AGRICULTURE VICTORIA

Greenhouse Gas Farm Monitor 2024-25

CONTENTS

ABOUT THE REPORT

Livestock Farm Monitor

The Livestock Farm Monitor Project is Agriculture Victoria's primary source of farm-level information for sheep and beef production practices, resource use, and economic data. The results of the annual Livestock Farm Monitor Project provide farm-level data to inform Agriculture Victoria's decisions that impact at a farm level and inform the direction of future policy design, research themes and service delivery programs.

Greenhouse gas emission estimates

In 2024-25 the type, source and quantity of greenhouse gas (GHG) emissions and sequestration was estimated using the University of Melbourne Sheep and Beef Accounting Framework (SB-GAF version 2.6) for each of the 134 farms surveyed. The aggregated emissions results generated from the analysis are summarised in this report. Farm emissions and sequestration are reported in carbon dioxide equivalents (CO_2-e). This allows for more meaningful comparisons of total emissions by adjusting each different GHG emissions type by its global warming potential.

Scope 1 emissions are direct GHG emissions that occur from sources owned or controlled by the farmer. Scope 2 GHG emissions are from purchased electricity consumed by the farm business. Scope 3 emissions are from upstream or downstream activities that are consequence of the farm business but from sources not controlled or owned by the farm business. For this analysis only upstream sources are included in the scope 3 emissions reported.

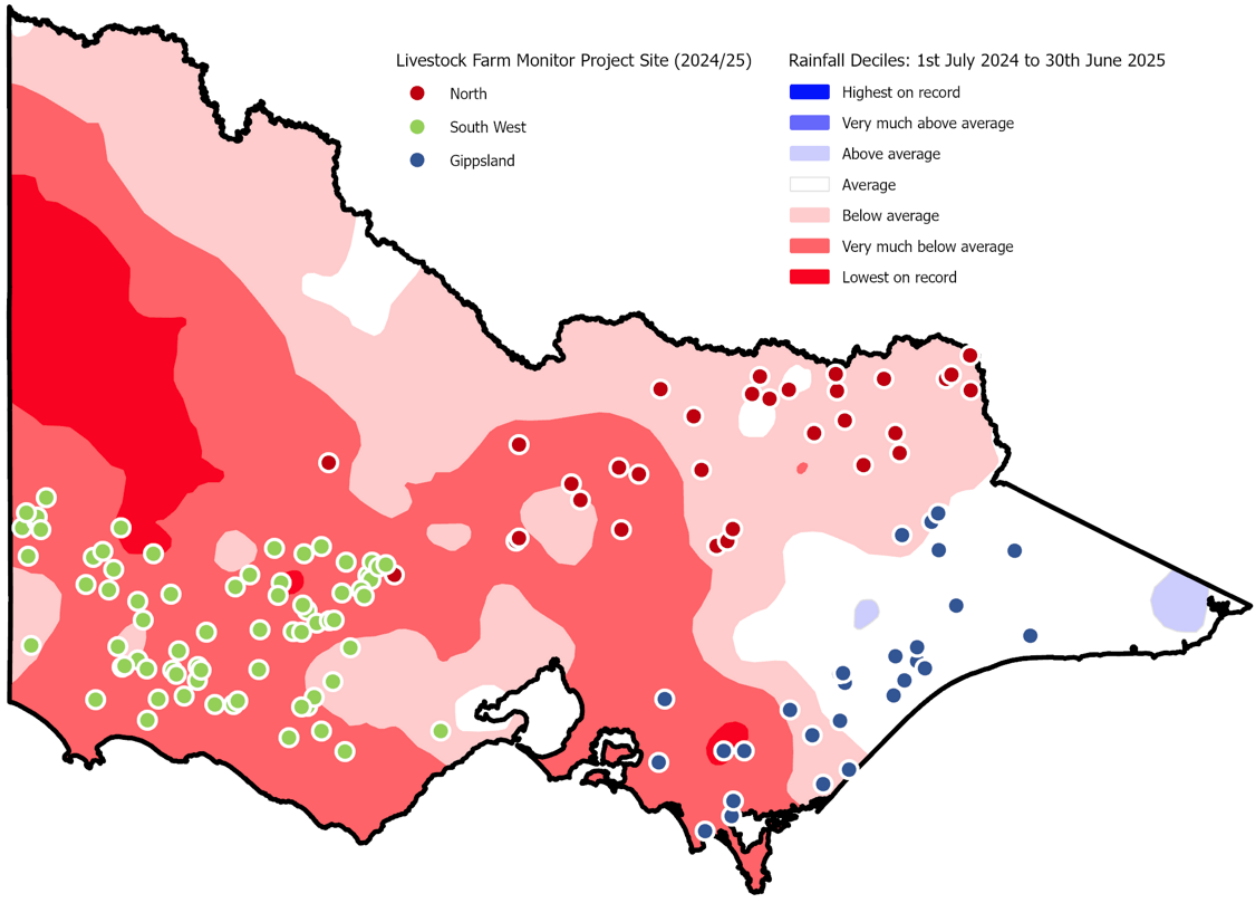
Acknowledgements

Agriculture Victoria staff are grateful for the cooperation of the farmers who contributed their data to this project.

This work is funded by Agriculture Victoria.

DATA COLLECTION

The Livestock Farm Monitor Project annually collects detailed financial and production performance information from 134 farm businesses from across Victoria. The map below shows the location of the 2024-25 participating farms, the rainfall decile they received during the financial year and whether they are categorised as being from Gippsland, Northern Victoria or South West Victoria. Rainfall was below average for most of the state except for East Gippsland.



40

Sheep and beef businesses

31

Beef specialist businesses

134

Farm businesses surveyed

50

Sheep specialist businesses

13

Stock and grain businesses

TOTAL EMISSIONS

STATEWIDE SUMMARY

The median total net emissions per livestock farm was 2,004 tonnes CO_2-e, with a range of 1,121 to 3,710 t CO_2-e (Figure 1).

The major source of total farm emissions (scope 1, 2 and 3) from livestock farms was emissions released from the process of ruminant digestion (enteric methane. Enteric methane made up 77% of total emissions (Figure 2). The next largest emission sources were from urine and manure (8%), pre-farm emissions (7%) and fuel and electricity (1%).

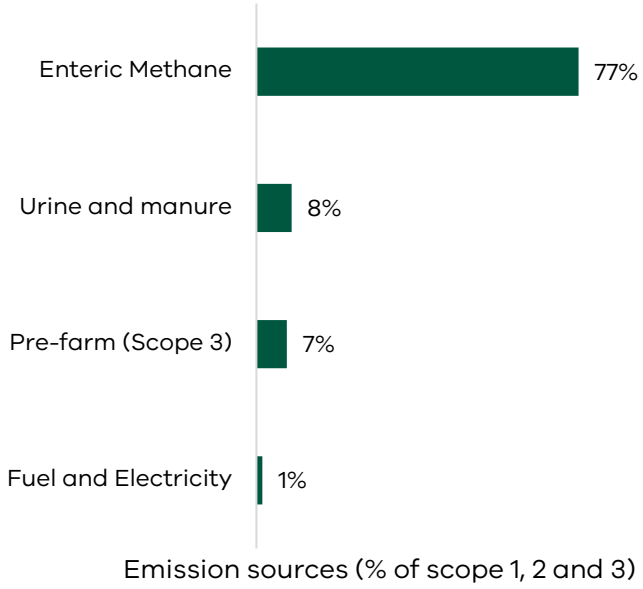
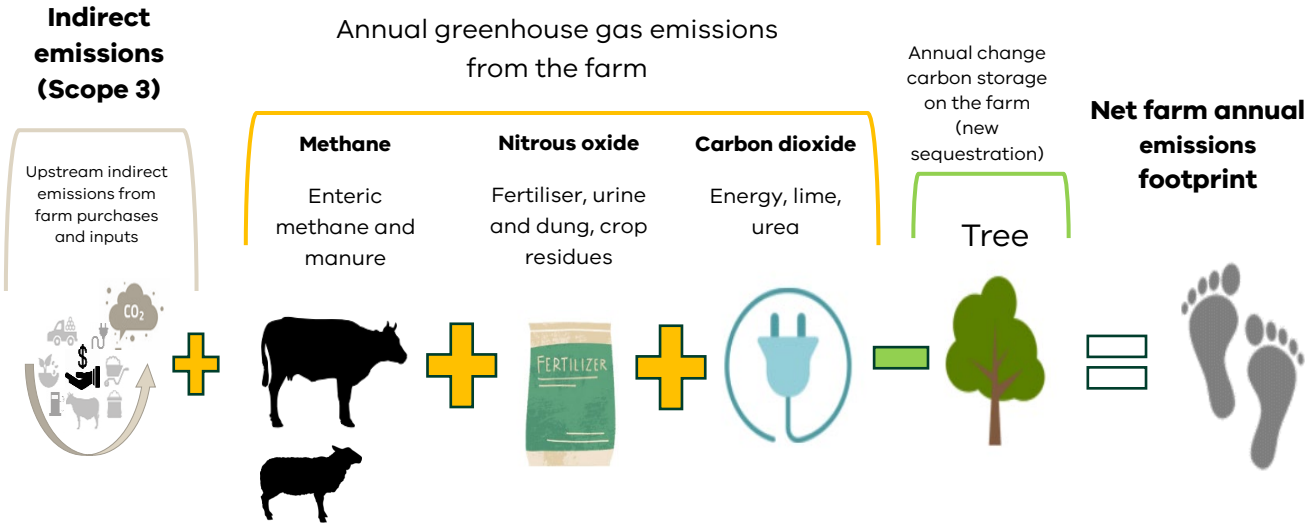


Figure 2. The statewide median proportion of emission sources per farm (% of Scope 1, 2 and 3).



Median emissions	**185 t CO_2-e**	**1,700 t CO_2-e**	**132 t CO_2-e**	**52 t CO_2-e**	**76 t CO_2-e**	**2,004 t CO_2-e**
Range	***42-425 t CO_2-e***	***1,002-2,992 t CO_2-e***	***77-221 t CO_2-e***	***20-148 t CO_2-e***	***19-249 t CO_2-e***	***1,121-3,710 t CO_2-e***

Figure 1. The median and range (as shown by Q1 to Q3) in different types and sources of emissions.

2024-25 FARM EMISSIONS

Total emissions per farm decreased by 6% in 2024-25 (Figure 3). This was mostly influenced by the management of dry seasonal conditions. Farmers reduced their stocking rates and fertiliser usage contributing to the lower methane and nitrous oxide emissions than the previous year. In 2024-25, scope 3 emissions increased by 14% due to an increase in the quantity of supplementary feed purchased as a result of poor pasture growth from dry conditions.

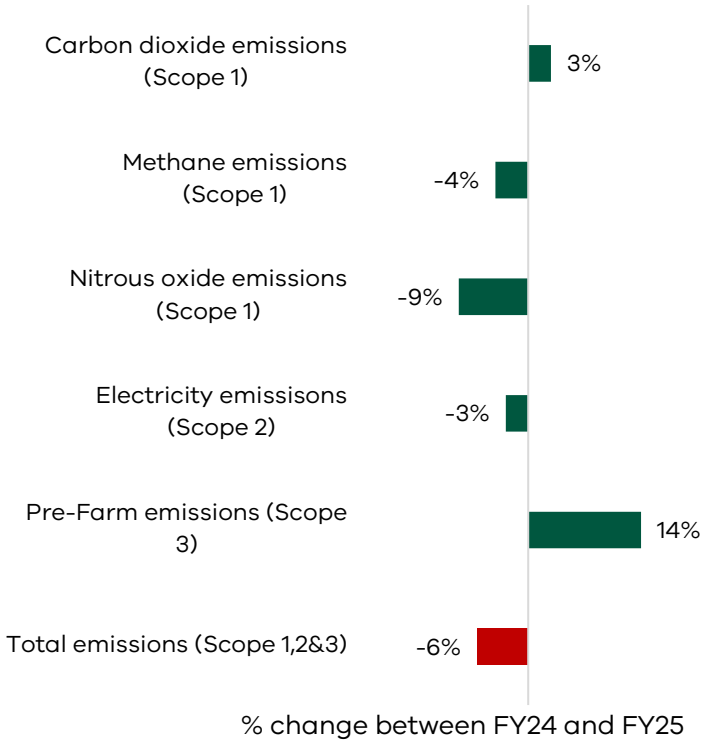


Figure 3. The statewide median percentage change of different emission types between financial year (FY) 2023-24 and 2024-25.

Figure 4 shows the number of livestock per farm can explain almost all the variation in farm emissions between regions. For example, South West Victoria farms had higher total emissions than participating farms in Northern Victoria and Gippsland because they had more livestock per farm (dry sheep equivalent per farm).

As livestock farm emission profiles are predominately comprised of emissions from livestock, the total number of livestock on a farm is therefore a good predictor of total farm emissions

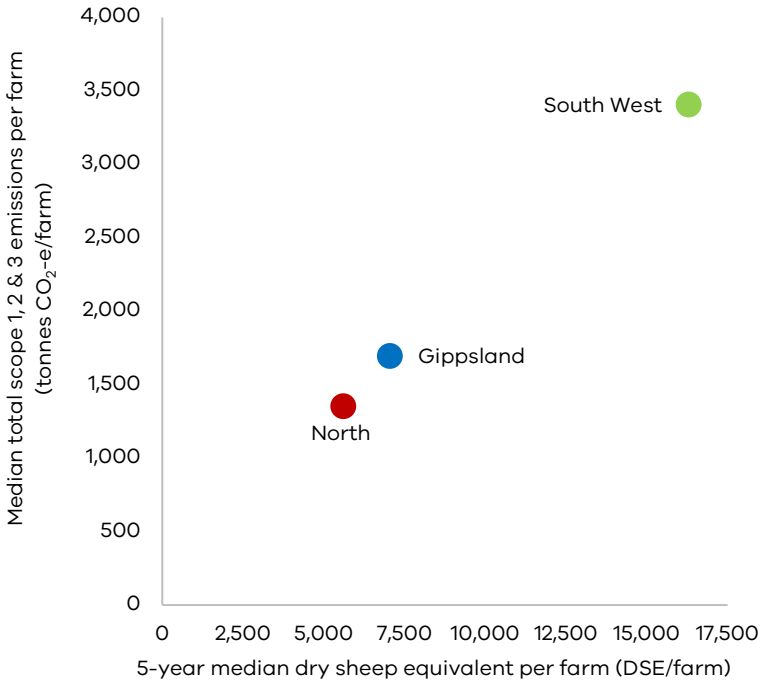


Figure 4. Regional 5-year median dry sheep equivalent per farm versus median total scope 1, 2 and 3 emissions per farm from 2020-21 to 2024-25.

TREE CARBON SEQUESTRATION

Trees can capture and store carbon; this process is called sequestration. Carbon that is sequestered in trees can be used in greenhouse gas accounting to balance emissions produced from a farm business. Trees on the 134 livestock farms captured and stored a total of 26,179 tonnes of CO_2-e in 2024–25 (Figure 5).

Gippsland livestock farms sequestered an average of 160 tonnes of CO_2-e per farm from trees in 2024–25, the highest of all regions (Figure 6). This is largely because Gippsland is a higher rainfall region. The percentage of farm area allocated to trees tends to increase in higher rainfall areas and often due to smaller farm sizes. Gippsland had the highest proportion of tree area per farm and therefore sequestered more carbon per farm than other regions (Figure 6).

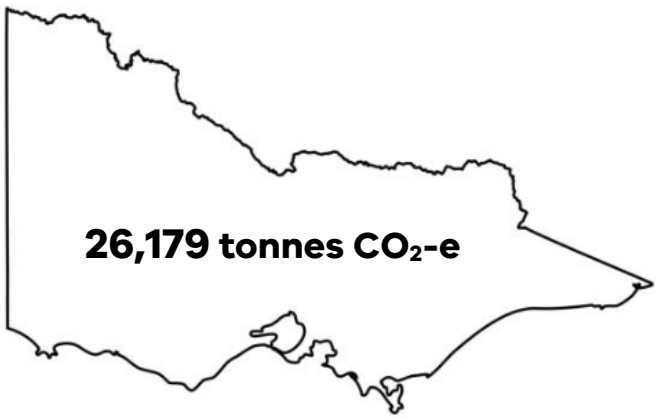


Figure 5. 2024-25 total tonnes of CO_2-e sequestered by trees across 134 livestock farms

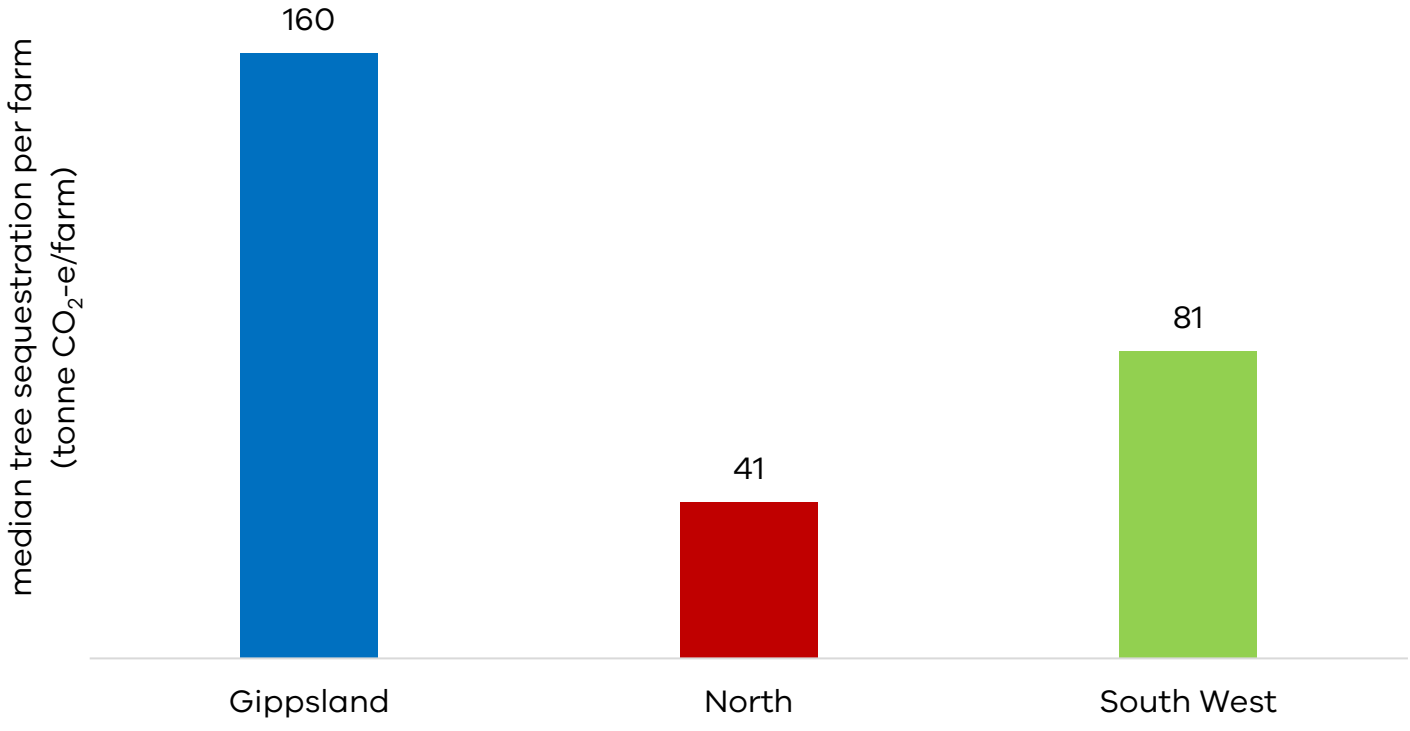


Figure 6. 2024-25 median carbon sequestration in trees per farm for each region.

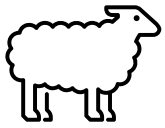
EMISSIONS INTENSITY

Notes on emissions intensity

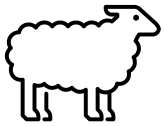
The measure of emissions intensity is used to provide a comparison of the amount of emissions per unit of product. Emissions intensity includes Scope 1, 2 and 3 emissions but not sequestration. The goal is to achieve a lower emissions intensity, which indicates fewer emissions produced per unit of farm product.

A variety of emission intensity benchmarks generated from the 2024-25 Livestock Farm Monitor Project dataset are listed in Tables 1-4 in the Appendix. Comparisons against project averages or median values need to be done with caution since individual farm circumstances, environment, resources and climatic variation between years can significantly affect the emissions footprint of a farm business.

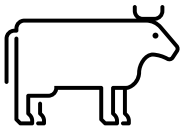
Farmers should assess their baseline emissions, set goals and targets for emissions reduction in their own business, then track their progress over time.



Median **24.4** kg CO_2-e emitted for every kilogram of greasy wool shorn. (**Q1 to Q3 range was 21 to 30**)



Median **6.3** kg CO_2-e emitted for every kilogram of sheep liveweight sold. (**Q1 to Q3 range was 5 to 8**)



Median **11.1** kg CO_2-e emitted for every kilogram of beef liveweight sold. (**Q1 to Q3 range was 7 to 13**)

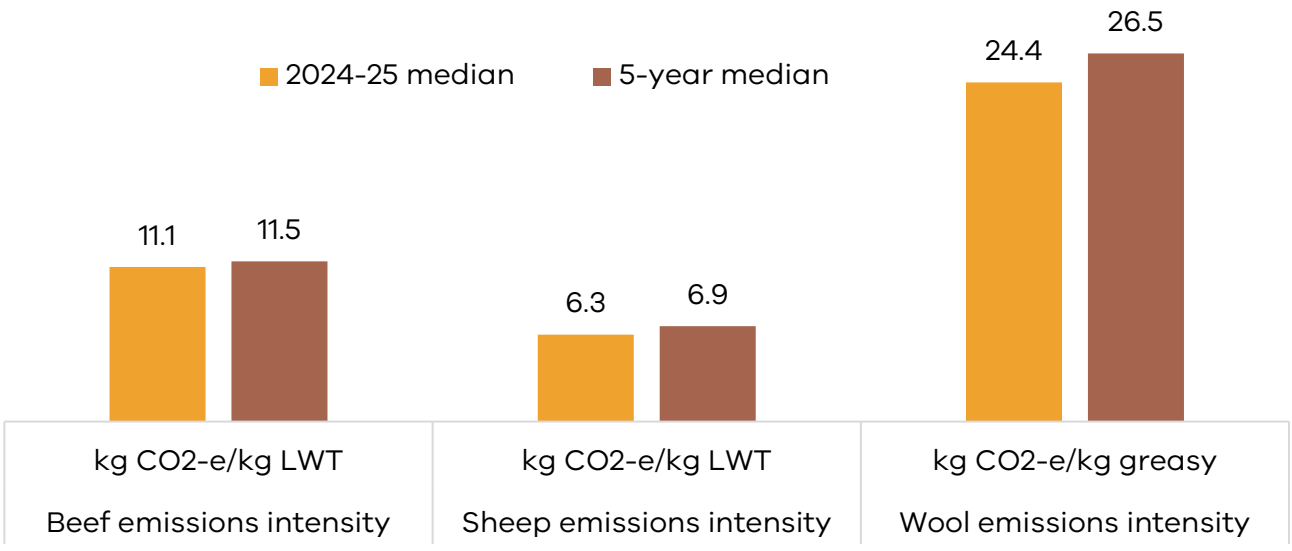


Figure 7. 2024-25 and 5-year median emissions intensity for production of beef, sheep and wool.

2024-25 EMISSIONS INTENSITY

The amount of liveweight sold relative to the number of livestock generating emissions on a farm (expressed as dry sheep equivalent) is a major influence on emissions intensity of sheep and beef enterprises. Enterprises that sold more liveweight per DSE tended to have lower meat emissions intensities.

Prime lamb and beef trading enterprises showed lower emissions intensity than wool sheep and beef breeding enterprises because they sold more liveweight per DSE (Figure 8 and 9).

For all sheep and beef enterprises, emissions intensity declined rapidly for increases in liveweight sold up to 50 kg LWT per DSE. After that, additional increases in liveweight sold produced smaller reductions in emissions intensity.

No single management variable explains differences in liveweight sold per DSE between farms. Improving total liveweight sold is highly specific to the farming system and operating environment.

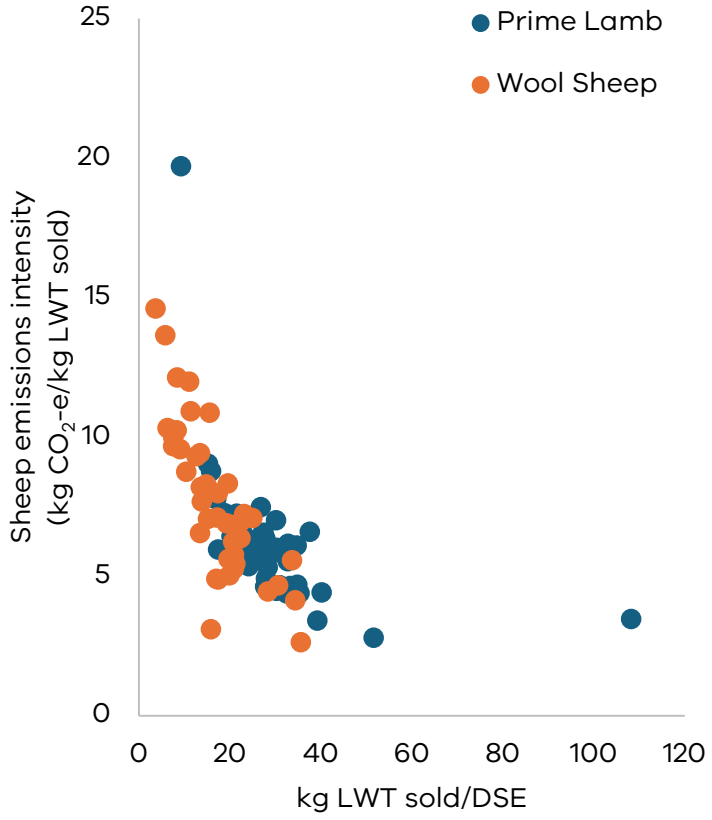


Figure 8. The influence of the amount of liveweight sold (kg LWT sold/Dry Sheep Equivalent) on sheep emissions intensity (kg CO_2-e/kg LWT sold) in 2024-25. The colour of the dots represents the different sheep enterprises.

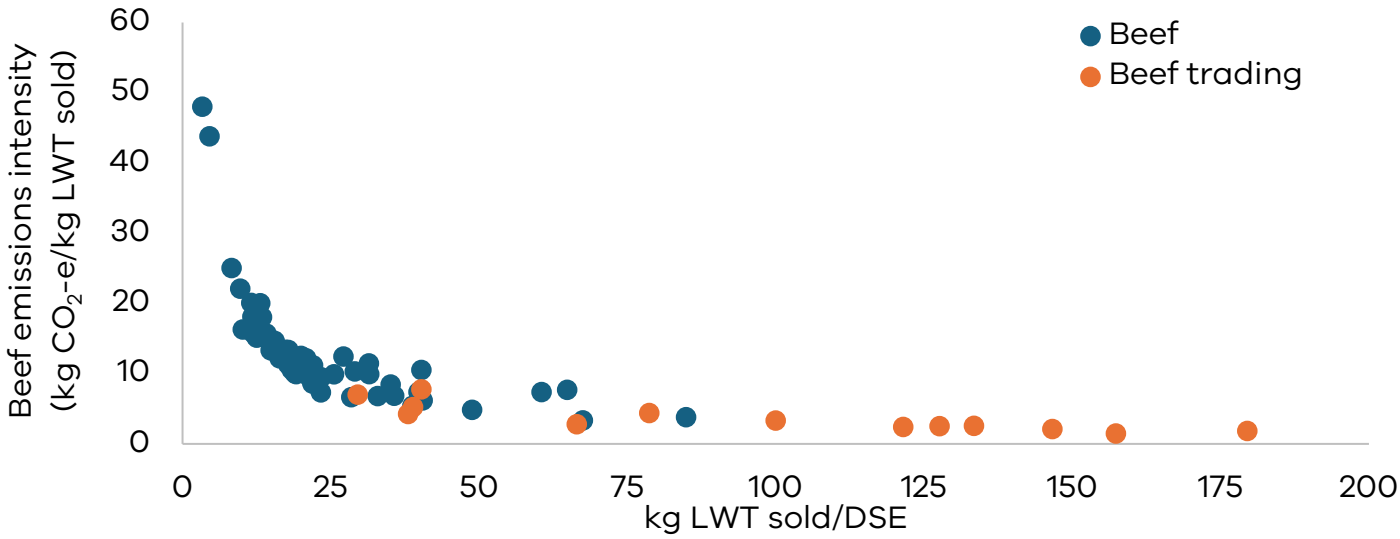


Figure 9. The influence of the amount of liveweight sold (kg LWT sold/Dry Sheep Equivalent) on beef emissions intensity (kg CO_2-e/kg LWT sold) in 2024-25. The colour of the dots represents the different beef enterprises.

APPENDIX

Table 1. 2024-25 statewide emissions intensity (scope 1, 2,3 excluding sequestration)

	Whole farm emissions intensity	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Sheep emissions intensity**	**Beef emissions intensity**	**Beef emissions intensity**	**Sheep meat emissions intensity**	**Wool emissions intensity**
	kg CO_{2}-e /cash income $	t CO_{2}-e/$m Assets	EBIT ($)/ t CO_{2}-e	kg CO_{2}-e /DSE	kg CO_{2}-e /ha	kg CO_{2}-e /DSE	kg CO_{2}-e /DSE	kg CO_{2}-e /kg LWT	kg CO_{2}-e /kg LWT	kg CO_{2}-e /kg greasy
Statewide average	2.5	158	-$2	221	2,722	213	264	11	6.8	26
Statewide median	2.5	159	$7	212	2,673	206	222	11	6.3	24
Statewide Q1 to Q3 range	2 - 3	109 - 203	-78 - 55	196 - 232	1860 - 3350	190 - 229	205 - 246	7 - 13	5 - 8	21 - 30
Statewide 5-year median	2.9	198	67	250	3,356	179	264	16	7.6	29
Statewide 5-year average	2.5	192	66	213	2,912	185	212	12	6.9	26

Table 2. 2024-25 median emissions intensity (scope 1, 2,3 excluding sequestration) for each Livestock Farm Monitor region

	Whole farm emissions intensity	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Sheep emissions intensity**	**Beef emissions intensity**	**Beef emissions intensity**	**Sheep meat emissions intensity**	**Wool emissions intensity**
Region **Median**	kg CO_2-e/cash income $	t CO_2-e/$m Assets	EBIT ($)/ t CO_2-e	kg CO_2-e /DSE	kg CO_2-e /ha	kg CO_2-e /DSE	kg CO_2-e /DSE	kg CO_2-e /kg LWT	kg CO_2-e /kg LWT	kg CO_2-e /kg greasy
Gippsland	3.0	184	-$36	208	3,112	203	212	11.5	6.0	23
Northern Victoria	2.8	143	$7	219	2,734	215	224	11.6	6.5	27
South West Victoria	2.2	162	$12	206	2,399	204	237	9.8	6.3	24

Table 3. 2024-25 median emissions intensity (scope 1, 2,3 excluding sequestration) for each Livestock Farm Monitor business type.

	Whole farm emissions intensity	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Sheep emissions intensity**	**Beef emissions intensity**	**Beef emissions intensity**	**Sheep meat emissions intensity**	**Wool emissions intensity**
Business type **median**	kg CO_2-e/cash income $	t CO_2-e/$m Assets	EBIT ($)/ t CO_2-e	kg CO_2-e /DSE	kg CO_2-e /ha	kg CO_2-e /DSE	kg CO_2-e /DSE	kg CO_2-e /kg LWT	kg CO_2-e /kg LWT	kg CO_2-e /kg greasy
Sheep and Beef	2.5	181	$7	222	3,002	215	239	10.6	6.2	24
Beef specialist	3.3	169	-$11	215	3,206		215	12.2		
Sheep specialist	2.3	157	-$7	206	2,329	206			6.3	24
Stock and grain	1.0	68	$173	190	1,332	190	204	10.5	5.7	22

Table 4. 2024-25 median emissions intensity (scope 1, 2,3 excluding sequestration) for each farm size (defined by farm cash income) quartile in the Livestock Farm Monitor Project.

	Whole farm emissions intensity	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Whole farm emissions intensity**	**Sheep emissions intensity**	**Beef emissions intensity**	**Beef emissions intensity**	**Sheep meat emissions intensity**	**Wool emissions intensity**
Farm size **median**	kg CO_2-e/cash income $	t CO_2-e/$m Assets	EBIT ($)/ t CO_2-e	kg CO_2-e/DSE	kg CO_2-e /ha	kg CO_2-e /DSE	kg CO_2-e /DSE	kg CO_2-e /kg LWT	kg CO_2-e /kg LWT	kg CO_2-e /kg greasy
Smallest 25%	3.1	148	-$75	206	2,832	196	217	11.7	6.4	27
Lower mid 25%	2.4	160	-$8	219	2,357	217	222	11.0	6.2	24
Upper mid 25%	2.2	157	-$2	210	2,869	203	217	11.3	6.2	24
Largest 25%	2.2	177	$45	215	2,716	207	242	10.0	6.3	24

GLOSSARY

Average
The sum of a collection of numbers divided by the count of the numbers in the collection

Asset
Value of anything managed by the farm, whether it is owned or not. Assets include owned land and buildings, leased land, plant and machinery, stock and cash.

Business type
Specialist sheep: Businesses with more than 85% of DSE coming from sheep and less than 30% income coming from grain and cropping.

Specialist beef: Businesses with more than 85% of DSE coming from beef and less than 30% income coming from grain and cropping.

Sheep and beef: Businesses with less than 85% of DSE coming from beef, less than 85% DSE coming from sheep and less than 30% income coming from grain.

Stock and grain: Businesses with more than 30% of income coming from grain and cropping sales and greater than zero sheep or cattle DSE.

Carbon accounting
The process used to quantify greenhouse gas emissions from an enterprise.

Carbon sequestration
The process whereby carbon dioxide is removed from the atmosphere and stored in soils and vegetation.

Carbon dioxide equivalents (CO_2-e)
Carbon dioxide equivalents are a unit used to compare emissions from different greenhouse gases based on their global warming potential (GWP) over a specified time period, typically 100 years (GWP100).

Dry sheep equivalent (DSE)
A standardised animal unit. One DSE represents the daily energy requirement of a 50kg dry ewe that is maintaining condition (8 ME MJ).

Earnings before interest and tax (EBIT)
The return on all the capital used in the business before accounting for finance costs. Calculated as gross farm income minus total variable and total overhead costs. Also known as 'Operating Profit' or 'Profit'.

Enteric methane
Enteric methane is produced through enteric fermentation where plant material is broken down in the rumen. Enteric methane is the by-product of this process and is expelled by the animal through belching.

Global warming potential (GWP)
A measure of cumulative radiative forcing, which aims to quantify the long-term contribution of a gas to global warming. Each GHG has a specific GWP value and this is relative to a specified time period (typically 100 years, but values are also available for 20-year and 50-year time horizons). For the 100-year time horizon, this is abbreviated as GWP100. This report has use GWP100.

Greenhouse gases (GHGs)
Gases that absorb and emit radiant energy. The main GHGs associated with agriculture are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

Median
The middle value in a set of numbers when they are arranged in order from smallest to largest. The median is often used to find a "typical" value in a group and is less affected by very high or very low numbers than the average (mean).

Q1 to Q3 range
The range that covers the middle half of a set of numbers. Q1 (first quartile) is the point where the lowest 25% of numbers end, and Q3 (third quartile) is where the highest 25% begin. The difference between them (Q3 - Q1) shows how spread out the middle half of the data is.

Range
See Q1 to Q3 range

Return per emission Calculated as farm EBIT divided by the total farm greenhouse gas emissions in tonnes of carbon dioxide equivalents.

SB-GAF
The Sheep and Beef GHG accounting tool created and maintained by the University of Melbourne which generates farm emission and sequestration estimates. The version used for 2024-25 data in this report was 2.6.

https://piccc.org.au/resources/Tools.htm

FURTHER INFORMATION

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