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Etiwanda, Cobar New South Wales

Whole Property Carbon Account

October 2023

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Contents

Purpose and Scope

Select Carbon was engaged to conduct a carbon account and carbon footprint for the property Etiwanda (located south of Cobar, NSW) as part of the Rangelands Living Skin Project funded by Meat and Livestock Australia (MLA) and NSW Department of Primary Industries (DPI). The Rangelands Living Skin Project is measuring the productivity and landscape outcomes of a variety of management interventions, including grazing management and rehydration techniques in the Western Division of NSW.

The Australian red meat industry (in particular, MLA) has set the target to be carbon neutral by 2030 (CN2030). To achieve the goal of carbon neutral by 2030 producers must be able to accurately quantify and benchmark greenhouse gas emissions, as well as carbon storage in trees and soils.

Definitions[1]

Carbon accounting: The process used to quantify greenhouse gas (GHG) emissions from an enterprise.

Carbon foot printing: The process of quantifying GHG emissions produced directly or indirectly by an individual, company or product.

Carbon stocks: A carbon stock refers to the mass of carbon that has been sequestered from the atmosphere and is stored in a carbon sink (e.g. in trees or soil).

Emission intensity: Emission intensity values are based on the net emissions relative to the output (e.g. per kg beef, sheep meat or greasy wool). Emission intensity values allow for comparison and benchmarking between farms of different sizes. They are the standard unit for a product carbon footprint.

Net farm emissions: Total emissions minus carbon sequestration.

[1]As defined by Meat and Livestock Australia in their Carbon Accounting Technical Manual (Wiedemann & Dunn 2021).

Background

Greenhouse gases reported under the Australian *National GHG Inventory* (National inventory report) include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6) and others (e.g. perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and nitrogen trifluoride (NF_3)).

Greenhouse gas emissions are delineated by the concept of 'scopes' that define the operational boundaries in relation to direct and indirect GHG emissions.

Scope 1 emissions are direct greenhouse gas (GHG) emissions produced on farm or sources owned or controlled by the reporting entity.

Scope 2 emissions are indirect GHG emissions associated with the production of electricity, heat or steam purchased and consumed by the reporting entity.

Scope 3 emissions are all other indirect GHG emissions. GHG produced as a consequence of the activities of the reporting

entity but occur from sources not owned by the reporting entity. In particular, those that originate pre-farm such as: fertiliser, purchased mineral supplementation, purchased feed, herbicides and pesticides, electricity, fuel, lime and purchased livestock.

GHG emissions are reported as carbon dioxide equivalents (CO_2-e) a standardised unit of measure using the 100-year global warming potentials (GWPs) contained in the 2007 IPCC Fourth Assessment Report (IPCC 2007) for each GHG. The contribution of each GHG to global warming potential differs, for example, methane (CH_4) a by-product of ruminant digestion has a warming potential 28 times greater than carbon dioxide (CO_2) (National Inventory Report Volume 1 2023, Wiedemann & Dunn 2021).

Benefits and reasons for conducting a carbon account

A whole farm carbon account quantifies and benchmarks greenhouse gas emissions and carbon sequestration (in trees, note soil carbon sequestration is not typically included) on a farm. It is an opportunity to identify strategies to reduce emissions or contemplate carbon sequestration opportunities in parts of the business.

Benefits and reasons for conducting a carbon account are:

- To improve **future market access**. Improve social licence and continued market support for red meat. It is likely in the near future, markets and consumers will look for an emissions report to prove eco-credentials or as evidence of a low-carbon or carbon neutral product or service.
- To meet the MLA goal for the red meat industry to **be carbon neutral by 2023** (CN2030). 'You can't manage what you don't measure'.
- To participate in the Australian Governments **ACCU Scheme** (formerly known as the Carbon Farming Initiative), including soil carbon projects, and to capitalise on the production, environmental, climate and financial benefits of carbon farming.
- To access **green finance** (sustainable finance). Green finance is investment in an activity that has positive environmental, biodiversity and climate outcomes.

Methodology and assumptions

MLA GHG Accounting Framework (GAF) Tools

The total annual GHG emissions for the whole farm were calculated using the GHG Accounting Framework (GAF) calculators developed by the University of Melbourne and accessed via the Primary Industries Climate Challenge Centre (PICCC, https://piccc.org.au/resources/Tools.html). The SB-GAF tool was used to calculate emissions associated with sheep and beef enterprises (Lopex et al. 2023a) and the Go-GAF tool was used to calculate emissions associated with goats (Lopez et al. 2023b). The MLA GAF tool includes carbon sequestration in planted trees but not from soil.

Data inputs

A GHG gas account was performed on the previous five (5) years, as would be typical for a soil carbon project under the following methodology: *Carbon Credits (Carbon Farming Initiative - Estimation of Soil Organic Carbon Sequestration using Measurement and Models) Methodology Determination 2021* (referred to as 'the Method'). The five-year baseline period (2018 to 2023) included both dry and wet years with rainfall ranging from 251 mm (between June 2018- end May 2019) to 577 mm (between June 2022 and end May 2023) (Bureau of Meteorology, 2023a). Cobar has a median annual rainfall of 390 mm (Bureau of Meteorology, 2023b).

As the MLA GAF spreadsheets must be completed with seasonal data, yearly data started at the beginning of Winter (June) and ended in Autumn (May) to somewhat align with financial years but meet the seasonal data input requirement of the GAF tool.

Monthly stock flows were exported from MaiaGrazing. The bespoke Etiwanda livestock categories were aligned with the MLA SB-GAF and Go-GAF livestock categories (Table 1). Livestock categories such as 'composite calves' or 'flock lambs' did not have the sex of the animals assigned. In these instances, a ratio of 50:50 male to female split was assumed. Where there was ambiguity over which MLA category the Etiwanda livestock category would align to, average weight was used as a guide (Appendix 1, Table A1). For example, yearling bulls were included in the steers 1-2 category given the average weight of yearling bulls (average of 367 kg). If they were included with Bulls (average of 635 kg per head) they would reduce the average weight by ~150 kg per head for bulls (Appendix 1, Table A1). Likewise for the categories of weaner goats, weaner ewes and flock weaners and these were sorted into MLA GAF tool categories using average weight. For example, flock weaners (average of 33.88 kg/ head) were placed in with lambs (flock lambs average of 25.09 kg/ head, stud lambs average of 29.52 kg/ head) as the average weight was more similar to lambs than the ewes (flock ewes average of 59.68 kg/ head or stud ewes average of 64.99 kg/head) or ram category (average of 68 kg/ head, Appendix 1, Table A1).

Monthly data including head (number) and weight (kg/head) was averaged to give seasonal data as instructed in the Carbon Accounting Technical Manual (Wiedemann & Dunn 2021). Liveweight gain (kg/head/day) was calculated automatically by the SB-GAF spreadsheets for beef and sheep, but not goats. Wool was not accounted for in the GHGe and Carbon account as Etiwanda have dorper sheep (i.e. they are not shorn). Annual electricity, fuel and diesel was apportioned to each enterprise type. A significant proportion of annual diesel that was used for landscape modification was not accounted for by the GAF spreadsheets which do not consider this activity type as part of the GHGe.

The MLA GAF tool only includes carbon sequestration in planted trees (e.g. plantations or environmental plantings), not carbon sequestered in regenerating vegetation, soil or carbon that accumulates in woody (<2m tall, e.g. shrubs) or other vegetation (e.g. grasses, forbs and herbs).

Soil organic carbon (SOC) stocks (t C/ha) for Etiwanda are derived from the NSW digital soil maps (Gray et al. 2019; Gray 2023). For this report, SOC stocks were calculated by summing the cell values (100 m resolution) from the SOC stocks 0 to 100 cm raster dataset (using the Etiwanda boundary, covering an area of 19,794 ha). For the whole farm calculation, the resulting total SOC stocks (t C) was divided by the number of hectares to give an average t C/ ha. This was then converted to t CO_2-e using the standard conversion factor of 3.67 (i.e. 1 t SOC = 3.67 t CO_2-e).

Table 1. MLA SB-GAF and Go-GAF Livestock Categories and their relationship to bespoke Etiwanda Livestock Categories.

MLA SB-GAF Livestock Categories	Etiwanda Livestock Categories
Bulls >1	Bulls
Steers <1	50% Composite Calves + 50% Red Angus Calves
Steers 1-2	Steer 1-2 + Yearling Bulls
Cows >2	Cows + Red Angus Cows + Agistment Cattle
Heifers <1	50% Composite Calves + 50% Red Angus Calves
Heifers 1-2	Red Angus Heifers + H1 Heifers
Rams	Rams + Hogget Rams + 50% Flock Hoggets
Breeding ewes	Flock Ewes + Stud Ewes
Other ewes	Hogget Ewes + Weaner Ewes + 50% Flock Hoggets
Ewe Lambs	50% Flock Lambs + 50% Stud Lambs + 50% Flock Weaners
Wether Lambs	50% Flock Lambs + 50% Stud Lambs + 50% Flock Weaners + Weaner Rams
Bucks/ Billy	50% Adult Goats
Breeding does/ nannies	Breeder Goats + 25% Adult Goats
Other does/ Culled females	25% Adult Goats
Kids	Kid Goats+ Weaner Goats

Results

Greenhouse gas emissions (GHGe)- MLA SB-GAF and Go-GAF- 2018-2023

The average annual net farm emissions for Etiwanda which include beef, sheep and goat enterprises was 2,233 t CO_2-e/farm (Table 2). The annual farm emissions varied across the five years from 1,776 t CO_2-e (year 2) to 4,396 t CO_2-e/farm (year 5) (Figure 1). The bulk of the GHG emissions per year for Etiwanda were attributed to enteric methane (CH_4), accounting for between 69 and 76 % of total GHG emissions each year. Purchased livestock (scope 3) emissions were the next most significant portion of GHGe from Etiwanda (7 to 25 % depending on the year). Emissions from the breakdown of manure (CH_4) plus urine and dung (nitrous oxide; N_2O) the next most significant contributor to GHGe. The trends in farm GHG emissions are driven by the number of livestock on Etiwanda each year (Figure 2 and 3). Pre-farm sources of emissions were larger when greater quantities of supplementary feed (grain, hay and cotton seed) were purchased in years 1 and 2 (Figure 1). Electricity and fuel only contributed a small fraction to overall farm GHG emissions (Figure 1).

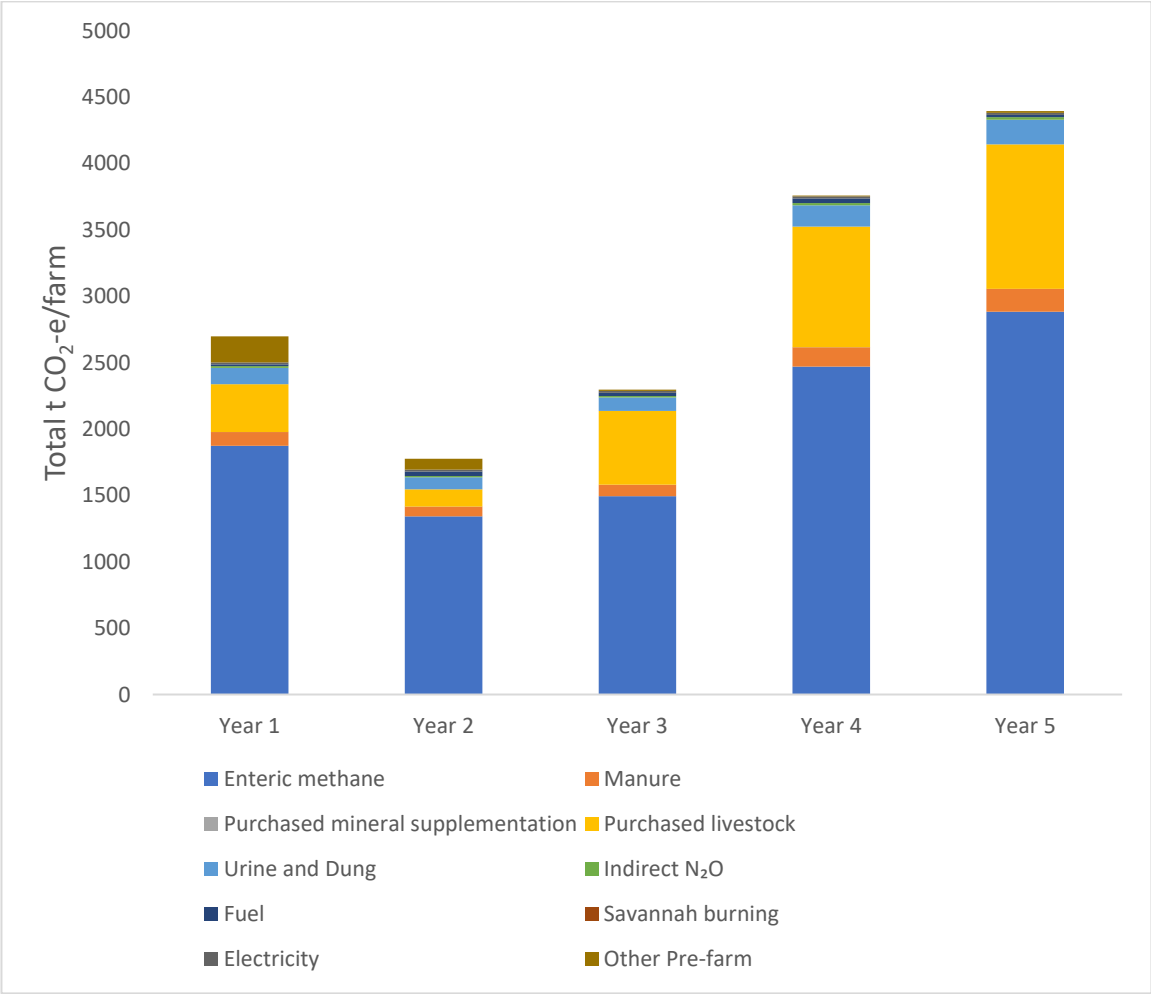

Figure 1. Annual net farm emissions (total t CO_2-e/ farm). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). Year 1 was the start of June 2018 to end of May 2019, year 2 was the start of June 2019 to the end of May 2020, year 3 was the start of June 2020 to the end of May 2021, year 4 was the start of June 2021 to the end of May 2022 and year 5 was June 2022 to May 2023. Electricity, fuel and diesel were apportioned to each enterprise (therefore, not double counted). The category 'other Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

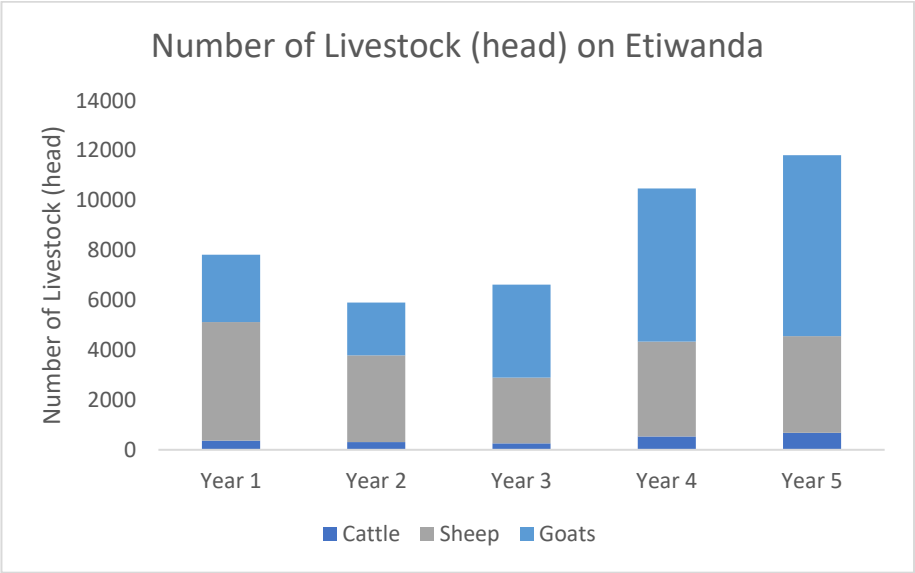

Figure 2. Number of livestock (head) on Etiwanda for each year from the start of Winter to the end of Autumn (June through May the following year) between 2018 and 2023.

Emissions intensity varied over the five year period (Table 2) and varied by farm enterprise. Emissions intensity is calculated as emissions minus carbon sequestration by trees (multipled by a range of assumption factors) divided by the number of sales and requires a 'stable' herd or flock (Wiedemann & Dunn 2021). Trends in the emission intensity of livestock enterprises for Etiwanda were driven by livestock sales. For example, annual goat sales (head) were 2541, 190, 1137, 1976, 2531 in years 1 to 5 respectively. For years where there is a low emissions intensity (year 1 and year 5) there was a relatively high number of goat sales compared to the total amount of goats in the herd. The year 3, the result for beef emissions intensity is artifically high and highlights a known shortfall in the MLA SB-GAF tool. Wiedemann & Dunn (2021) note that it is inaccurate to simply divide emissions by livestock sales as the model is not sophisticated enough to remove the effect of years where sales are unusually high (as is the case in year 3), however an alternative emissions intensity calculation is not presented by the authors.

Table 2. Emissions Intensity (kg CO_2-e / kg live weight (LW)) for Beef, Sheep and Goat enterprises for the 5-year period.

Enterprise	**Emissions Intensity (kg CO_2-e / kg LW)**				
	Year 1	Year 2	Year 3	Year 4	Year 5
Beef	10.6	9.0	778.5	29.2	15.8
Sheep	49.2	15.6	16.0	15.4	13.3
Goat	5.8	45.5	25.2	27.5	6.73

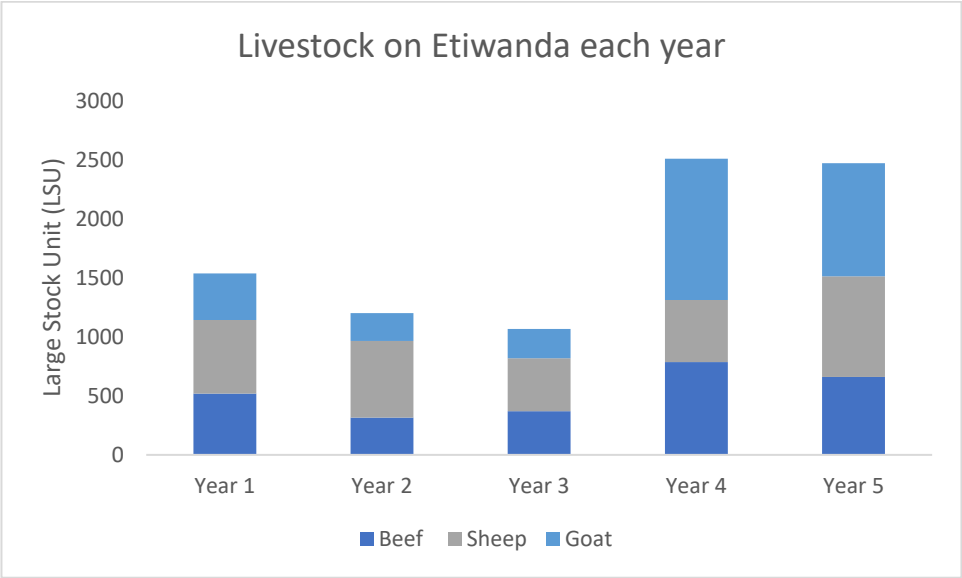

Figure 3. Standardised number of livestock on Etiwanda for each year (aligned with financial years). Large Stock Unit (LSU) ratings for each livestock category were extracted from MaiaGrazing records and multiplied by the number of head to give LSU/ category. MaiaGrazing defines one LSU as the feed required to maintain a 450 kg Steer with no weight gain. For each enterprise type total LSU was summed across all livestock categories.

In year 1 (June 2018-May 2019) annual rainfall (recorded at Cobar MO, BOM station: 48027, Lat: 31.48° S, Long: 145.83° E) for the same period was 252 mm. During this period, there were on average 7,823 head of livestock on Etiwanda including 366 beef cattle, 4,752 sheep and 2,740 goats of various ages and categories (Figure 2) with a total annual Large Stock Unit (LSU) equivalence of 1,537 (Figure 3). Total annual diesel usage was 17,065 L with 4,266 L used for on road use between properties, sheep, beef and goat enterprises and the remaining quantity (12,799 L) used for soil and landscape modification which was not accounted for by the GAF tools. Annual fuel usage was 1,454 L and annual electricity usage was 17,452 kW. A considerable quantity of supplementary livestock feed was purchased including 124 tonnes of grains (all grains) and 146 tonnes of hay for sheep and cattle with an additional 155 tonnes of cotton seed for cattle. For year 1, total annual farm emissions were 2,698 t CO_2-e (Figure 1) which consisted primarily of Scope 1 emissions (Table A2).

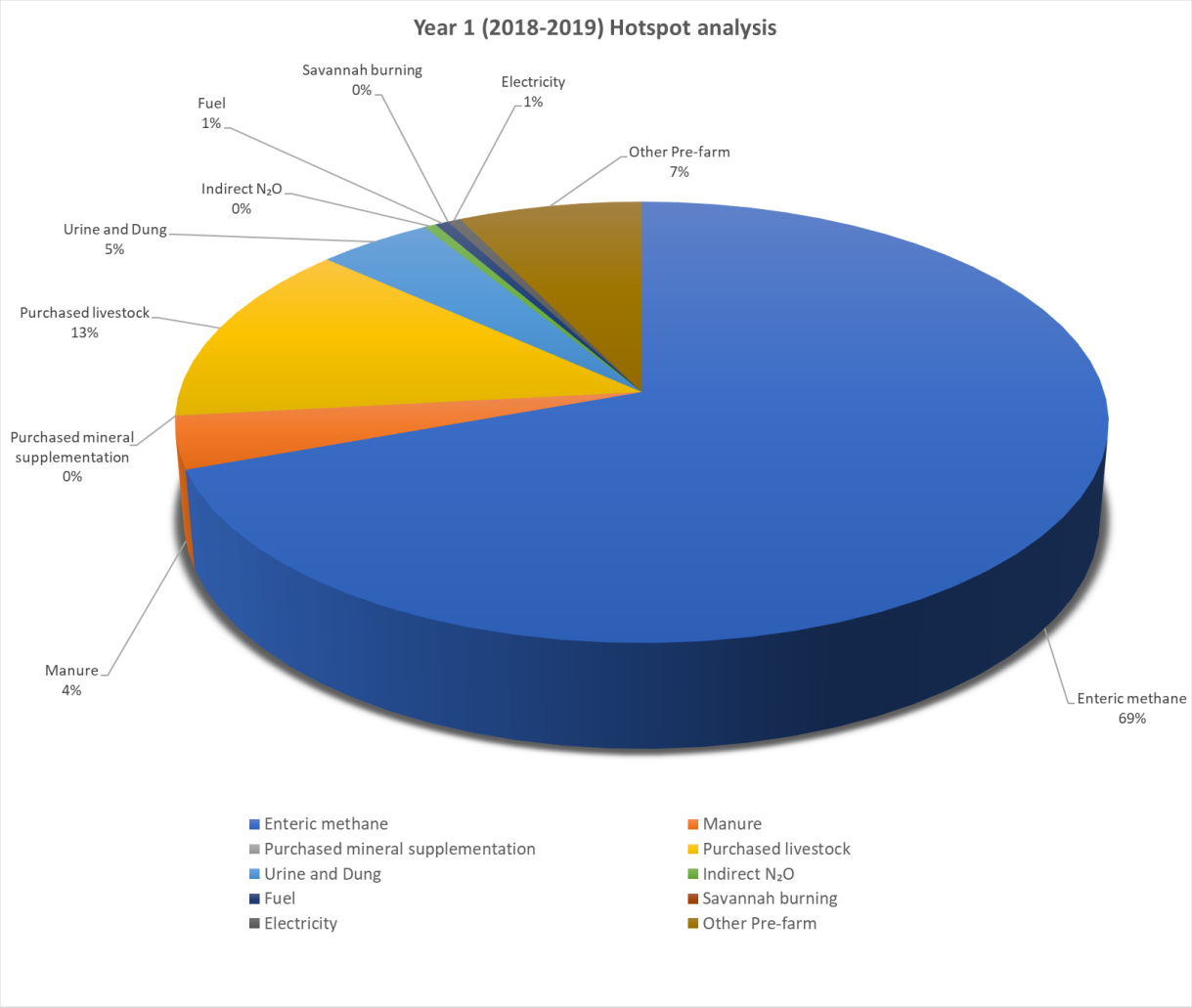

Figure 4. Total farm emissions (t CO_2-e/ farm) for year 1 (June 2018 through to May 2019). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). For components that totalled less than 1 % of total emissions, such as mineral supplementation are rounded down to zero in the graphic. The category 'other Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

In year 2 (June 2019- May 2020) annual rainfall for the same period was 329 mm. During this time there were on average 5,901 head livestock on Etiwanda including 308 beef cattle, 3,479 sheep and 2,114 goats of various ages and categories (Figure 2) with a total annual Large Stock Unit (LSU) equivalence of 1,200 (Figure 3). Total annual diesel usage was 39,209 L with 9,802 L used for on road use between properties, sheep, beef and goat enterprises with the remaining quantity used for soil and landscape modification. Annual fuel usage was 1,141 L and annual electricity usage was 18,103 kW. Supplementary livestock feed was purchased, and included 55 tonnes of grains (all grains) and 292 tonnes of hay for sheep and cattle. For year 2, total annual farm emissions were 1,776 t CO_2-e (Figure 1) which consisted primarily of Scope 1 emissions (Table A2).

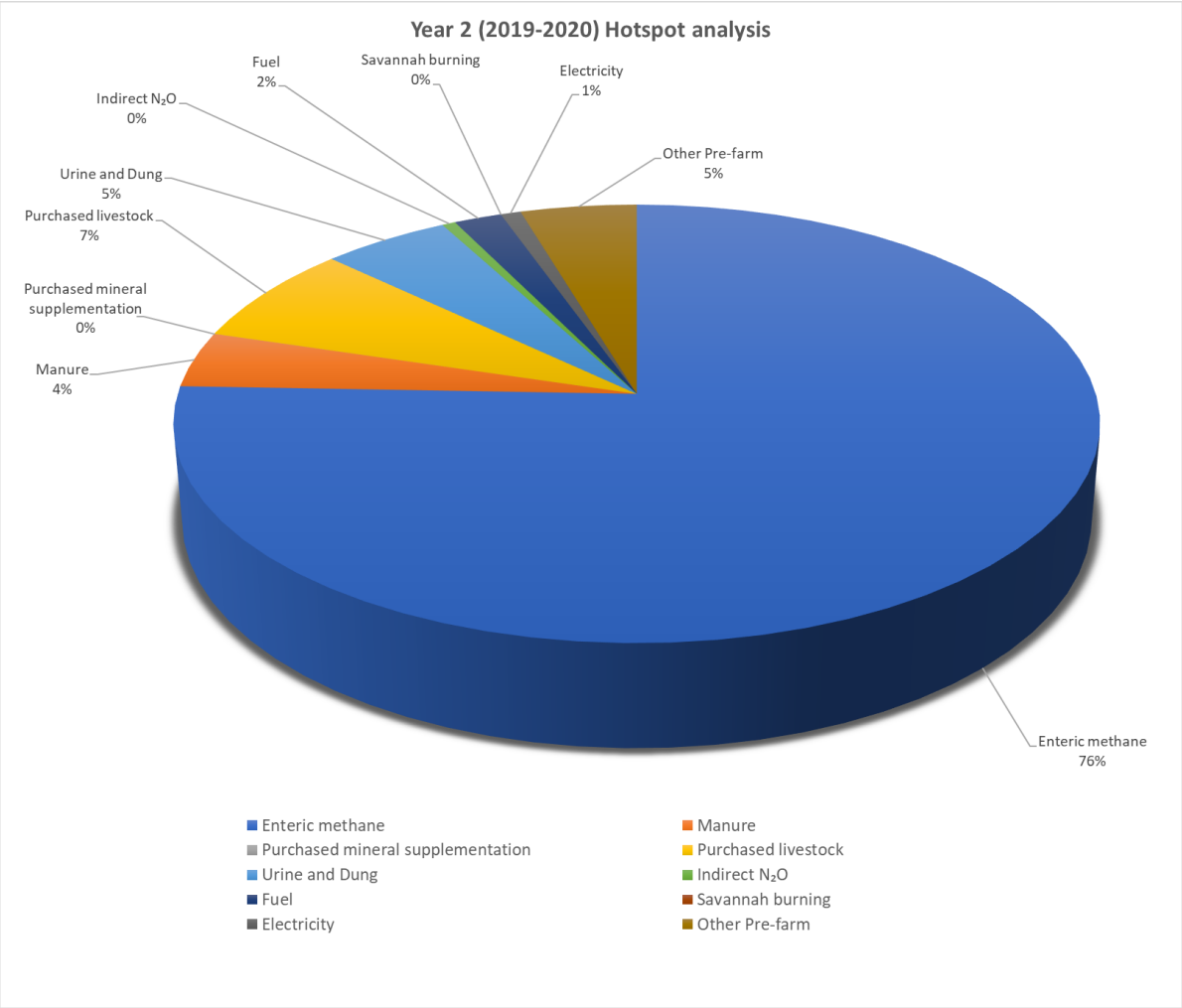

Figure 5. Total farm emissions (t CO_2-e/ farm) for year 2 (June 2019 through to May 2020). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). For components that totalled less than 1% of total emissions, such as mineral supplementation are rounded down to zero in the graphic. The category 'other Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

In year 3 (June 2020- May 2021) annual rainfall for the same period was 387 mm. During this time there were on average 6,625 head livestock on Etiwanda including 259 beef cattle, 2,636 sheep and 3,731 goats of various ages and categories (Figure 2) with a total annual Large Stock Unit (LSU) equivalence of 1,066 (Figure 3). Total annual diesel usage was 27,928 L with 6,982 L used for on road use between properties, sheep, beef and goat enterprises with the remaining quantity used for soil and landscape modification. Annual fuel usage was 1,558 L and annual electricity usage was 17,800 kW. Supplementary livestock feed was purchased and included 41 tonnes of hay for sheep and cattle. For year 3, total annual farm emissions were 2,296 t CO_2-e (Figure 1) which consisted primarily of Scope 1 emissions (Table A2).

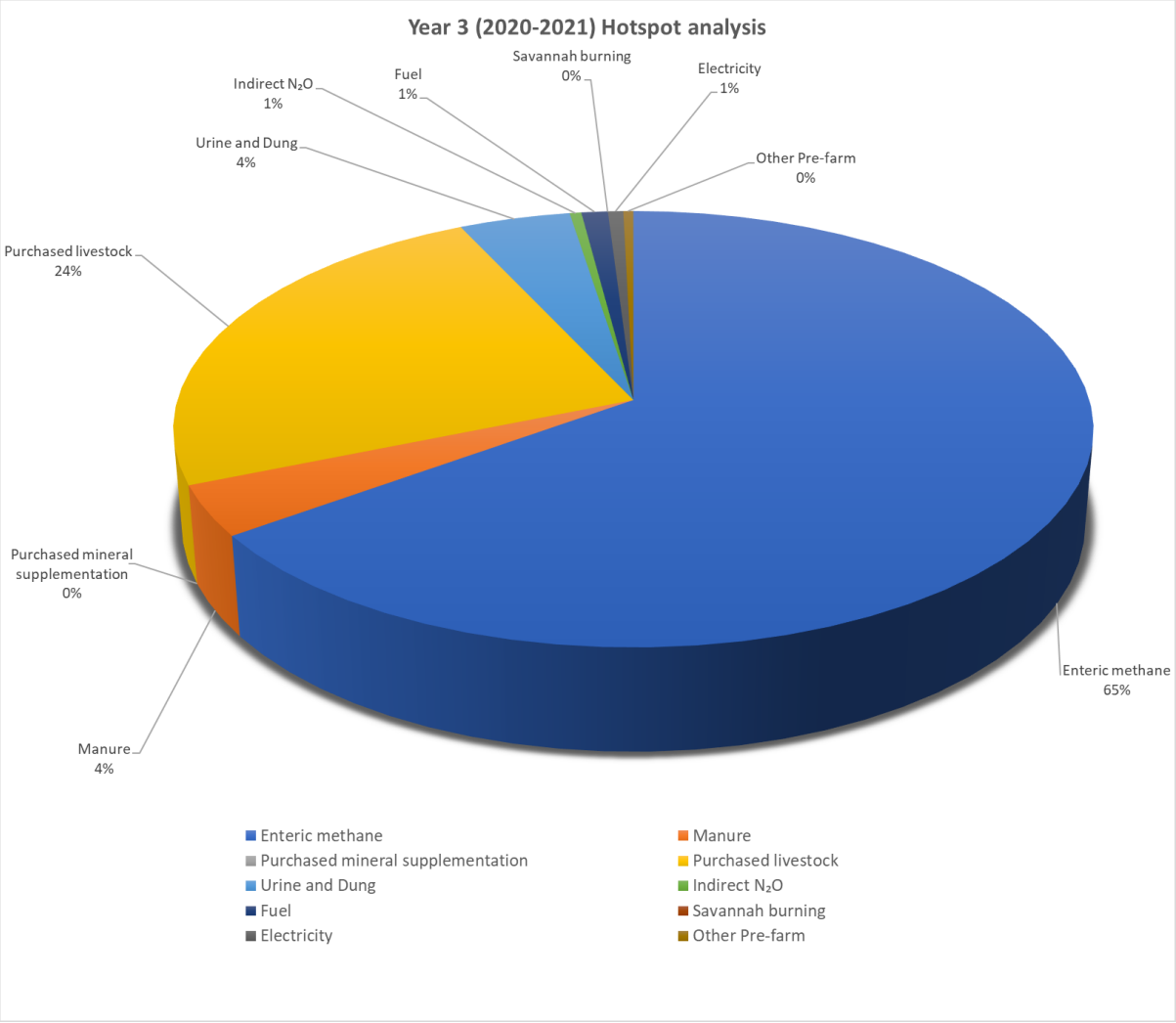

Figure 6. Total farm emissions (t CO_2-e/ farm) for year 3 (June 2020 through to May 2021). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). For components that totalled less than 1 % of total emissions, such as mineral supplementation are rounded down to zero in the graphic. The category 'other

Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

In year 4 (June 2021- May 2022) annual rainfall for the same period was 505 mm. During this time there were on average 10,478 head livestock on Etiwanda including 532 beef cattle, 3,806 sheep and 6,140 goats of various ages and categories (Figure 2) with a total annual Large Stock Unit (LSU) equivalence of 2,509 (Figure 3). Total annual diesel usage was 39,593 L with 9,898 L used for on road use between properties, sheep, beef and goat enterprises with the remaining quantity used for soil and landscape modification. Annual fuel usage was 2,296 L and annual electricity usage was 19,801 kW. Supplementary livestock feed was purchased and included 16 tonnes of hay for sheep and cattle and 2 tonnes of cotton seed for cattle. For year 4, total annual farm emissions were 3,760 t CO_2-e (Figure 1) which consisted primarily of Scope 1 emissions (Table A2).

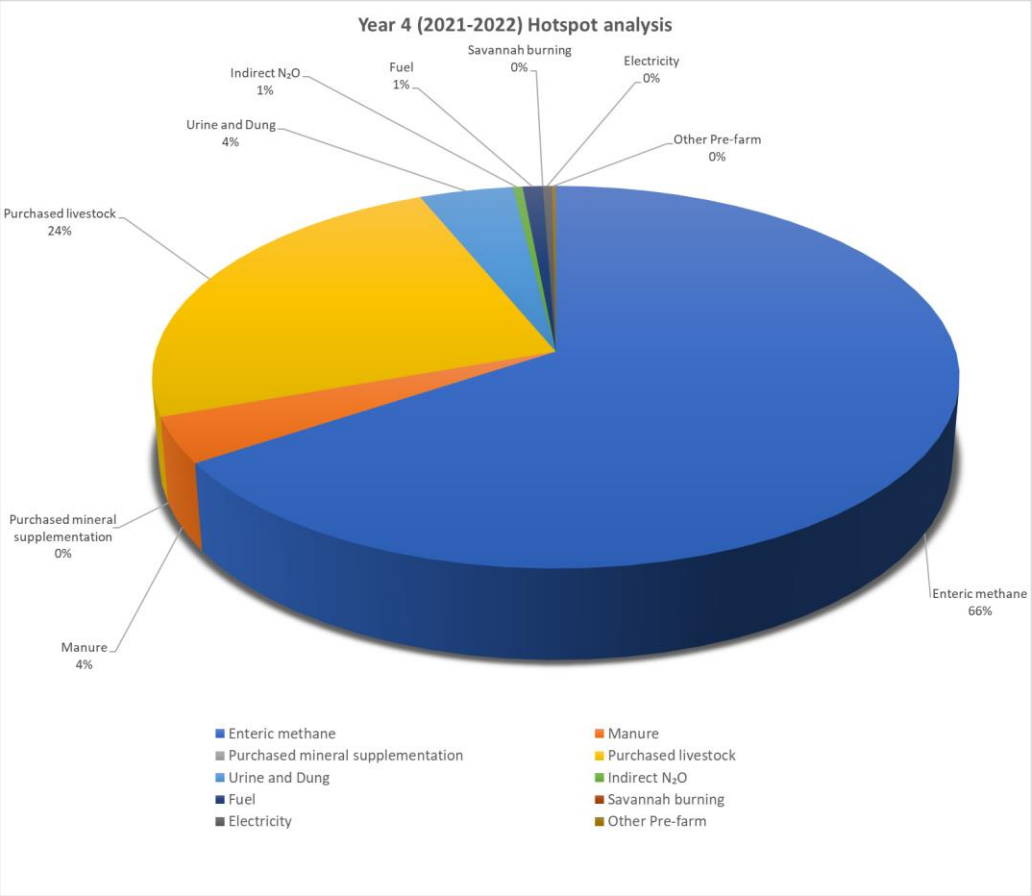

Figure 7. Total farm emissions (t CO_2-e/ farm) for year 4 (June 2021 through to May 2022). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). For components that totalled less than 1 % of total emissions, such as mineral supplementation are rounded down to zero in the graphic. The category 'other Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

In year 5 (June 2022- May 2023) annual rainfall for the same period was 577 mm. During this time there were on average 11,814 head livestock on Etiwanda including 681 beef cattle, 3,878 sheep and 7,255 goats of various ages and categories (Figure 2) with a total annual Large Stock Unit (LSU) equivalence of 2,470 (Figure 3). Total annual diesel usage was 18,090 L with 4,520 L used for on road use between properties, sheep, beef and goat enterprises with the remaining quantity used for soil and landscape modification. Annual fuel usage was 2,260 L and annual electricity usage was 19,640 kW. Supplementary livestock feed was purchased and included 2 tonnes of grains (all grains) and 60 tonnes of hay for sheep and cattle. For year 5, total annual farm emissions were 4,396 t CO_2-e (Figure 1) which consisted primarily of Scope 1 emissions (Table A2).

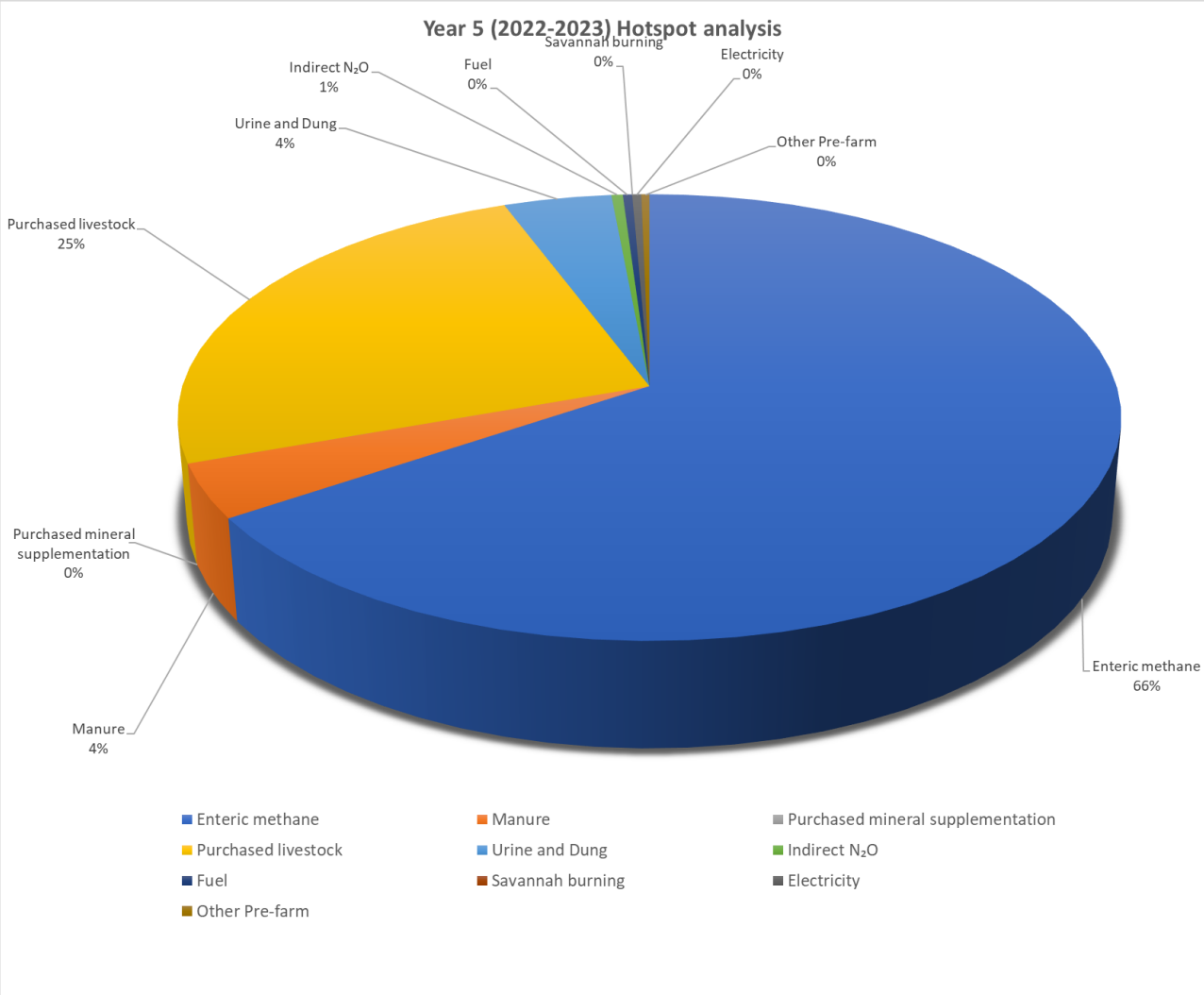

Figure 8. Total farm emissions (t CO_2-e/ farm) for Year 5 (June 2022 through to May 2023). Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). For components that totalled less than 1 % of total emissions, such as mineral supplementation are rounded down to zero in the graphic. The category 'other Pre-farm' includes fertiliser, purchased feed, herbicides and pesticides lime and livestock away on agistment.

Carbon stocks in soil

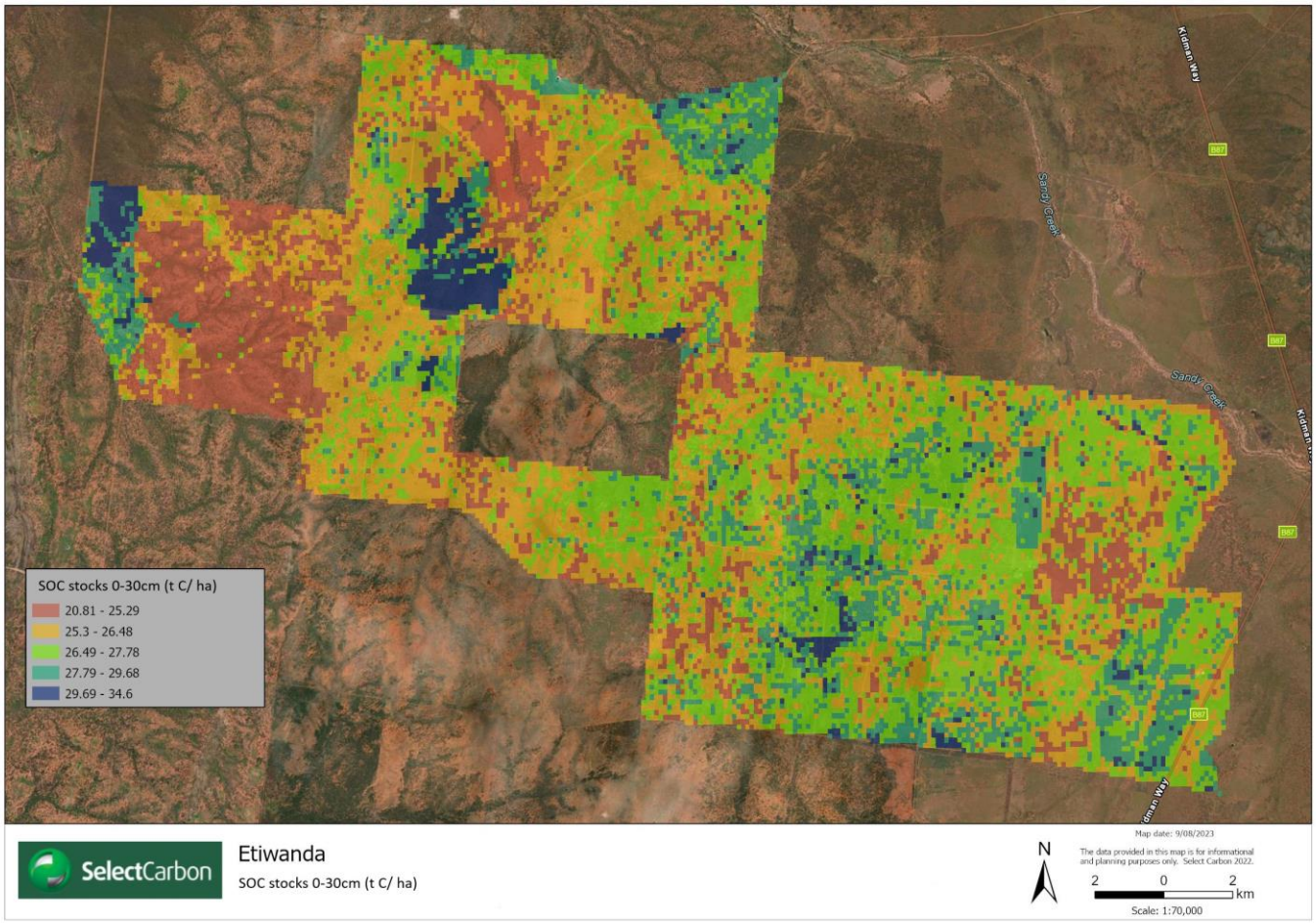

Figure 9. Soil organic carbon (SOC) stocks (t C/ha) in the 0 to 30 cm soil layer (Source: Gray 2023).

Total SOC stocks (t C/ha) are presented for the 0 to 30 cm soil layer to align with the minimum reporting requirements for the Method (Figure 9), as well as for the 0 to 100 cm soil layer (Figure 10) to indicate the total SOC stock (t C/ha) for the soil profile. As outlined earlier these maps are based on the NSW digital soil maps (Gray 2023).

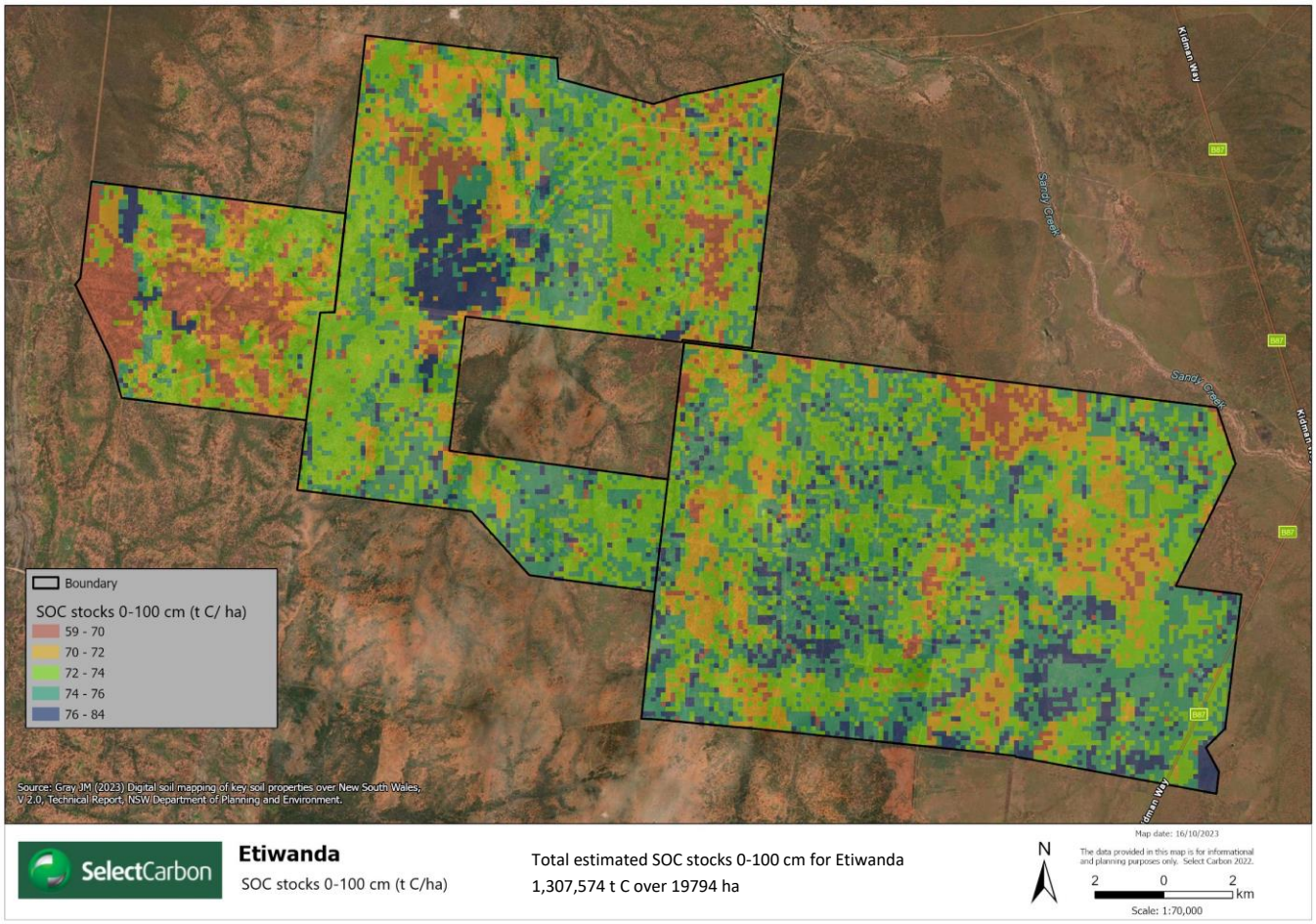

Figure 10. Soil organic carbon (SOC) stocks (t C/ha) in the 0 to 100 cm soil layer (Source: Gray 2023).

Based on the NSW digital soil maps (Gray 2023), the total SOC stock for the 0 to 100 cm soil layer (Figure 10) for Etiwanda (19,794 ha) is 1,307,574 t C which is equivalent to an average of 66 t C /ha (0 to 100 cm). When the total SOC stock figure is converted to CO_2-e (the same unit that GHGe are reported), the total value is for Etiwanda is 4,798,797 CO_2-e or 242 t CO_2-e/ha. Average annual farm emissions of 2,233 t CO2-e are negligible compared to the total stock of carbon in soil on Etiwanda.

An example of offsetting Etiwanda's annual GHGe may be considering carbon sequestered in soil through rotational grazing management to increase and maintain grass perenniality, legumes and ground cover in the landscape. For example, if grazing management can increase SOC concentration (SOC % equivalent to g/100 g) by 0.05 % (e.g. increase from 0.53 to 0.58 % SOC) over 100 cm over a 25-year period, and assuming a bulk density (BD) of 1.4 g/cm3, we can calculate SOC stocks using the following equation:

SOC stocks (t C/ ha) = SOC % (g/ 100 g) x depth (cm) x BD (g/ cm^3)

Change in SOC stocks (t C/ ha) = 0.05 % x 100 cm x 1.4 g/cm^3= 7 t C/ ha

7 / 25 years = 0.28 t C/ ha/ yr

To convert to CO_2-e (noting that 1 t soil carbon = 3.67 t CO_2) = 0.28 X 3.67 = 1.03 CO_2-e / ha/ year

It is estimated that approximately 18,000 ha of Etiwanda is grazed, so 1.03 x 18,000 ha = 18,497 t CO_2-e per year sequestered in soil.

Note, Gray et al (2021) estimated a carbon sequestration rate of 0.17 t C/ha/yr in the 0 to 30 cm soil layer (over 20 years) if a relative increase of 10 % groundcover could be achieved in the Western Division of NSW.

To put Etiwanda's average annual farm emissions of 2,233 t CO_2-e into perspective, we compared this to potential hypothetical annual increase in SOC stocks (Figure 11). It may be noted that even a conservative increase in SOC sequestration would be enough to offset the average annual emissions produced by Etiwanda. This would even remain the case for the largest emissions year in the 5-year baseline period.

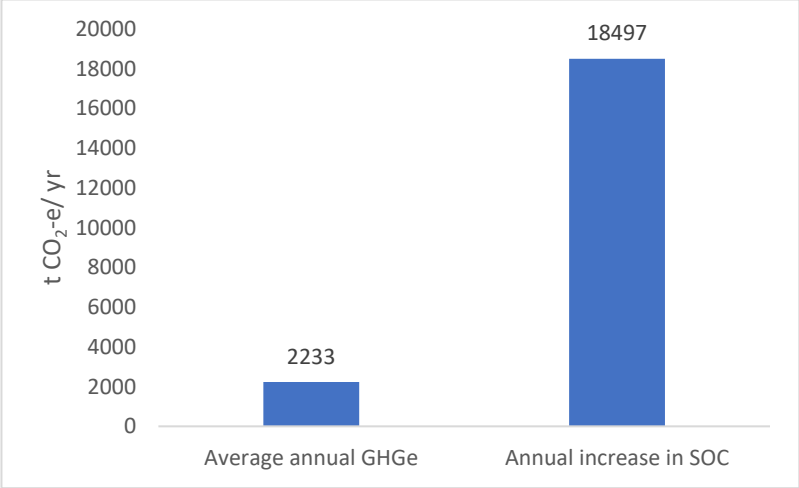

Figure 11. A comparison of Etiwanda's average annual farm emissions with *potential* annual increase in SOC (*based on the stated example with a 0.05% increase in SOC over 0 to 100 cm, and assuming a BD of 1.4 g/cm^3).

Summary

- The annual average farm emissions for Etiwanda which included beef, sheep and goat enterprises was **2,233 t CO_2-e/farm.**
- The major source of GHGe was **methane from livestock**.
- Whilst only carbon sequestration in planted trees is included when using the MLA GAF tools, carbon sequestration in regenerating vegetation and soil may be an important consideration and, in some situations, may outweigh annual GHG emissions*.

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Appendix.

Table A1: Average weight (kg/head) for each Etiwanda livestock category over 5-year period (June 2018-May 2023 inclusive).

Etiwanda Livestock Category	Average weight (kg/head)
Composite Calves	160
H1 Heifers	280
Cows	443
Steer 1-2	337
Bulls	635
Yearling Bull	367
Red Angus Calves	165
Red Angus Heifers	336
Red Angus Cows	427
Agistment Cattle	402
Flock Ewes	60
Flock Lambs	25
Flock Weaners	34
Flock Hoggets	53
Weaner Goats	34
Breeder Goats	45
Adult Goats	41
Kid Goats	26
Stud Ewes	69
Rams	68
Stud Lambs	29
Weaner Ewes	38
Weaner Rams	43
Hogget Ewes	52
Hogget Rams	60

Table A2. Total farm emissions (total t CO_2-e/ farm) per year. Total emissions are the sum of all livestock enterprises on Etiwanda including Sheep and Beef (SB-GAF) and Goat (Go-GAF). Electricity, fuel and diesel were apportioned to each enterprise and are not double counted.

Year (months)	**Enterprise**	**Total t CO2-e/farm**			
		Scope 1	**Scope 2**	**Scope 3**	**Net Farm Emissions**
Year 1 (June 2018-May 2019)	Beef & Sheep	1680	13	560	2254
	Goat	443	0	1	444
	Total	**2123**	**13**	**561**	**2698**
Year 2 (June 2019-May 2020)	Beef & Sheep	1191	13	218	1422
	Goat	352	0	2	354
	Total	**1543**	**13**	**220**	**1776**
Year 3 (June 2020-May 2021)	Beef & Sheep	110	13	569	1682
	Goat	612	0	1	614
	Total	**722**	**13**	**570**	**2296**
Year 4 (June 2021-May 2022)	Beef & Sheep	1816	14	839	2669
	Goat	1006	0	85	1091
	Total	**2822**	**14**	**925**	**3760**
Year 5 (June 2022-May 2023)	Beef & Sheep	2092	14	1105	3212
	Goat	1183	0	1	1184
	Total	**3275**	**14**	**1106**	**4396**
Average annual net farm emissions (Beef, Sheep and Goat)					**2233.2**

Table A3. Number of livestock on Etiwanda for a given year. Large Stock unit (LSU) ratings for each livestock category were extracted from MaiaGrazing records and multiplied by the number of head to give LSU/ category. MaiaGrazing defines one LSU as the feed required to maintain a 450 kg Steer with no weight gain. This is the feed required to maintain a 450 kg Steer with no weight gain. For each enterprise type total LSU was summed across all livestock categories.

Enterprise	**Large Stock Unit (LSU)**				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Beef	518.7	316.00	369.40	785.50	660.10
Sheep	623.5	649.1	449.6	526.0	852.7
Goat	394.4	235.3	247.3	1197	957
Total	**1,536.6**	**1,200.4**	**1,066.3**	**2508.5**	**2469.8**
Enterprise	**Annual average number (head) - All classes/ categories**				
Beef	366	308	259	532	681
Sheep	4752	3479	2636	3806	3878
Goat	2704	2114	3731	6140	7255
Total	**7823**	**5901**	**6625**	**10478**	**11814**