to your broader farming system?
6. Which commodities are also part of your farm business?
7. How could delivery of information on GHG emissions reduction and carbon sequestration on your farm be improved?
8. How could available content on GHG emissions reduction and carbon sequestration on your farm be improved?

Appendix B.2. Vertical collaboration survey

Interview questions:

1. Do you currently source scope 3 (cane grower) emissions data for mandatory (i.e. climate-related disclosures) or voluntary (e.g. sustainability reporting or marketing) purposes?
 - a. If yes, what are the challenges you have getting the data you need? Or what strategies have you used to help get the data you need?
 - b. If no, do you expect to in future, and when?
2. Does the strawman model meet your needs for GHG accounting and reporting (including actions to support your management of climate-related risks and opportunities, as well as sourcing scope 3 data)?
 - a. If no, what specific actions or changes to this strawman model would you want to see to meet the needs of the sugar value chain?
3. Are you sending signals to cane growers now, or plan to in future, that measuring and mitigating GHG emissions is important?
 - a. If yes, what are you doing (unprompted)
 - b. If no, why not?
 - c. If not sure, prompt the following opportunities to support cane growers:
 - i. Communicate to growers you need this data for trade or regulatory purposes (and what you will do for growers who don't provide data).
 - ii. Offering premiums for low GHG-intensity sugar (or discounts for high GHG-intensity)
 - iii. Financial or other support for growers to take actions to reduce emissions
 - iv. Recognition of growers who are already growing low-emission cane
 - v. Helping growers quantify the financial benefits of greater resource efficiency that is needed for lower intensity cane growing? (better NUE, efficient machinery use, good soil health etc)
4. Is there anything else you'd like to suggest or comment on, to support us identify gaps and opportunities for cane growers to improve their GHG knowledge?

Appendix D. CFOP Training Package Contents and Resources

1. Introduction to Carbon Farming

- Carbon farming reduces emissions, stores carbon
- Carbon farming is good for business, good for the environment and Country
- How carbon farming responds to climate change: MyClimateView
- Reducing emissions
- Increasing C storage
- Key concept ('carbon neutral' and 'net zero emissions'; ACCUs; Climate Active certification; CO2-e)
- Other resources:

Annual Climate Change Statement 2024: The Annual Climate Change Statement 2024, published by DCCEEW, explains Australian and state and territory government climate change policies, adapting to climate change and progress towards achieving Australia's targets for reducing GHG emissions.

Low Emissions Agriculture (New South Wales Department of Primary Industries and Regional Development): The New South Wales Department of Primary Industries and Regional Development Low Emissions Agriculture webpage provides information about GHG emissions and carbon sinks, and carbon farming opportunities for farmers.

Making cent\$ of carbon and emissions on-farm (Agriculture Victoria): The Agriculture Victoria Making cent\$ of carbon and emissions on-farm booklet focuses on practical actions that farm businesses can take to improve their emissions performance.

Building a world-leading, climate-smart agriculture industry (Department of Agriculture, Fisheries and Forestry): This Australian Government Department of Agriculture, Fisheries and Forestry website has examples of:

- a New South Wales orchardist who has used new technologies to improve water efficiency
- b. Producing drought resilience plans that recognise and represent the needs of Aboriginal communities who speak for Country.

2. What Carbon Farming Means for Farmers and Land Managers

- Why you might undertake carbon farming: Carbon farming activities and co-benefits
- Potential trade-offs and risks: Expert interviews and case study
- Other resources:

Livestock

- **Reducing methane from livestock (DCCEEW):** This DCCEEW webpage Reducing methane from livestock provides information on research into reducing methane emissions through feeding and grazing practices.
- **Delivering CN30 – Meat & Livestock Australia (MLA):** MLA's Delivering CN30 website provides four key areas of work referring to activities to manage emissions: Greenhouse gas emissions avoidance, Carbon storage on farm, Integrated management systems, Industry leadership
- **Climate and environment (Dairy Australia):** This Dairy Australia website provides resources on sources of dairy emissions and Dairy Farm Emissions Reduction Strategies: Reducing dairy's greenhouse gas emissions (PDF 662 KB), Reducing fossil fuel emissions (PDF 615 KB), Reducing manure emissions (PDF 457 KB), Reducing nitrous oxide emissions (PDF 538 KB), Reducing rumen emissions (PDF 453 KB), Storing more carbon (PDF 796 KB), Dairy shed effluent and biogas (PDF 521 KB).

Environmental sustainability (Australian Pork): This Australian Pork website provides information on research and resources for environmentally sustainable pork. There are 2 roadmaps for producers:

- **Low Carbon Emission Roadmap:** to help understand emissions and learn what practices can be implemented to reduce emissions
- **Closing the Loop:** to help understand how to minimise feed inputs, improve efficiency to minimise waste, utilise manure nutrients and discover new ways to manage hard waste.

Cropping, Horticulture and Forestry

- **Sustainability Initiative (Grains Research and Development Corporation):** The Grains Research and Development Corporation's Sustainability Initiative (PDF 4.6 MB) summarises GRDC's position and plan for ongoing investment in sustainability (including climate mitigation and adaptation). Work stream 2 of the initiative includes

information on emissions reduction practices for the sector as well as references to relevant resources and tools.

- **Sustainability framework for Australian horticulture (Hort Innovation):** This Hort Innovation website provides information on sustainable agricultural practices within the Horticulture sustainability framework and links to industry-led sustainable production assurance programs (Hort360, EnviroVeg, Banana BMP, Freshcare Environmental and EcoHort).
- **Emissions Reduction Guide (Wine Australia):** This Wine Australia website provides an Emissions Reduction Roadmap, a reference manual containing tools, resources and advice to help Australia's grape growers and winemakers take action in their own businesses.
- **FWPA Carbon Guides (Forest & Wood Products Australia):** This Forest & Wood Products Australia website provides information including the Forests & Wood Products and Australia's Carbon Balance Guide that describes the key concepts associated with the life cycle of carbon in forests and forest products and provides guidance on forest management.

Additional

- **Accounting for Nature methods:** The Accounting for Nature website has a catalogue of methodologies to measure and report on environmental assets to prepare an environmental account. Accounting for Nature is one approach to measuring environmental conditions.
- **Zero Net Emissions from Agriculture Cooperative Research Centre:** The Zero Net Emissions from Agriculture Cooperative Research Centre aims to catalyse industry, community and government action to achieve zero net emissions from agriculture from 2040 and below zero net emissions by 2050. Its four research programs focus on: low-emissions plant solutions, towards, methane-free cattle and sheep, whole-farm and mixed enterprise systems analysis, delivering value from net zero.
- **Blue Carbon – Opportunities for First Nations Peoples:** The Blue Carbon in Australia, understanding the opportunity for Indigenous People report provides information and mapping related to First Nations participation in Blue Carbon projects.
- Other Materials
 - **Understanding carbon co-benefits (Indigenous Carbon Industry Network):** Chapter 10. Understanding Co-Benefits from the downloads page of the Indigenous Carbon Industry Network provides information about co-benefits from carbon farming practices for First Nations farmers and land managers.
 - **Evaluation of potential indicators for the co-benefits of carbon farming (New South Wales Department of Primary Industries and Regional Development):** Potential indicators for the co-benefits of carbon farming is a report from a workshop hosted in 2019 on indicators relating to the potential co-benefits of carbon farming by the New South Wales Department of Primary Industries and Regional Development in collaboration with the University of New South Wales and the University of Technology Sydney.
 - **Life Cycle Assessments (AgriFutures):** Life Cycle Assessments: A Useful Tool for Australian Agriculture is a booklet by the entity formerly known as the Rural Industries Research and Development Corporation, now called AgriFutures, that explains the main aspects of assessments, including the methodology for conducting one. It also provides several case studies of life cycle assessments.
 - **What is a life cycle assessment? (Australian Pork Limited):** Life Cycle Assessment is a fact sheet produced by Australian Pork, explains life-cycle assessment, its difference from a carbon footprint and the different scopes of emissions included in a life cycle assessment.
 - **Calculating net emissions and reduction strategies for a broadacre farm (Grains Research and Development Corporation):** Carbon Neutral Grain Farming by 2050 – an example in calculating net emissions for a broadacre farm and strategies to reduce net emissions is a Grains Research and Development Corporation report that looks at example GHG accounts from Western Australian cropping enterprises.

3. Your Greenhouse Gas Account

- GHG accounting and accounts: Accounting approaches
- Calculators (MLA Quick Start, GAF tools, AIA EAP, LOOC-C): Meeting calculation requirements
- Other Resources: Calculators

While there are many other calculators, some of which are below, the logic of the original GAF tools (developed by the Primary Industries Climate Challenges Centre and the University of Melbourne) sits under many of them. All the calculators below are free to use unless otherwise indicated. This is not a comprehensive list of available calculators.

- **Australian Dairy Carbon Calculator:** The Australian Dairy Carbon Calculator was developed by the Tasmanian Institute of Agriculture and Dairy Australia. The calculator is a spreadsheet to provide an understanding of GHG emissions under current management practices and to explore potential management practices to reduce on-farm GHG emissions. These practices include the management of herds, feed and soil, and reducing energy use and switching to renewables.
- **Australian Wine Carbon Calculator:** The Australian Wine Carbon Calculator was developed by the Australian Wine Research Institute. It is a spreadsheet for estimating scope 1 and 2 emissions of vineyards and wineries. It also provides information on calculating scope 3 emissions, but it does not include them in calculations. The institute provides advice about carbon accounting (PDF 520 KB) in viticulture and additional links to information about vineyard soil health, soil analysis, salinity and management practices to improve soil structure and grapevine nutrition.
- **DairyBase:** DairyBase, developed by Dairy Australia, helps dairy farmers and advisers measure and compare farm business performance over time. Dairy farmers already using DairyBase can estimate their GHG emissions using pre-populated data from their DairyBase farm dataset. The calculator is only accessible to registered users. The website has guides to using DairyBase.
- **MLA Carbon Calculator:** The MLA Carbon Calculator enables farmers to calculate total enterprise GHG emissions and emissions intensity for beef, sheep, goat, wool, feedlot and crops. The MLA has digitised the Sheep and Beef Greenhouse Accounting Framework (SB-GAF) (XLSX 2.6 MB) and the Grains Accounting Framework (G-GAF) (XLSX 2.5 MB). MLA provides a Carbon accounting technical manual (PDF 1.8 MB) and a video about how to use the calculator.
- **Platform for Land and Nature Repair:** The Australian Government's Platform for Land and Nature Repair (PLANR) provide a calculator enabling users to estimate their GHG emissions and the condition of the natural assets on their land. They can then compare the results to other areas in their region.
- **Ruminati:** The Ruminati calculator is managed by a group of industry experts and has BASE and PRIME versions that help estimate a farm's GHG emissions and carbon storage. Ruminati PRIME, an enhanced, purchasable version, allows for modelling of GHG abatement options, creating emissions reduction plans and sharing emissions-related information with other organisations in their supply chain.

4. Planning Carbon Farming Activities

- **Carbon EDGE training (MLA):** Carbon EDGE is a 2-day MLA training program for the red meat industry, providing participants with an understanding of the opportunities for emissions reduction and carbon storage activities in a livestock grazing business. Participants use their own information to develop an action plan for their business as they learn about the practices and technologies that could reduce their carbon footprint and improve sustainability and productivity.
- **On-Farm Carbon Advice (New South Wales Department of Primary Industries and Regional Development):** The New South Wales Department of Primary Industries and Regional Development's On-Farm Carbon Advice project provides advice on carbon farming practices in extensive beef, sheep, dairy, and mixed farming systems. It covers topics including understanding climate change, agricultural emissions, emissions reduction and carbon storage strategies, and pros and cons of carbon farming.
- **Farm Business Resilience Plan – planning template (Business Queensland):** Business Queensland's Farm Business Resilience Plan provides templates and advice for writing a plan, including identifying opportunities to support and improve your business' productivity and profitability.
- **Calculating net emissions and reduction strategies for a broadacre farming (Grains Research and Development Corporation):** This article Carbon Neutral Grain Farming by 2050 – an example in calculating net emissions for a broadacre farm and strategies to reduce net emissions on the Grains Research and Development Corporation website looks at calculating emissions for a broadacre farm and ways those emissions might be reduced.
- **Environmental Economic Accounting Dashboard:** The Environmental Economic Accounting Dashboard administered by DCCEEW lets users explore, visualise and customise content from various government databases. The content is presented as account tables, charts, customisable stories and underlying spatial data maps. Users can answer questions like 'How is our land cover changing over time in a particular state or territory?' and 'What is the economic value of mangroves for a particular stretch of coastline?'
- **Co-Benefits Standards - Western Australian Carbon Farming and Land Restoration Program (Western Australia Department of Primary Industries and Regional Development):** The Co-Benefits Standard 2022-2023 (PDF 1 MB) provides guidance and resources for the Western Australian Carbon Farming and Land Restoration Program. It addresses monitoring and reporting for 5 co-benefits: biodiversity and conservation, agricultural

productivity, soil health, salinity mitigation and Aboriginal economic and cultural wellbeing. The program's Co-Benefits Information Portal allows applicants to assess co-benefits for any particular area or location.

- **Indigenous Carbon Project Guide (Indigenous Carbon Industry Network):** The Indigenous Carbon Industry Network's 2022 Indigenous Carbon Project Guide (PDF 8.5 MB) aims to ensure that First Nations groups are well-informed to position themselves to maximise the benefits from carbon projects for their country and community. It covers 13 topics, including what is the carbon market; free, prior and informed consent; project feasibility; project governance; First Nations rights and interests; understanding co-benefits; and keeping your story strong. The guide can be downloaded as a whole or for relevant areas of interest.
- **Land Restoration Fund Co-Benefits Standard (Queensland Government):** The Land Restoration Fund Co-Benefits Standard (PDF 2.1 MB) is focused on growing the carbon farming industry by supporting carbon projects that deliver priority co-benefits for Queensland. This document is the framework that specifies how co-benefits generated from a carbon project are to be measured, reported, and verified for the purposes of the Land Restoration Fund.

5. The ACCU Scheme

- **Carbon on Country – A guide for NSW Aboriginal landholders and managers (New South Wales Government):** The New South Wales Government's Carbon on Country guide for Aboriginal landholders and managers explains carbon farming, participating in carbon markets, conducting ACCU Scheme projects and sources of funding and support.
- **Fighting fire with fire (Clean Energy Regulator):** Fighting fire with fire explains a savanna burning project managed by the Nyaliga Aboriginal Corporation on 6,400 km² of Country just southwest of Wyndham, Western Australia.
- **Jawoyn Fire Project (Jawoyn Association):** The Jawoyn Fire Project is an Australian Government-approved project that recognises ACCUs produced by reducing wildfires through strategic, controlled savanna burning. Please note this resource does not cover potential costs or risks, which should always be considered before embarking on a project.
- **Savanna Burning:** Savanna Burning, a 7:33 minute video (supported by NAILSMA, Live and Learn Environmental Education), overviews savanna burning to earn ACCUs. It includes animated diagrams explaining how ACCUs are created. It also explores the co-benefits of savanna burning by addressing, from an Indigenous perspective, the question, 'Why would we want to be involved?'.
- **Carbon Farming Planning Guide (Western Australia Department of Primary Industries and Regional Development):** This Western Australian Government Carbon Farming Plan Guidance (PDF 682 KB) explains the process of developing a carbon farming plan for the ACCU Scheme, including the need for a cost-benefit analysis.
- **Case studies (Clean Energy Regulator):** ACCU Scheme case studies highlight different emissions reduction projects and show how each has benefitted participants.
- **Integrity in the Australian Carbon Market Explainer (Carbon Market Institute):** The Carbon Market Institute Integrity in the Australian Carbon Market Explainer (PDF 433 KB) factsheet overviews the ACCU Scheme and the checks and balances to ensure that ACCUs achieve environmental integrity, are only issued for abatement that has actually occurred and that abatement cannot be credited twice.
- **Mapping the Opportunities for Indigenous Carbon in Australia (Indigenous Carbon Industry Network):** The Indigenous Carbon Industry Network's Mapping the Opportunities (PDF 7 MB) report provides First Nations carbon farming opportunities in Australia.
- **Arnhem Land Fire Abatement (Clean Energy Regulator):** The Arnhem Land Fire Abatement project is a savanna fire management project combining traditional Indigenous knowledge with modern technologies conducted under the ACCU Scheme.
- **Video – North Australia Savanna Fire Forum:** 2020 North Australia Savanna Fire Forum video is from an event where some 320 people from across northern Australia, including Indigenous fire managers, government representatives, scientists and carbon businesses, gathered on Larrakia Country to discuss savanna fire management. Fire is central to Indigenous knowledge and culture. Right-way fire is an important tool for looking after Country, supporting biodiversity, reducing greenhouse gas emissions and renewing connections to cultural stories and traditional knowledge.
- **Video – Storing blue carbon (Clean Energy Regulator):** Storing blue carbon in our coastal ecosystems. This video describes the process of storing blue carbon in our coastal ecosystems and how ACCUs can be earned by doing so.

Appendix E.1. Output of first cross-RDC GHG Gap Analysis workshop

7 October 2025

Attendees

- Australian Livestock Export Corporation: Imogen Goode, James Malaguenas
- Australian Meat Processor Corporation: Seamus Hoban
- Cotton R&D Corporation: Nicola Cottee, Chris Cosgrove
- Dairy Australia: Elissa McNamara
- Fisheries R&D Corporation: Thomas Cosentino
- Forest and Wood Products Australia: Ian Blanden, Blair Freeman
- Horticulture Innovation Australia: Onyeka Nzie
- Meat and Livestock Australia: Hilary Connors
- Sugar Research Australia: Chris Cosgrove
- Wine Australia: Julian Marchant

Purpose

Initial online meeting to address the cross-sector collaboration needed by the Carbon Farming Outreach Program. Integrated Approaches to Building On-farm Emissions Knowledge: Gap Analysis.

Summary discussion

See the next page for a summary of GHG information knowledge and delivery gaps from each RDC. Based on that context, a discussion on obvious opportunities to collaborate with RDCs, government and other horizontal stakeholders to leverage CFOP saw three key themes emerge:

Measurement: Need for a single emissions footprint calculator that is fit for purpose for farmers and the value chain. Collaborate for priority emission factor updates that cut across sectors (eg shipping for Fisheries, Live Export, dairy and meat products) Work with VEERG / AIA to ensure AIA EAP is fit-for-purpose, and coordinate promotion of the EAP and other calculators derived from it. “Fit-for-purpose” includes: having very clear farmer guidance on what data is needed and of what quality, and being simple enough for farmers to use themselves accounting for geographic and commodity differences being consistent with other initiatives and needs: e.g., incorporating FullCAM for LULUCF; integrating automated data collection by various industry projects meeting the needs of the value chain.	Knowledge: Reframe CFOP content to be much clearer and prioritise basic knowledge gaps. What: GHG 101, how to reduce emissions, how to increase removals (to provide a common starting point for adaptation by RDCs and others) Why: Benefits individual farm businesses will see from measuring emissions or reducing GHG intensity: Increased productivity via increased resource efficiency Enhanced resilience via using data to inform decisions that strengthen natural capital Improved risk and opportunity management: reputation, market and regulatory Potential for carbon market revenue (as an optional extra, not as the focus of CFOP). Beyond this basic core information, make CFOP a directory that points users to the right existing information specific to them.	Delivery: Scale up place-based or regional in-person delivery so farmers can co-learn with peers, from trusted advisers. Collaborate across RDCs on delivery of content specific to sources of emissions or removals (eg, manure management content that dairy, feedlot, poultry and pig farmers in a place can all attend and learn) Collaborate across RDCs on delivery of emissions or removals content relevant to all farmers in a place (eg, GHG 101, power purchase agreements, reforestation). Recognise each sector has existing peak bodies with websites and trusted advisors already providing guidance to farmers/producers – preferred platforms rather than housing knowledge on a new ‘knowledge bank’.
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Appendix E.2. Output of second cross-RDC GHG Gap Analysis workshop

13 November 2025

Attendees

- Agrifutures: Emma Harbison
- Australian Livestock Export Corporation: Imogen Goode, James Malaguenas, Sarah Castellanos
- Australian Meat Processor Corporation: Seamus Hoban
- Australian Pork Limited: Mary-Frances Copley
- Cotton R&D Corporation: Nicola Cottee, Chris Cosgrove
- Dairy Australia: Elissa McNamara, Chris Murphy
- Fisheries R&D Corporation: Jamin Forbes, Thomas Cosentino
- Forest and Wood Products Australia: Ian Blanden; Blair Freeman
- Horticulture Innovation Australia: Kathryn Young, Onyeka Nzie, Clinton Muller
- Meat and Livestock Australia: Julia Waite
- Sugar Research Australia: Cathy Mylrea, Chris Cosgrove
- Wine Australia: Julian Marchant
- Other “horizontal” stakeholders:
 - Department of Agriculture, Fisheries and Forestry (DAFF): Leann Palmer
 - Department of Climate Change, Energy, the Environment and Water: Penny Reyenga, Fiona Dickson, Zoe Bucher
 - Agriculture Victoria: Alison Kelly
 - CRC for Zero Net Emissions in Agriculture (CRC ZNE-ag)/ Carbon Farming Outreach Program (CFOP): Janelle Wilkes
 - Agriculture Innovation Australia (Environmental Accounting Platform – AIA-EAP): Sarah Castellanos

Meeting background and purpose

Australia's agricultural RDCs have been commissioned by DAFF to conduct a gap analysis of farmer GHG knowledge in their sector [1]. Part of this gap analysis is to explore “opportunities for horizontal collaboration ... to address information gaps to ensure consistency across commodities and avoid duplication [that leverages existing CFOP training materials]”.

To meet this requirement as efficiently as possible, a first meeting of RDCs was held on 7 October 2025. Three key themes for future cross-sector collaboration emerged from this meeting.

The purpose of this second meeting of RDCs was to further refine these themes by hearing any new insights RDCs had noted in subsequent consultation. In addition, the other “horizontal” stakeholders listed above were invited to provide additional stress-testing of the collective RDC thinking.

The output of this meeting is the refined summary of the three themes below. This is intended to be used by RDCs as part of their project report to DAFF, and to support a coordinated approach across RDCs that complement existing work and plans by CRC ZNE-ag, CFOP, AIA-EAP, and others.

Themes for cross-RDC collaboration

Measurement: Need for a single emissions footprint calculator that is fit for purpose for farmers and the value chain. Collaborate for priority emission factor updates that cut across sectors (eg shipping for Fisheries, Live Export, and industries where shipping is a material part of the emissions profile) Work with VEERG / AIA to ensure AIA EAP is fit-for-purpose, and coordinate	Knowledge: Reframe CFOP content to be much clearer and prioritise basic knowledge gaps. What: GHG 101, how to reduce emissions, how to increase removals (to provide a common starting point for adaptation by RDCs and others). Provide a glossary a single glossary as part of a single source of truth NB: CRC-ZNE has a glossary; unclear if it is publicly available NB: AIA & CSIRO's Common Approach to GHG Accounting includes a common terminology While providing a single source of information,	Delivery: Scale up place-based or regional in-person delivery so farmers can co-learn with peers, from trusted advisers. Recognise the critical role of existing trusted advisers (agronomist, accountants, milk supply field officers, Canegrowers network etc) in each industry, and ensure they are appropriately trained Collaborate across RDCs on delivery of content specific to sources of emissions or
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promotion of VEERG and the EAP and other calculators derived from it Remove unnecessary sources of confusion, eg GHG accounting boundaries, and LCA v GHG accounting. Clearly defining the purpose of measuring farm emissions – to provide downstream scope 3 data, or to make business decision etc - is also important to remove confusion and inform what a farm should d “Fit-for-purpose” includes: having very clear farmer guidance on what data is needed and of what quality, and being simple enough for farmers to use themselves accounting for geographic and commodity differences being consistent with other initiatives and needs: e.g., incorporating FullCAM for LULUCF; integrating automated data collection by various industry projects meeting the needs of the value chain for their Scope 3 reporting.	ensure commodity-specific emission challenges / removal opportunities are highlighted, eg blue carbon in fisheries Consider providing a single source of regional climate scenarios to support climate-related disclosures (and avoid expensive duplication of climate scenarios by agribusinesses) and to make clearer for farmers what the future climate impacts will be for their farm / community (suggested as part of what is needed to increase motivation for farmers to act). This informs place-based delivery as well (next column) Why: Benefits individual farm businesses will see from measuring emissions or reducing GHG intensity: Increased productivity via increased resource efficiency (i.e. good practices) Enhanced resilience via using data to inform decisions that strengthen natural capital Improved risk and opportunity management: reputation, market and regulatory Potential for carbon market revenue (as an optional extra, not as the focus of CFOP). NB: CFOP can't quantify these to the granularity needed, but content deliverers need to be aware of benefits and questions likely to be asked. There may be role for RDCs to quantify benefits and coordinate across sectors (eg improved whole farm nutrient efficiency, not just cotton nutrient efficiency) How: Have a clear pathway for what farmers can do now and what is likely in future. Interventions should also be prioritised by impact. This is likely to be a role for RDCs, rather than CFOP	removals (eg, manure management content that dairy, feedlot, poultry and pig farmers in a place can all attend and learn) Collaborate across RDCs on delivery of emissions or removals content relevant to all farmers in a place (eg, GHG 101, power purchase agreements, reforestation) Consider building in behavioural science prompts + tailoring for segments (socio/economic, demographics etc) for content deliverers. NB: dairy and cotton currently conducting behavioural research, and many other resources to draw on eg AgriFutures report on extension and adoption of emissions info with Wimmera farmers Recognise each sector has existing peak bodies and trusted advisors already providing guidance to farmers/producers. Preference is for CFOP to signpost users to the right existing information specific to them, rather than hosting and maintaining everything on a new 'knowledge bank'.
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Appendix E.3. Summary of emerging themes in GHG information knowledge and delivery gaps for each RDC

Australian Livestock Export Corporation

- Project just begins so too early to provide specific themes. Context however is there are very few tools specific to live export, so the project will be looking at what tools and information are already available and what can be applied to live export in Australia.

Australian Meat Processor Corporation

- No direct farmer involvement, so using the grant to prepare members for climate disclosures. This will include how to measure emissions, and climate scenario impact analysis
- Advised they will be happy to share outputs of this work with other RDCs, eg the risk analysis

Cotton Research Development Corporation

- Knowledge gaps: simple information on how to reduce emissions and increase removals (including co-benefits)
- Delivery gaps: strong preference for in-person, independent extension
- Opportunities to reduce inconsistency or duplication: A single trusted calculator that can account for different commodities on the same farm.

Dairy Australia

- Drawing on previous work to tailor CFOP materials for dairy, and combining this with two gap analysis research projects: international GHG R&D adoption scan, and behavioural science research to inform behaviour change
- Bringing all of that into a workshop next week and looking at how that will shape the approach. Likely to fall into 3 buckets:
 1. Vertical collaboration: Supply chain collaboration opportunities
 2. Delivery: What can DA do to upscale farm-specific delivery of emission reduction action plans
 3. Horizontal: Likely involves place-based or regional collaboration with other RDCs on emission sources. Eg horticulture for on-farm energy, poultry, piggeries for manure management, etc.

Fisheries Research and Development Corporation

- Minimal opportunities for sequestration (none for wild catch)
- The focus is on reducing emissions. Calculators that are available are either not widely used (and therefore not verified for accuracy or for meeting value chain requirements) or don't provide accurate enough options to determine emissions.

Forest and Wood Products Australia

- LULUCF is the primary sector featuring carbon sinks as well as emissions from managed lands. This underpins a prominent interest in ACCU Scheme methods for carbon sequestration in forests and wood products, as well as accounting for emissions along value chains.
- LULUCF carbon sinks and emissions are estimated using FullCAM, at the national level and project level, so it's important this is recognised as part of any common calculators or language.
- Gap: A single knowledge hub / directory that points users to where they can find the information they need, from FWPA and peak body organisations in the sector, or other RDCs. ACCU Scheme info and how to reduce emissions or increase removals are important for forestry knowledge gaps currently.

Horticulture Innovation Australia

- Project just started, but with 37 industries and different levels of GHG knowledge within each industry, the expectation is farmers will want to know where they are now: what their current emissions are.
- This will require a single tool that works for multiple industries; it has to be simple, and it has to be clear about what data is needed.

Meat and Livestock Australia

- Grower engagement is just starting. Previous engagement, however, suggests there is a range from early adopters who understand GHG and are measuring emissions, to very limited knowledge. Most producers are waiting until there is a clear carrot or stick to take action.

Sugar Research Australia Limited

- Knowledge gaps: simple information on how to reduce emissions and increase removals; need information specific to their regional and climatic circumstances
- Delivery gaps: more incentives or recognition needed for taking action
- Opportunities to reduce inconsistency or duplication: A single trusted calculator that is farmers can use themselves and accounts for differing data quality, and a single platform for consistent information and knowledge.

Wine Australia

- Project focus is on improving accuracy of off-farm emissions as that accounts for the majority of value chain emissions. Key grower knowledge and delivery gaps include:
- What does mandatory reporting mean for growers
- AIA EAP is good but needs more work to be fit for purpose to meet value chain needs.
- Power imbalance – growers don't get the benefits of reporting
- Data quality: wine growers use spend-based data inputs for inventory calculations – may not always be good enough.

Appendix E.4. Summary of December 3 Cotton Sustainability Roundtable

Purpose of the roundtable

The Roundtable brought together representatives from government, finance, retail, consultancy, growers, and R&D to discuss emerging sustainability drivers impacting Australian cotton. The session identified challenges and opportunities across emissions reduction, biodiversity, international regulation, market expectations, and the enabling conditions needed to support growers in adapting to these shifts.

These insights will directly inform the CRDC Gap Analysis being undertaken under the Carbon Farming Outreach Program: Integrated Approaches to Building On-farm Emissions Knowledge (AE11697).

Speaker summaries

Dr Jason Crean – NSW DPIRD

- Agriculture contributes ~18% of NSW emissions and may become the largest emitting sector by 2050 as other sectors decarbonise.
- NSW and Australia have ambitious legislated targets (NSW Net Zero 2050; national 62–70% by 2035).
- Because the agriculture industry is export-oriented, internal targets and regulations are probably more important than domestic ones.
- Two mechanisms for abatement, both of which need to be covered by R&D portfolio:
 - Move producers toward the abatement frontier, improving efficiency of current practices.
 - Shift the frontier through innovation and new technologies.
- DPIRD invests in multi-location demonstration sites because R&D results often fail to translate consistently across farm environments.
- Businesses will increasingly face scope 1, 2 and 3 supply chain reporting obligations.
- Tension exists between government targets (absolute emissions) and industry focus on emissions intensity, particularly for export commodities.
- Energy transition and AgTech are critical for lowering measurement costs and reducing uncertainty around farm-level decisions.

Bergstrand Consultancy

- The EU Green Deal aims to make Europe the first climate-neutral continent by 2050, affecting all textiles and fibre sources.
- Cotton faces emerging pressures from multiple EU instruments:
 - Deforestation-Free Products Regulation – Cotton not yet included but flagged as a gap; inclusion could significantly affect sourcing standards.
 - Forced Labour Regulation – Applies to all imports; requires deep supply chain traceability and proof of no forced labour.
 - Eco-design for Sustainable Products – Digital Product Passports, recyclability, circularity; current methodologies disadvantage natural fibres.
 - Extended Producer Responsibility – Brands must cover waste-management costs; recyclability rewarded.
 - PEF Category Rules – Harmonisation of LCA rules; current scoring unfairly favours synthetics due to methodological limitations.
 - CSRD Reporting – Companies must disclose environmental and social impacts, including emissions and biodiversity.
- Key opportunities for Australian cotton:
 - Strong performance on low forced-labour risk.
 - Potential differentiation if cotton is added to deforestation rules.
- Key challenges:
 - High traceability costs and traceability will be required to adhere to this legislation.
 - Synthetics are cheaper and have a simpler supply chain which is more easily controlled.
 - Brands driven by compliance, not consumers. Strong demand for credible, low-cost data is important.

James Bentley

- Increasing farmer interest in emissions reduction and sequestration and how these relate to financing.

- Market signals for premiums are weak; the strongest signal is market access risk, not price advantage.
- Emphasised the move from measurement to transparency to the creation of value, drawing on the green bond experience.
- Banks require clearer taxonomy rules to define what counts as “green”.
- NAB’s \$300m concessional loan program incentivises emissions-reduction activities through:
 - Funding emissions-reduction projects, or
 - Refinancing at a lower rate with savings reinvested in emissions reductions.
- Banks face internal tension: avoiding onerous requirements for customers while meeting investor expectations.
- Open questions around:
 - Tree planting vs agricultural production and long-term land value.
 - Markets’ ability to finance long-term sequestration assets.
 - Soil carbon’s 10-year accounting window.
 - “What is green?” for agriculture.
- Biodiversity poses valuation challenges due to lack of data; AgTech may help solve this.
- Fragmentation of calculators and methodologies is a problem as banks want standardised, consistent emissions data.
- An example of commercial real estate.
 - NABERS is a mature and accepted scheme that has great coverage.
 - Buildings with a higher rating are worth more, but more importantly reduce the risk of a stranded asset, which banks are worried about.
 - Farms are a lot more complicated than commercial real estate, so this will look different. The message is the same though; more sustainable farms with higher natural capital have lower risks. Just need the data and measures to prove these so banks can value it.

Nadene Smith – Big W

- Cotton Australia is a key strategic partner for Big W in its sustainability journey.
- A major focus is on how to tell the cotton sustainability story to customers in a way that is accurate and trustworthy.
- Big W’s sustainability journey began in 2022, working to define what responsible cotton sourcing looks like for its customer base.
- Messaging principle: “do the right thing and don’t be misleading”.
- Organic cotton resonates with customers, but organic prices have risen sharply, and Big W customers are unwilling to pay those premiums, so Big W has moved away from organic.
- Marketing campaign on Australian cotton towels has been highly successful; customers value affordable, Australian-grown products.
- The challenge is maintaining the balance between price and sustainability, but evidence shows it’s working.
- Big W has invested heavily in ORITAIN, which is currently the only credible method available, but it is costly at 5c per item. ORITAIN testing shows a 94% success rate in confirming Australian cotton origin.
- Having end-to-end visibility is extremely difficult. Some suppliers many uses multiple yarn sources, and even one strand can prevent a product being labelled as 100% Australian cotton.

Alex Banks – EY Partner

- TNFD is following a similar pathway to TCFD: starting voluntarily, moving toward mainstream adoption.
- 27 Australian companies and >130 global financial institutions have signed on.
- TNFD requires disclosure of:
 - Governance
 - Strategy
 - Risk and impact management
 - Metrics and targets.
- Cotton sits within global moves toward nature-positive transitions.
- The Nature Repair Market:

- Initially, a voluntary biodiversity credit market.
- New legislation allows its use for offsets.
- One registered project so far.
- Methods for conservation and enhancement are still developing.
- Potential for credit stacking with carbon projects.
- Registration could act as a proxy for certification and be used in traceability/branding.
- Key challenges
 - Additionality and fairness in how to Recognise growers who already manage land well but also isolating the public benefit component.
 - Permanence obligations.
 - Alignment with traceability tools and Digital Product Passports.
- *Tackling TNFD in Domestic Cotton Cultivation for Export* report by Government
 - Included the whole value chain; port, financial institutions, growers.
 - What could the Government be doing to support the uptake of the TNFD?
 - Big question on compliance work and its current relation to nature reporting.
- Will nature be integrated into climate disclosure frameworks?

Hugh Ball – Cotton grower perspective

- Multi-year sustainability journey, learn by doing:
 - 2021 baseline carbon assessment
 - 2022 improved data systems
 - 2023 review
 - 2024 full GHG audit
 - 2025 industry-facing sustainability reporting
- Participates in ADM regenerative certification, providing price premiums per bale.
- Roadmap includes:
 - Grants and funding
 - Credentials and potential premiums
 - AI deployment
 - Climate-related disclosures
 - Natural capital mapping
 - Public image and branding opportunities
- Key grower concerns
 - Differences between calculators and lack of clear guidance
 - Need for continuous improvement rather than perfection
 - Risk of being locked into early methodologies

Combined Summary – Patrick Filippi, Michelle Miller, Guy Roth & Bill Malcolm

These four speakers provided perspectives from precision agriculture, behavioural systems, biodiversity measurement, and agricultural economics. Although working in different areas, their contributions converged on issues at the micro level in terms of reducing emissions and enhancing biodiversity on farms.

- Carbon and nature costs will ultimately be pushed through value chains to producers and consumers.
- Technical solutions such as Enhanced Efficiency Fertilisers (EEF) could reduce N₂O emissions by up to 30%.
- Good policy requires investing in R&D before compliance instruments become heavy-handed.
- Innovation is essential to reduce the “social cost of carbon” embedded in cotton production.
- Nitrogen (N) is the largest contributor to cotton emissions profile and is tightly linked to profitability.
- Growers frequently overapply N as insurance, due to uncertainty and mistrust of decision-support tools.
- New work focuses on building site-specific response curves to identify the economically optimal N rate (EONR).

- Mapping fibre quality and yield variability could further refine inputs and reduce emissions intensity.
- Major opportunity: significant emissions reductions through more precise N management.
- Biodiversity has been recognised as an issue since 2002, but progress has been limited due to extremely high measurement costs.
- New technologies (AI, machine learning, acoustic monitoring, remote sensing) can dramatically reduce these costs.
- Demand from banks and institutional investors is increasing. Biodiversity is now seen as a risk and value factor, not just an environmental issue.
- The challenge is developing broad-acre-appropriate, scalable, low-cost measurement tools that meet market and regulatory expectations.
- Adoption is shaped by dynamics at three levels:
 - Macro: regulation, markets, and climate pressures.
 - Meso: research, innovation systems, advisers, and supply chains.
 - Micro: grower decision-making culture, risk appetite and behavioural norms.
- Current incentives favour more nitrogen rather than less.
- The system is highly rigid, prioritising uniform yields, which limits the adoption of variable, climate-smart practices. Future systems must become flexible and adaptive, not uniform and prescriptive.

Group Discussion Themes

Measurement and accounting issues

- Multiple carbon calculators produce different emissions numbers, creating confusion and mistrust.
- Growers worry about being locked into the first calculator they use, especially if buyers or banks later require different methodologies.
- Tools requiring farm polygons raise privacy concerns (risk of commercial sensitivity being exposed).
- The emissions factors behind calculators, particularly for nitrous oxide, vary widely and are often poorly understood.
- Assurance levels (limited vs reasonable) add complexity and cost.
- There is a strong desire for a single, standardised approach across the cotton industry.
- ZNE CRC project
 - Is aiming to produce standards and guidelines for carbon accounting to be used by tool providers.
 - There is a reference group for the project.
 - In terms of emissions factors, there is a dearth of them in agriculture. They are on the agenda at the CRC.
- If you do measure data, it becomes part of the asset and therefore adds value.

Implications: A core gap exists around consistency, confidence, and clarity in emissions accounting.

Traceability as a system-wide requirement

- EU policy (e.g., Forced Labour Regulation, Digital Product Passport), supply-chain due diligence, and nature/climate disclosures all converge on a need for traceable cotton.
- Traceability costs remain high (e.g., ORITAIN), and supply-chain blending undermines verification.
- Brands increasingly require physical proof of origin; traditional paper-based traceability is no longer adequate.

Implication: Traceability is the central enabler of market access and sustainability claims.

Market expectations and signals

- Sustainability premiums are inconsistent and often small.
- But market access risks, being excluded from EU or brand procurement, are escalating. Large brands will follow EU standards regardless of final market destination.
- Active movements:
 - Make the Label Count
 - Plants not Plastic
- Brands prioritise:
 - defensible, non-misleading claims
 - supply-chain integrity

- avoidance of greenwashing risk
- Consumer demand is not the primary driver; compliance teams and ESG reporting are.
- Discussion on whether emissions-reduction expectations will push land from production into tree planting.
- Banks emphasised they are not the right vehicle to decide land-use change; their role is assessing land value and credit risk. Banks take a long-term view of land value and recognise natural capital can lower risk.
- Example: Gun Agri allocates ~30% of purchased farms to tree planting, with precision agriculture lifting productivity on remaining land.
- NAB 1.5% financing eligibility
 - Eligibility depends on credit risk and whether the bank can support the innovation, and whether the investment fits into the program criteria.
 - CSIRO is involved in reviewing interventions.
 - Novel projects are often conservatively assessed due to lack of precedent.
 - Once methods and technologies prove themselves, debt will more readily replace equity to scale adoption.
- TNFD
 - It is not a coincidence that it is under the Clean Energy Regulator which also covers TCFD.
 - Mining and property are already starting to think about it, because it is more tangible for them with real opportunities. They are also simpler industries which higher degree of regulation. Agriculture is the next logical industry.
 - Will hopefully help to achieve scale, but for this to happen there needs to be much more uptake on both the supply and demand side. Hopefully endorsement by government and surety of claims added by certificates will help but need to avoid the mistakes of the ACCU markets.
- Representative from Rabo Bank quoted that 35% of their book by dollar value have done emissions reporting. Rabo has done a considerable amount of work on this, highlighting the importance of the individual banker and individual farmer relationship. They provide funding assistance to do this but not technical expertise, which is a challenge to practically get it done.

Implication: Expectations of regulation and incentives are leading to change in the absence of actual market forces.

Biodiversity and nature-positive trends

- Biodiversity surveys are expensive and require specialist expertise.
- New technologies (AI, remote sensing, acoustic monitoring) show promises to reduce costs.
- Banks and corporates increasingly ask biodiversity questions as part of due diligence.
- Confusion exists about how carbon sequestration, biodiversity credits, TNFD and nature repair markets overlap.
- Productivity Commission work shows conservation currently costs farmers; markets alone are insufficient as regulatory tools.
- Need better policy and regulatory frameworks to support environmental services.
- Participants encouraged to watch law reform currently moving through parliament.
- Science should drive policy.
- Ecologists (e.g., ANU) heavily shape nature frameworks, while agricultural voices are underrepresented. Soil biodiversity is largely ignored in accounting frameworks.

Implication: Can we take any lessons from the carbon experience, which is slightly more mature, to nature?

Behavioural and system level barriers

- Growers are overwhelmed by tools, calculators, frameworks, and reporting obligations.
- The data is being collected by some but don't know what to do with it.
- Incentive structures across the value chain are misaligned.
- A recurring question: "How do we get everyone going in the same direction?"
- The role of the ACCC is important in preventing greenwashing but has made people scared of making claims. This could potentially be positive if the industry can have complete confidence in claims where others can't.

Cotton-specific operational issues

- High-quality Australian cotton is often blended, limiting its ability to carry sustainability claims forward.

- Retailers do not want blended products if making origin claims, but blending is cheaper and common.
- Cotton growers fear being disadvantaged by regulatory frameworks designed for synthetics.
- On-shoring/value-adding remains difficult due to cost structures and complex supply chains.

Implication: Australian cotton's sustainability story is strong, but supply-chain dynamics dilute its competitive advantage. How do we create a strong industry voice around advocacy and marketing to overcome this?

