Final report

Carbon Footprint and Carbon Account Workshops

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Prepared by: Jane Dunn, Stephen Wiedemann
Integrity Ag & Environment

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Meat and Livestock Australia Limited
PO Box 1961
NORTH SYDNEY NSW 2059

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Abstract

The red meat industry has set a goal to become carbon neutral by 2030 to meet consumer and community expectations, ensure market access in the future and utilise technologies that deliver economic, environmental and social benefits. Meat & Livestock Australia (MLA) and Integrity Ag & Environment conducted carbon accounting workshops for beef and sheep producers across Australia to assist in generating farm carbon accounts from March to May 2020. A training manual for wider industry use was developed to support this task based on the findings and feedback provided in the workshops. The manual included (1) a step by step guide detailing how to generate a baseline carbon account using the SB-GAF tool, (2) a variety of different farm scenarios and examples, and (3) options to reduce emissions and store carbon on-farm. Literature summarised in the manual identified that current opportunities to reduce on-farm emissions include improvements in livestock productivity, while future opportunities include utilising feed additives and anti-methanogenic legumes. Emissions can be offset through carbon sequestration in trees and soils. This project will provide ongoing benefits to both producers and the industry as a whole as improved accuracy and understanding of farm carbon accounting are essential steps in working towards achieving carbon neutrality within the industry.

Executive summary

Background

MLA has set a goal to achieve net zero carbon emissions by 2030 to meet consumer and community expectations, ensure market access in the future and utilise technologies that deliver economic, environmental and social benefits. The current project addressed greenhouse gas (GHG) measurement, accounting and reporting (MAR) at the enterprise scale by working with beef and sheep producers to develop baseline carbon accounts. An improved accuracy and understanding of farm carbon accounting are essential steps in working towards achieving carbon neutrality within the industry.

This project involved working with producers to develop skills and understanding by completing a farm carbon account. Following development of the farm carbon accounts, MLA and Integrity Ag & Environment conducted workshops throughout Australia's main beef and sheep production regions to assist producers in understanding carbon accounts and options to reduce emissions and store carbon. During stages 1 and 2 of the project, more than 50 farm carbon accounts were completed.

Objectives

This project had the following objectives:

1. Conduct workshops across Australia and assist participants in developing a carbon account.
2. Develop forest and soil carbon stock maps for participant's properties prior to workshop.
3. Produce a training booklet/manual for wider industry use based on workshop findings/feedback and case studies developed by MLA.

Objectives 1 and 2 were achieved through the workshops conducted by MLA and Integrity Ag & Environment which concluded in May 2020. The final objective was achieved through the development of a 30-page carbon accounting manual which provided a step by step guide on how to generate a carbon account using the SB-GAF tool. The manual also provided background information on farm GHGs, gave farm carbon accounting scenarios, and identified opportunities to reduce farm emissions and store carbon.

Methodology

Objectives 1 and 2 involved conducting 1 on 1 meetings with producer participants to gain an understanding of their operation and assist in completing an accurate and representative carbon account. Once the carbon accounts were generated and soil carbon maps for each producer's property had been developed, carbon accounting workshops were held.

The training manual was developed in accordance with the SB-GAF tool. The findings and feedback from the carbon accounting workshops were incorporated into the manual.

Results/key findings

In total, Integrity Ag and Environment conducted 1 on 1 meetings with over 50 producers to assist in developing an accurate carbon account for their enterprise. Producers who supplied their property boundaries were provided with a vegetation report generated by Mullion Group. These reports provided a rapid assessment of carbon stocks in relation to forests on the property using readily available data. Following the development of carbon accounts and property reports, webinars were held in Queensland, South Australia, Western Australia, New South Wales, Tasmania and Victoria.

The manual included sections on information on livestock related GHG emissions, a step by step guide detailing how to complete a carbon account for a beef and/or sheep enterprise using the SB-GAF tool, farm carbon accounting example scenarios, tree and soil carbon storage on farm, opportunities to reduce GHG emissions, and opportunities to store carbon to offset emissions.

The carbon account generated with the SB-GAF tool does not provide a carbon footprint (this requires more inputs on purchased inputs to the farm) and did not include a detailed verification stage. For this reason, the accuracy of the total emissions and emissions intensity value generated by the tool is generally within +/- 20% and was highly dependent on the accuracy of data supplied by farmers to generate the carbon account. Improved accuracy can be achieved through good record keeping, using financial records and careful matching of livestock performance with the inputs to the calculator. Basing the carbon account on a 'normal year' or taking an average across 2-3 years was found to improve the representativeness of the findings and to reduce the impact of unusual seasonal conditions, particularly the severe drought experienced recently in much of Australia.

Benefits to industry

This project will provide ongoing benefits to both producers and the industry as a whole as improved accuracy and understanding of farm carbon accounting are essential steps in working towards achieving carbon neutrality within the industry.

Future research and recommendations

Continued work with producers at the enterprise level to build knowledge and skills surrounding farm GHGs and carbon accounting are essential steps in working towards carbon neutrality at the industry scale. Modifications to and updating of the SB-GAF GHG calculator tool are essential to allow for improved accuracy in farm carbon accounting.

In order of priority we recommend:

- Modifications and updates to the SB-GAF tool to increase the user-friendliness of the interface and simplify the carbon accounting process for producers;
- Annual updates to the manual in accordance with the NIR and SB-GAF tool updates; and
- Continued engagement with producers to promote the importance of understanding farm GHGs, accurate generation of carbon accounts and to help identify next steps as the industry moves towards achieving carbon neutrality.

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1. Background

The Red Meat Industry has set a goal to achieve net zero carbon emissions by 2030 (CN30). This project aligns with the CN30 initiative and involves working with producers to develop carbon accounts for individual farms. The current project addresses greenhouse gas (GHG) measurement, accounting and reporting (MAR) at the enterprise scale by working with beef and sheep producers to develop baseline carbon accounts and to support their ongoing GHG MAR. A carbon account allows producers to (1) establish their current GHG position, (2) understand how GHGs and the management of carbon interact with the productivity of the enterprise, and (3) identify management options to improve the farm carbon balance. Potential benefits of generating a carbon account include increased farm productivity and long-term sustainability, improving the social licence and market support for red meat, and engaging with emerging market opportunities for low carbon products.

The first stage of this project involved holding workshops across Australia to assist beef and sheep producers in developing carbon accounts for their farms and providing guidance around options to reduce emissions and store carbon. The second stage of this project was achieved during the workshops and involved developing forest and soil carbon stock maps for participant's properties. The third and final stage of this project was the development of a training manual which was produced for wider industry use and was based on workshop findings and feedback.

The manual will allow producers to gain insight into their GHG position by creating a baseline carbon account, understand key factors influencing GHG emissions, management options to reduce on farm emissions, and opportunities to store carbon. Benefits of the training manual include development of carbon accounts for beef and sheep production enterprises across Australia, improved accuracy of farm carbon accounting, a better understanding of on-farm GHG emissions, guidance around options available to reduce emissions and increase carbon sequestration to work towards becoming carbon neutral.

2. Objectives

This project had the following objectives:

1. Conduct workshops across Australia and assist participants in developing a carbon account.
2. Develop forest and soil carbon stock maps for participant's properties prior to workshop.
3. Produce a training booklet/manual for wider industry use based on workshop findings/feedback and case studies developed by MLA.

Objectives 1 and 2 were achieved through the workshops for beef and sheep producers across Australia which were conducted by MLA and Integrity Ag & Environment, concluding in May 2020. The final objective was achieved through the development of a 30-page carbon accounting manual which provides a step by step guide on how to generate a farm carbon account using the SB-GAF tool. The manual also provides background information on farm GHGs, gives farm carbon accounting scenarios, and discusses opportunities to reduce farm emissions and store carbon.

3. Methodology

Objectives 1 and 2 involved conducting 1 on 1 meetings with producer participants to gain an understanding of their operation and assist in completing an accurate and representative carbon

account. Once the carbon accounts were generated and soil carbon maps for each producer's property had been developed, carbon accounting workshops were held.

The carbon accounting training manual was developed for wider industry use and was based on the outcomes and feedback received from the carbon accounting workshops conducted by MLA and Integrity Ag in stage one of this project. The training manual was developed in accordance with the SB-GAF tool (P.PSH.1252).

4. Results

In preparation for the first webinar held in QLD, Integrity Ag conducted 1 on 1 meetings with all 6 QLD participants. Prior to the second webinar, which was SA based, Integrity Ag conducted 1 on 1 meetings with all 5 participants. In the WA workshop there was a total of 12 participants, 10 of which had 1 on 1 meetings with Integrity Ag prior to the workshop. Integrity Ag conducted 1 on 1 meetings with 8 of the 9 NSW participants prior to the workshop. The final participant was unable to complete their spreadsheet before the workshop, so a 1 on 1 meeting was completed after the final workshop. A total of 5 producers were beef and sheep producers, 1 was just beef and another was just sheep. In the Tasmanian workshop a total of 14 participants registered for the webinar. Integrity Ag conducted 1 on 1 meetings with 11 of these producers. The 3 participants who were unable to complete their spreadsheets on time have been offered 1 on 1 meetings after the final workshop. The final workshop, which was Victorian based had a total of 11 participants. Of these 11 participants, 8 had 1 on 1 sessions with Integrity Ag prior to the webinar. In total Integrity Ag conducted 50 1 on 1 sessions.

These 1 on 1 sessions involved discussing the participant's farm details to ensure values had been correctly entered into the tool and were reflective of the farm. Data were modified and additional information was inputted into the tool where required. An emissions intensity value and a value for total farm emissions was also generated, with the aim of being accurate to within +/- 20%. Participants were given a brief explanation of what these values mean and the factors affecting them.

The net farm emissions and emissions intensity values for beef, sheep meat and wool from the 50 carbon accounts generated across 6 states can be seen in Table 1– Table 6.

Table 1 - Emissions summary QLD workshop - beef

Farm	Net Emissions	Emissions Intensity
	Tonnes CO2-e (excl. vegetation and soil)	kg CO2-e / kg LW (excl. veg and soil)
1	1808	13.5
2	341	8.8
3	3159	9.7
4	2945	10.9
5	545	13.1
6	386	8.9
av.	1531	10.8
min.	341	8.8
max.	3159	13.5
st dev	1185	1.9
CoV	77%	18%

Table 2 - Emissions summary SA workshop - beef

Farm	Net Emissions	Emissions Intensity
	Tonnes CO2-e (excl. vegetation and soil)	kg CO2-e / kg LW (excl. veg and soil)
7	8195	9.1
8	162	9.6
9	2551	10.3
10	7379	
11	1066	
av.	3871	10
min.	162	9.1
max.	8195	10.3
st dev	3298	0.5
CoV	85%	5%

Table 3 - Emissions summary WA workshop - beef

Farm	Net Emissions	Emissions Intensity
	Tonnes CO2-e (excl. vegetation and soil)	kg CO2-e / kg LW (excl. veg and soil)
12	50.4	9.6
13	185.5	9.3
14	160.0	14.3
15	1180.5	11.1
16	2721.9	8.3
17	910.8	9.1
18	195.3	10.3
19	606.3	10.9
20	623.3	9.7
21	1608.2	11.4
av.	1012	9.7
min.	195	8.3
max.	2722	10.9
st dev	885	0.9
CoV	87%	9%

Table 4 - Emissions summary for NSW workshop - beef and sheep

	Beef		Sheep		
Farm	Net Emissions	Emissions Intensity	Net Emissions	Emissions Intensity meat	Emissions Intensity wool
	Tonnes CO2-e (excl. vegetation and soil)	kg CO2-e / kg LW (excl. veg and soil)	Tonnes CO2-e (excl. vegetation and soil)	kg CO2-e / kg LW (excl. veg and soil)	kg CO2-e / kg greasy (excl. veg and soil)
22	393	11.3	899	8.1	32
23	1347	9.6	673	6	25.2
24	954	12.7	1444	5.8	21.3
25	968	10.2	269	7	30.1
26	453	9.9	1849	6.8	27
27	200		307	6.8	28.5
28	1693	10			
29	1500	11.8	4918	6.2	24
30	81				
av.	939	10.8	1479.9	6.7	26.9
min.	200	9.6	269.0	5.8	21.3
max.	1693	12.7	4918.0	8.1	32.0
st dev	516	1.1	1501.8	0.7	3.4
CoV	55%	10%	101%	11%	13%

Table 5 - Emissions Summary TAS workshop - beef and sheep

	Beef		Sheep		
Farm	**Net Emissions**	**Emissions Intensity**	**Net Emissions**	**Emissions Intensity meat**	**Emissions Intensity wool**
	Tonnes CO2-e (excl. vegetation and soil)	**kg CO2-e / kg LW (excl. veg and soil)**	**Tonnes CO2-e (excl. vegetation and soil)**	**kg CO2-e / kg LW (excl. veg and soil)**	**kg CO2-e / kg greasy (excl. veg and soil)**
31	354	10.8	83	7	27.6
32	1441	10.8	240	5.7	21.8
33	759	12.3			
34	2797	10.5			
35	300	9			
36	299				
37	912				
38	1429				
39	825	11.3			
40			2685		
41			212	6.4	24.8
av.	1013	10.8	805.0	6.4	24.7
min.	299	9	83.0	5.7	21.8
max.	2797	12	2685.0	7.0	27.6
st dev	753	1	1087.0	0.5	2.4

Table 6 - Emissions summary VIC - beef and sheep

	Beef		Sheep		
Farm	**Net Emissions**	**Emissions Intensity**	**Net Emissions**	**Emissions Intensity meat**	**Emissions Intensity wool**
	Tonnes CO2-e (excl. vegetation and soil)	**kg CO2-e / kg LW (excl. veg and soil)**	**Tonnes CO2-e (excl. vegetation and soil)**	**kg CO2-e / kg LW (excl. veg and soil)**	**kg CO2-e / kg greasy (excl. veg and soil)**
42			9656	7.2	30.1
43	439		1556	8.1	33.7
44	1475	11	1066	8.1	33.6
45			1269	7.2	25.6
46			1538	6	23.2
47			5346	6.7	26.9
48			3569	6.3	23.3
49			5179		
50	1971	11	913	6.2	24.1
av.	1295	11.0	3343.6	7.0	27.6
min.	439	11.0	913.0	6.0	23.2
max.	1971	11.0	9656.0	8.1	33.7
st dev	638	0.0	2771.5	0.8	4.1
CoV	49%	0%	83%	11%	15%

A summary of the key values from the 6 workshops can be seen below in Table 7.

Table 7 - Emissions summary of 50 carbon accounts

	Beef		Sheep		
	Net Emissions	**Emissions Intensity**	**Net Emissions**	**Emissions Intensity meat**	**Emissions Intensity wool**
	Tonnes CO2-e (excl. vegetation and soil)	**kg CO2-e / kg LW (excl. veg and soil)**	**Tonnes CO2-e (excl. vegetation and soil)**	**kg CO2-e / kg LW (excl. veg and soil)**	**kg CO2-e / kg greasy (excl. veg and soil)**
av.	1364	10.6	2183.5	6.8	26.8
min.	50	8.3	83	5.7	21.3
max.	8195	14.3	9656	8.1	33.7
st dev	1645	1.4	2375.1	0.7	3.7
CoV	121%	13%	109%	11%	14%

Table 7 shows a large variation in net farm emissions for the 50 carbon accounts however little variation in the emissions intensity values. The net farm emissions for beef ranged from between 508195 tonnes CO_2-e, while the emissions intensity ranged from 8.3 to 14.3 kg CO_2-e /kg LW. The

net farm emissions values are reflective of the size of the enterprise. Smaller herds and flocks will result in less methane produced and lower emissions from inputs as fewer inputs are required as there are less animals in the system. This will result in lower net farm emissions. In contrast, emissions intensity is based on kg of CO_2 emitted per kg of LW, which removes the influence of property size and reflects only flock or herd productivity. For this reason, there was less variation in the emission intensity results.

The average emissions intensity for beef production from the 50 carbon accounts was 10.6 kg CO_2-e/kg of LW, for sheep meat production the average emissions intensity value was 6.8 kg CO_2-e / kg LW, and for wool 26.8 kg CO_2-e/ kg greasy. These results are comparable to those in the literature. A life cycle assessment conducted by Wiedemann et al. (2015) reported an emissions intensity of 12 kg CO_2-e/ kg LW for Queensland beef cattle farms and a value of 10.8 kg CO_2-e/ kg LW for New South wales beef cattle farms. The average emissions value from the Queensland workshop was 10.8 kg CO_2-e/ kg LW and the average emissions intensity from the New South Wales workshops was also 10.8 kg CO_2-e /kg LW. On average the emissions intensity value for the carbon accounts generated is likely to be underestimated. The lack of refinement of data and the lack of incorporation of other components which impact on farm emissions are reasons for this likely underestimation. That being said, it is possible that the lower results reported here also reflect improvements in herd efficiency over the past years since the LCA study was conducted. It was noted that many workshop participants reported improvements in herd efficiency in recent years which would support the idea that emission intensity may be declining.

The average emissions intensity from all of the workshops for sheep meat was 6.8 kg CO_2-e /kg LW. This value sits within the 6.1-7.3 CO_2-e /kg LW range reported by Wiedemann et al. (2016) for Australian Lamb. The average for NSW from the workshops was 6.7 kg CO_2-e /kg LW which is slightly lower than the 7 kg CO_2-e /kg LW reported by Wiedemann et al. (2016) for New South Wales. The Victorian workshop average was 7 kg CO_2-e /kg LW which is higher than the 6.2 kg CO_2-e/ kg LW reported by Wiedemann et al (2016) for Victorian farms. Similarly to the beef carbon accounts, it was also expected that emissions intensity would have been underestimated due to the lack of refinement and lack of incorporation of certain aspects in the carbon account. The data used to generate each carbon account varied between each farm. Some producers provided data from an average/normal year, data that was an average of the past few years, data from the most recent year which was typically a drought year or based the data on future predictions.

Emissions intensity values were not generated for all farms in the workshops. Some of these enterprises were trading enterprises so an emissions intensity value would not be comparable to an emissions intensity value from breeding herd. Other enterprises used data from an unusual year where data reflected an unstable herd or flock. In many instances this scenario was a result of a drought period where producers were either destocking, so had higher than normal sales, or rebuilding their herd after a drought period, so had very low sales. In these cases, emissions intensity values were not included as they were not reflective of the enterprise.

Producers who supplied their property boundaries were provided with a vegetation report for their property generated by Mullion Group. These reports provided a rapid assessment of carbon stocks in relation to forests on the property using readily available data. The reports included carbon stored in three forest components: aboveground biomass (aboveground parts of living trees); below ground biomass (roots of living trees); and, dead organic matter (biomass in tree litter and deadwood). Soil carbon was not included in the assessment.

Webinar's covered topics such as: GHGs in agriculture and sequestration sources; emissions from livestock and farm inputs; key aspects influencing emissions; comparison of results against benchmarks; tree and soil carbon storage, and opportunities to reduce emissions and store carbon.

The manual was based on feedback received in the webinars and includes sections on livestock related GHG emissions, a step by step guide detailing how to complete a carbon account for a beef and/or sheep enterprise using the SB-GAF tool, farm carbon accounting example scenarios, tree and soil carbon storage on farm, opportunities to reduce GHG emissions, and opportunities to store carbon to offset emissions.

5. Conclusion

5.1 Key findings

- Many producers were interested in the carbon accounting process, particularly establishing a baseline carbon account and identifying next steps to reduce emissions on farm, store carbon and understanding the steps involved in the certification process
- Continued work and improvements on the SB-GAF tool are required to allow for improved accuracy in farm carbon accounting.
- The accuracy of the SB-GAF is highly dependent on the quality of the data and the precision of input.
- Basing the carbon account on a 'normal year' or taking an average across 2-3 years was found to improve the representativeness of the findings and to reduce the impact of unusual seasonal conditions, particularly the severe drought experienced recently in much of Australia.

5.2 Benefits to industry

This project will provide ongoing benefits to both producers and the industry as a whole, as improved accuracy and understanding of farm carbon accounting are essential steps in working towards achieving carbon neutrality within the industry.

6. Future research and recommendations

Continued work with producers at the enterprise level to build knowledge and skills surrounding farm GHGs and carbon accounting are essential steps in working towards carbon neutrality at the industry scale. Modifications to and updating of the SB-GAF GHG calculator tool are essential to allow for improved accuracy in farm carbon accounting.

In order of priority we recommend:

- Future modifications and updates to the SB-GAF tool to increase user-friendliness and simplify the carbon accounting process for producers;

- Annual updates to the manual in accordance with the *National Inventory Report* and SB-GAF tool updates; and continued engagement with producers to promote the importance of understanding farm GHGs, accurate generation of carbon accounts and to identify next steps as the industry moves towards achieving carbon neutrality.