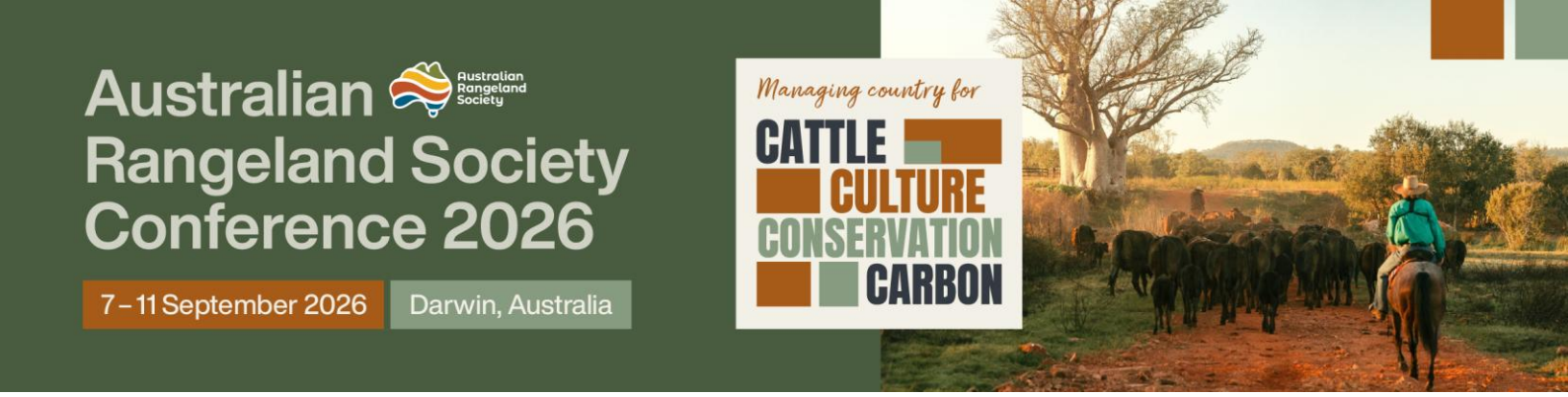


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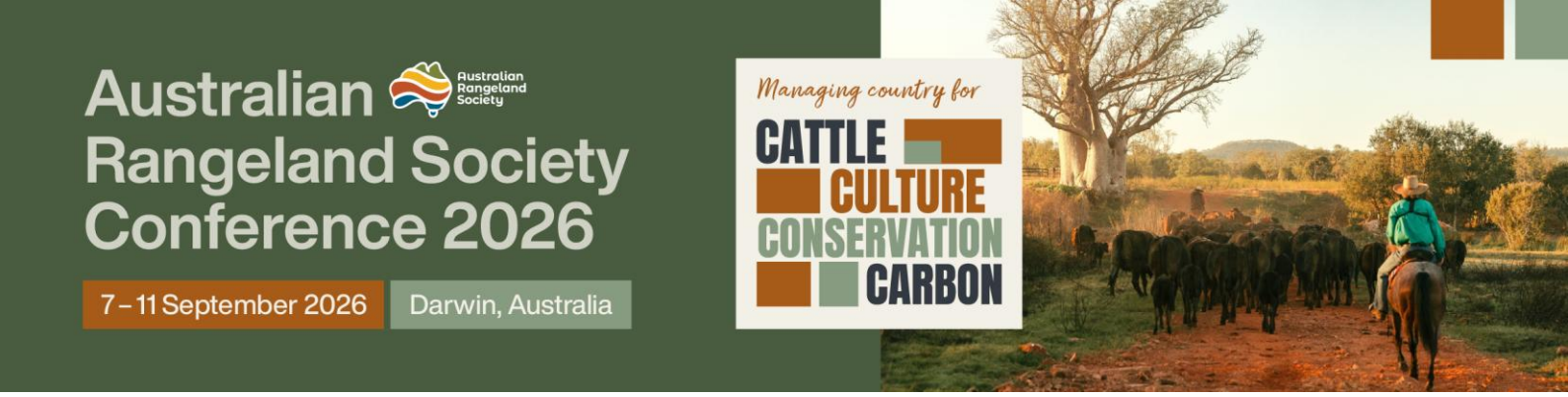
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Practical approaches to emissions and carbon in northern Queensland grazing systems

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Abstract
Australian producers face increasing pressure to demonstrate sustainability within their businesses. Although information on carbon sequestration, emissions reduction, biodiversity, and sustainability is abundant, it can be challenging for producers to identify which information is credible, relevant and practical to their enterprise and region. Extension support is critical to help producers build their emissions and carbon literacy, improve data readiness, ensure initiatives are locally relevant, and reinforce that sustainability is already embedded in maintaining a successful grazing business.

Extension activities conducted from February to November 2025 included one-on-one property visits and group workshops with graziers across Northern Queensland through the statewide DPI Carbon Outreach Program. These activities improved understanding of emissions reduction and carbon sequestration opportunities in Northern Queensland grazing systems, and supported graziers to record, consolidate and standardise the on-farm data required to calculate enterprise emissions.

Insights from this program highlight the importance of tailored regional delivery and of framing sustainability conversations around productivity and profitability - areas where producers are already comfortable with the objectives and language.

Several themes were consistent across regions, enterprise types, and business sizes:

- Confusion between emissions accounting, carbon sequestration, and Australian Carbon Credit Unit (ACCU) participation.
- Uncertainty about data requirements and acceptable levels of accuracy.
- Strong stewardship values: Producers who participated in the program demonstrated genuine care for the land and recognised that long term business success depends on sustainable landscape management.

Improved data collection supports decision making, helps identify opportunities to increase production efficiency, and enables businesses to demonstrate sustainability credentials. This program highlighted the importance of extension support that integrates triple-bottom-line outcomes, provides regionally specific information, and offers practical steps that producers can implement regardless of their starting point. Together, these elements reinforce that sustainability and productivity are not competing priorities but interconnected drivers of resilient grazing businesses.

Introduction

Australian producers are increasingly expected to understand and demonstrate sustainability within their business. While information is becoming more accessible, determining what is credible, relevant, and practical for a particular enterprise remains challenging. Graziers must determine which initiatives are appropriate for their enterprise while balancing existing business priorities.

In this complex and rapidly evolving space, extension services play an important role in supporting graziers to evaluate available options and determine which are relevant to their business (Rolfe *et al.* 2021, Burbi *et al.* 2016). The Queensland Department of Primary Industries (QDPI) Carbon Outreach Program was developed to support producers in understanding carbon and emissions opportunities relevant to their business. This paper summarises feedback and observations from the component of the program that was delivered across northern Queensland extensive livestock systems and identifies common themes relating to carbon literacy, data readiness, and effective sustainability extension.

Methods

The Queensland DPI Carbon Outreach Program was delivered across multiple agricultural industries and regions of Queensland. This paper focuses specifically on producer-focused extension activities conducted in northern Queensland that were delivered or co-delivered by the author between February and November 2025.

Introductory workshops and 1:1 emissions baseline development were conducted in seven locations across northern Queensland. Participants were invited to complete post-workshop feedback forms at four of the six workshops delivered.

Property-level emissions baselines were developed for interested graziers using the Sheep Beef Greenhouse Accounting Framework (SB-GAF) (Lopez *et al*, 2025), an industry emissions accounting tool. The process involved supporting graziers to identify and consolidate relevant farm records, and establishing regionally appropriate assumptions where farm records were not available.

Existing relationships between regional grazing extension staff and graziers were critical for establishing trust, facilitating engagement and supporting participation in both workshops and emissions baseline development.

Post-workshop feedback, recurring producer questions, and observations arising from 1:1 baseline establishment were reviewed regularly and used to adapt workshop content and delivery methods.

Results

A total of 6 producer-facing emissions and carbon workshops were delivered to 52 participants across Croydon, Sarina, Mareeba, Tully, Bowen and Mount Isa. Additionally, 13 emissions baselines were completed with graziers in Charters Towers, Bowen, Cooktown, Mareeba and Tully. Post-workshop feedback was collected from 32 participants across four locations (Mareeba, Sarina, Tully and Bowen), comprising 23 producers, and 9 advisors and service providers. Two workshops (Croydon and Mount Isa) delivered to 20 participants did not include formal post-workshop feedback collection.

Overall participant satisfaction was high, with a median satisfaction score of 6.5 out of 7. When asked how valuable the information provided at the event is to assist participants in conducting their business, the median response was 5.5 (7-point scale). 96% of producers reported having learned something new at the workshops, and self-assessed knowledge of carbon increased from a median of 3 prior to the workshop, to 5.5 afterwards (7-point scale).

Confusion between emissions accounting, carbon sequestration, and ACCU methods

A consistent theme across all regions was confusion regarding the distinction between enterprise emissions accounting, carbon sequestration, and Australian Carbon Credit Unit (ACCU) participation. This was particularly evident when discussing carbon market opportunities. Participants frequently sought clarification about how these concepts relate to each other, and what each means for their grazing business.

Workshop feedback reinforced these observations, with one participant noting that they learnt “what to expect from carbon accounting, better understanding of carbon projects/ credits”, another noted that they now understood the “difference between carbon emissions accounting and carbon credits”.

Data readiness and emissions baseline calculations

The process of calculating farm-emissions baselines highlighted data readiness as a major challenge. Data availability varied considerably between enterprises. Few graziers had all of the information required to complete an emissions baseline. For graziers who had most of the data available, records were often spread across notebooks, software, invoices, and producer memory, but had not been consolidated for analysis. Other enterprises had substantial gaps or inconsistencies in the data required to calculate emissions. Questions regarding acceptable levels of accuracy and appropriate assumptions were common throughout the emissions baseline development process.

Workshop feedback indicated improved understanding of the data required for enterprise emissions calculations and how it should be collected and applied. One participant reported learning “what record

keeping [and] data points are useful for measuring carbon". Another noted learning that "Majority of our emissions are from cattle, and what we need to change to reduce our/ their emissions".

Intent to implement changes following the workshop was mixed. 13 participants indicated that they intended to implement practice change in the next 12 months, 15 were unsure, and 4 did not intend to make changes. Of those not intending to implement changes, 3 reported that this was because they were already "running a very sustainable operation".

Planned actions were typically aligned with improving management and production or improving farm-data collection, rather than adopting new carbon-specific practices. Examples included "greater emphasis on herd management", increased "attention to pasture health", and intention to "collect and retain data relevant to carbon emissions reporting".

Adaptive extension delivery

Workshop content and delivery methods were progressively adapted in response to recurring producer questions, participant feedback, and facilitator observations which indicated that participants were more receptive to interactive and discussion-based formats. Initial workshops included theoretical information on policy settings, climate change data, carbon markets, alongside practical emissions reduction discussions. As the program progressed, workshops increasingly focused on practical examples and participant-led discussion, integrating carbon and emissions concepts into existing knowledge and production-focused outcomes rather than being presented as entirely new concepts.

Participants consistently responded positively to this approach, describing the workshops as "highly engaging" commenting that "conversations were exceptional" and noting that the interactive format was preferable to "having a ton of information on the slides or a long slideshow".

Stewardship and production focused decision making

Workshop discussions consistently indicated that producers valued environmental sustainability as a mechanism for supporting long term business performance. Sustainability was commonly viewed as an outcome of good grazing management rather than a separate business objective.

This perspective was reflected in feedback from participants who did not intend to implement changes following the workshop, commenting that they are "already doing what [they] can", suggesting that sustainability outcomes were already embedded within their existing management practices.

Discussion

The findings from this program suggest that effective sustainability extension is less dependent on comprehensive producer understanding of all aspects of carbon and emissions, and more dependent on supporting producers to identify information that is relevant to their enterprise and can be translated into practical actions (Burbi *et al,* 2016, Knook *et al,* 2020). Establishing sufficient understanding of a few key concepts to support informed decision-making may be more valuable than attempting to cover all aspects of this rapidly evolving space within a single extension activity.

Carbon and emissions extension often attempts to cover climate science, carbon and nitrogen cycling, emissions accounting, carbon sequestration, carbon markets and policy settings within a single workshop. While each topic is important, presenting all concepts in quick succession can overwhelm producers who are still developing a foundational understanding and determining how the information is relevant for their business. A staged learning approach that establishes foundational understanding before introducing more complex policy and market considerations may improve learning outcomes (Knook *et al,* 2020).

Linking carbon and emissions concepts to existing production decisions improved understanding and enabled environmental outcomes to be more readily integrated into grazing businesses, rather than being viewed as separate environmental or compliance activities (Rolfe *et al,* 2021; Burbi *et al,* 2016). When discussions were centred around production, graziers more readily identified management practices that could improve both enterprise and emissions outcomes. These discussions generated practical actions that could be implemented immediately, such as improving the collection and consolidation of farm records. In contrast, discussions focused primarily on current or emerging policy settings were more likely to prompt questions about future obligations and business impacts.

Improving data readiness emerged as a practical entry point for producer engagement. Although enterprise emissions calculations were the initial objective of the one-on-one activities, the process consistently identified opportunities to strengthen record keeping, business analysis and decision-making. These findings suggest that improving data readiness involves more than collecting additional data. Many enterprises required support to consolidate existing records, while others lacked key information and needed to make assumptions to estimate farm emissions. Strengthening data collection and management can support both emissions calculations and broader business decision making (Burbi *et al,* 2016).

Workshop participant feedback consistently indicated that when a producer felt they were already managing a sustainable grazing business, their sentiment was that sustainability was embedded in their day-to-day practices. This aligns with national survey findings that many Australian producers have already implemented practices that reduce emissions or improve sustainability, despite not necessarily identifying those practices as carbon or climate initiatives (Farmers for Climate Action, 2025)

Conclusion

Many practices that facilitate emissions reduction in extensive grazing systems are already well understood best practice approaches, including reproduction , genetics, grazing management, nutrition, and animal health. Using these practical fundamentals as the basis for emissions and carbon discussions may improve adoption of both sustainability and productivity outcomes. Positioning emissions and carbon within existing best-practice extension messages allows sustainability outcomes to be accepted as a component of productive, profitable and resilient grazing businesses, rather than as a separate environmental objective (Rolfe *et al,* 2021, ZNE Ag CRC 2025). This framing supports long-term environmental, social and economic outcomes for grazing businesses regardless of future policy settings.

Collectively, these findings reinforce the importance of extension that helps graziers interpret, prioritise, and apply carbon and emissions information within their business. Extension programs that are regionally relevant, practically focused, and built around best management practices are likely to be more effective at improving carbon literacy, strengthening data readiness, and supporting informed decision-making. Importantly, this approach demonstrates that sustainability and productivity are complementary outcomes that underpin the long-term environmental, social and economic resilience of northern Queensland grazing businesses.

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