# Methane emissions in livestock – can we manage it?

Emma Winslow
Climate and Adaptation Officer
22nd August, 2022

# Total emissions vs emissions intensity

Net emissions:

The total emissions from the defined area (e.g. farm, product, supply chain)

Emissions intensity:

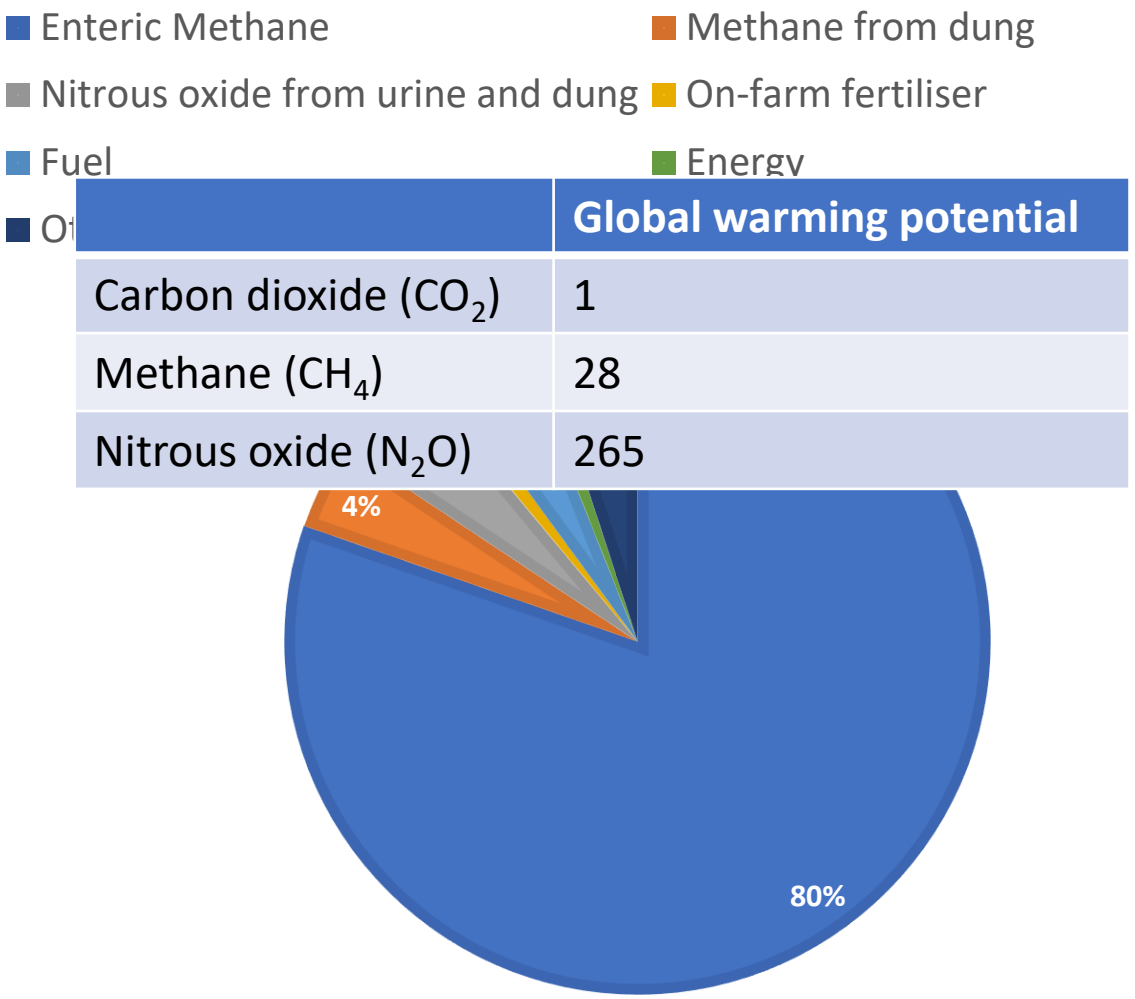
The GHGs released per kg of product produced

| | SA average emissions intensity (kg $CO_2e$/ kg LW or greasy wool) |
|---|---|
| Prime lamb | 6.7 |
| Merino | 8.4 |
| Wool | 26.1 |


Government of South Australia

Department of Primary Industries and Regions

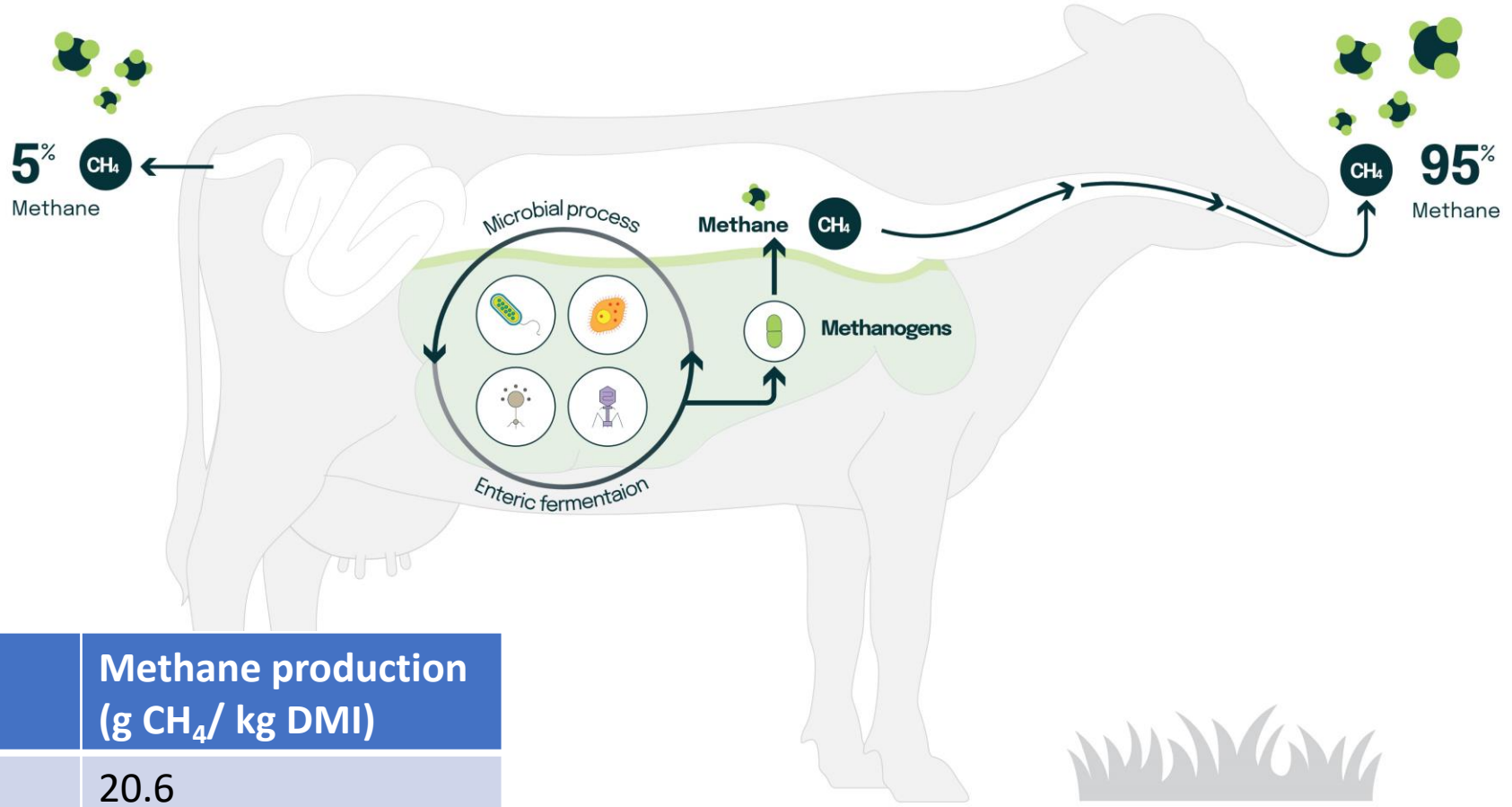
# Emissions in grazing systems




| | Global warming potential |
|---|---|
| Carbon dioxide ($CO_2$) | 1 |
| Methane ($CH_4$) | 28 |
| Nitrous oxide ($N_2O$) | 265 |

Government of South Australia
Department of Primary Industries and Regions

# Enteric methane production




| | Methane production (g $CH_4$/ kg DMI) |
|---|---|
| Cow | 20.6 |
| Sheep | 18.6 |

Government of South Australia
Department of Primary Industries and Regions

# Current emissions reduction opportunities

| | |
|---|---|
| 1. Increase flock/ herd efficiency | 10 – 20% |
| 2. Feed additives/ supplements (modifiers) | 10 – 20% |
| 3. Pastures and pasture compounds | 10% |
| 4. Genetic selection for reduced emissions | 1% pa |

# Increase flock/ herd efficiency

- Grazing and pasture management

Rotational/ strip grazing for maximum LWG and pasture utilisation.

- Reproductive efficiency

Increase lambing/ calving rate and survival to weaning.

Culling unproductive individuals.

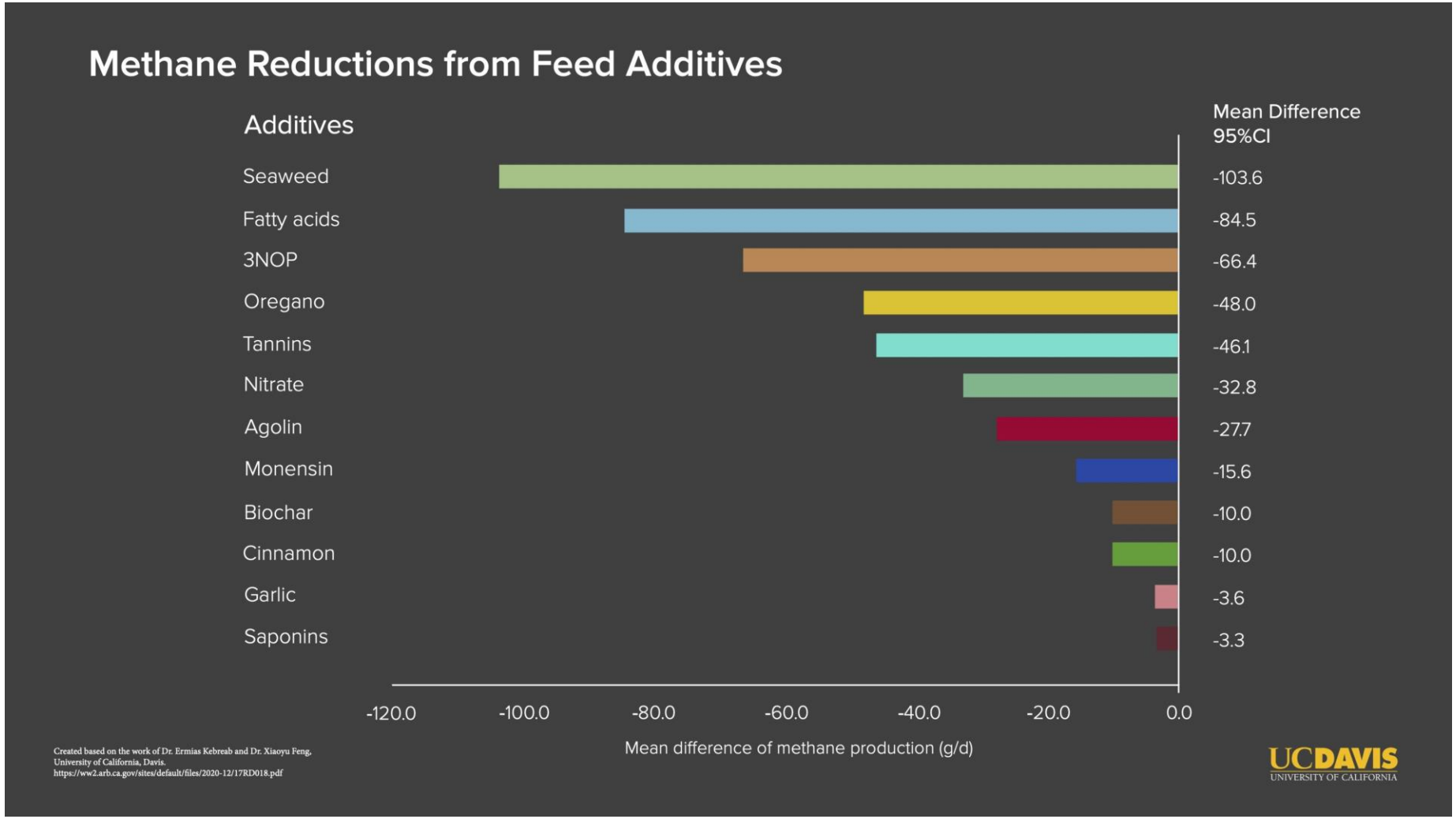
Pregnancy scanning.

- Animal health

Intestinal parasites

ERF - Beef cattle herd efficiency method

# Feed additives/ supplements



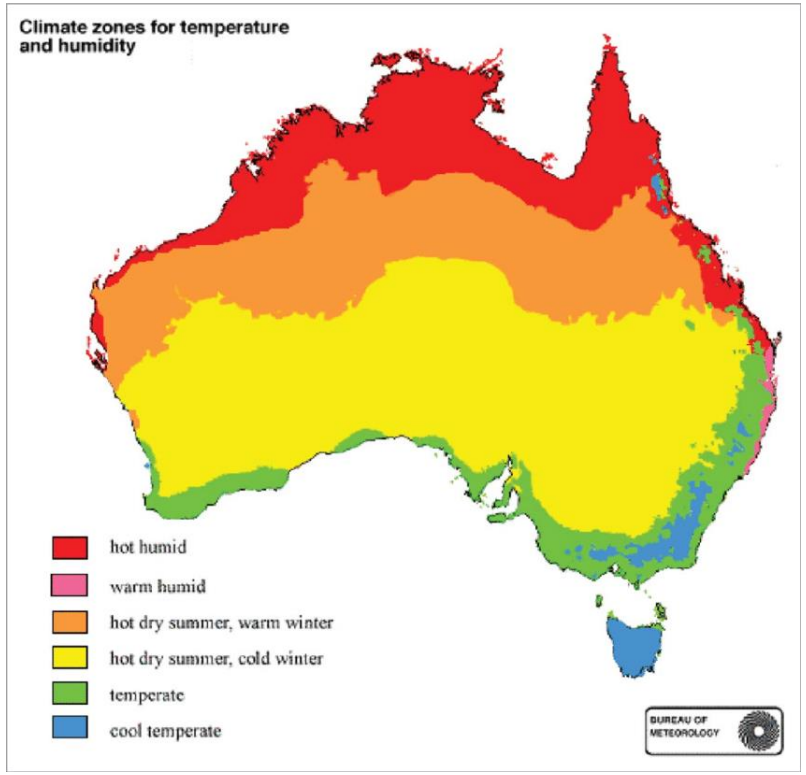

Government of South Australia
Department of Primary Industries and Regions

# Pastures and pasture compounds

**96%** of Australian sheep and beef are grazed on pasture over **416M ha**.

**23M ha** of improved pasture in the temperate zone.

**9.4M** cattle in the temperate zone and **58.4M** sheep.




Tannins
- Sulla
- Plantain
- Grape marc

Saponins
- Lucerne (most widely grown forage legume in Australia)
- Annual medics

Other pastures e.g. biserrula, sainfoin

# Genetic selection/ breeding

**Lower methane yield**

Direct selection

Increased growth rate

10% higher growth rate reduces methane by 3%

Trade off with other selection criteria

**Higher feed conversion efficiency**

Indirect selection

10% improved feed use efficiency reduces methane by 3 - 10%

Improves profit by up to 10%

May allow higher stocking rates

Higher stocking rates may increase emissions/ ha

# Future emissions reduction opportunities

| | | |
|---|---|---|
| 1. | Feed additives/ supplements (inhibitors) | up to 90%?? |
| 2. | Vaccine | ? |
| 3. | Technologies? | 60%? |

Government of South Australia
Department of Primary Industries and Regions

# Feed additives

**Asparagopsis**

Red seaweed (*A. taxiformis and A. armata*)

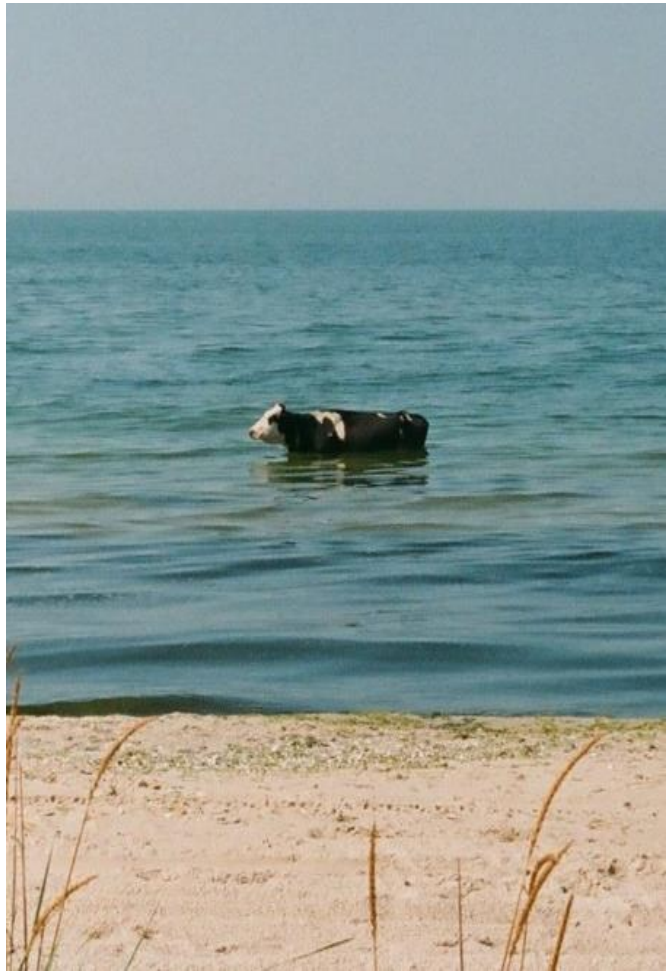
80 – 90% reduction in methane in short term studies

0.5 – 3% TMR

Grazing studies required to validate efficacy in long-term grazing scenarios

Research underway:

MERiL program (federal government)
FDF innovation grants
NZ Agricultural Greenhouse Gas Research Centre



Government of South Australia
Department of Primary Industries and Regions

# Feed additives

**3-NOP (Bovaer)**

30 - 90% reduction in methane in some short term studies

~1-- 5% feed intake

Grazing studies required to validate efficacy in long-term grazing scenarios

Registered for use in Chile and Brazil
EU market approval for Bovaer for dairy cows

Research underway:

MERiL program (federal government)
NZ Agricultural Greenhouse Gas Research Centre
Maternal programming

# Vaccines/ other technology

Vaccines

Immune system to suppress the growth of methanogens
5-10 years away

Wearable technology

Convert emitted methane into $CO_2$
Up to 60% methane converted
Available in 2023

Image: Zelp device

Dung beetles
Not included in LCAs
14% reduction in manure methane emissions
2% reduction in nitrous oxide emissions
Improved soil health

Government of South Australia
Department of Primary Industries and Regions

# Accounting for emissions

**Link to tools**

Emissions reduction fund:
Carbon Sequestration (looc-c.farm)

Farm footprints:
Presentations | Primary Industries Climate Challenges Centre (piccc.org.au)
SB-GAF

Biodiversity:
LOOC-B

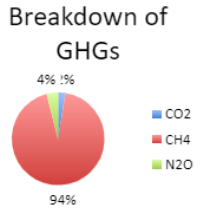
Natural capital:
Farm participation - Farming for the future

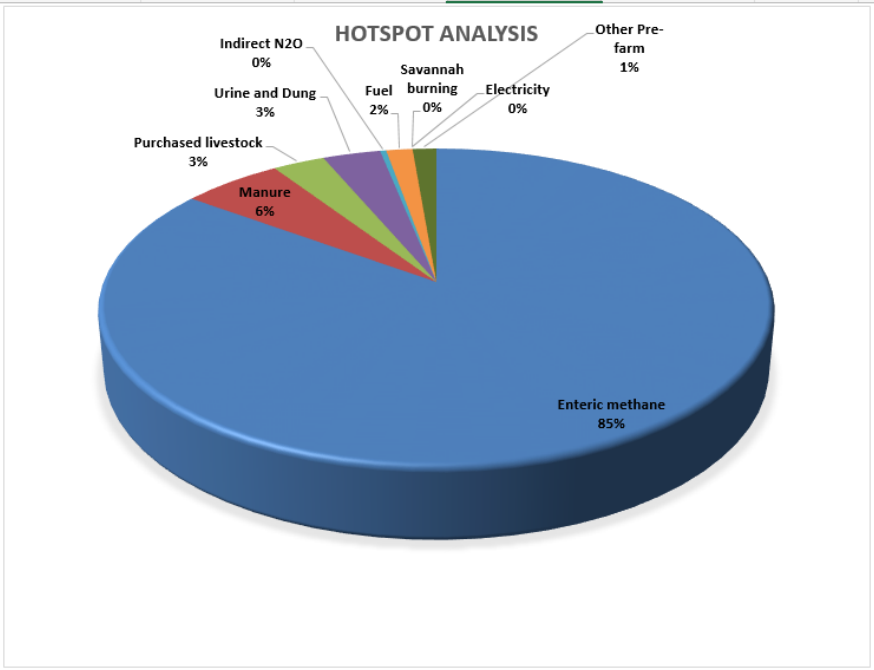
Government of South Australia
Department of Primary Industries and Regions

# Beef & Sheep Greenhouse Accounting Tool

| Outputs | beef t $CO_2$e/farm | sheep t CO2e/farm | total t CO2e/farm |
|---|---|---|---|
| **Scope 1 Emissions** | | | |
| $CO_2$ - Fuel | 9.47 | 0.00 | 9.47 |
| $CO_2$ - Lime | 0.00 | 0.00 | 0.00 |
| $CO_2$ - Urea | 0.00 | 0.00 | 0.00 |
| $CH_4$ - Fuel | 0.00 | 0.00 | 0.00 |
| $CH_4$ - Enteric | 576.59 | 0.00 | 576.59 |
| $CH_4$ - Manure Management | 38.21 | 0.00 | 38.21 |
| $CH_4$ - Savannah Burning | 0.00 | | 0.00 |
| $N_2O$ - Fertiliser | 0.00 | 0.00 | 0.00 |
| $N_2O$ - Urine and Dung | 21.97 | 0.00 | 21.97 |
| $N_2O$ - Atmospheric Deposition | 2.31 | 0.00 | 2.31 |
| $N_2O$ - Leaching and Runoff | 0.00 | 0.00 | 0.00 |
| $N_2O$ - Savannah Burning | 0.00 | | 0.00 |
| $N_2O$ - Fuel | 0.05 | 0.00 | 0.05 |
| **Scope 1 Total** | **649** | **0** | **649** |
| **Scope 2 Emissions** | | | |
| Electricity | 0.00 | 0.00 | 0 |
| **Scope 2 Total** | **0** | **0** | **0** |
| **Scope 3 Emissions** | | | |
| Fertiliser | 0.00 | 0.00 | 0.00 |
| Purchased feed | 9.00 | 0.00 | 9.00 |
| Herbicides/pesticides | 0.00 | 0.00 | 0.00 |
| Electricity | 0.00 | 0.00 | 0.00 |
| Fuel | 0.50 | 0.00 | 0.50 |
| Lime | 0.00 | 0.00 | 0.00 |
| Purchased livestock | 19.84 | 0.00 | 19.84 |
| Livestock on agistment | | | |
| **Scope 3 Total** | **29** | **0** | **29** |
| **Carbon Sequestration** | | | |
| Carbon sequestration in trees | -31.82 | -17.43 | -49.25 |

| Summary | t CO2e/farm |
|---|---|
| $CO_2$ | 16 |
| $CH_4$ | 615 |
| $N_2O$ | 26 |




Citation: Ekonomou A., Dunn J., Wiedemann S., Eckard R. (2020). A Greenhouse Accounting Framework for Beef and Sheep properties based on the Australian National Greenhouse Gas Inventory methodology. Beta version by Integrity Ag and Environment, updated July 2022. http://piccc.org.au/Tools

Excel SB-GAFv1.8 - View-only

Search (Alt + Q)

File Home Insert Draw Page Layout Formulas Data Review View Help Viewing

Read-only This workbook was opened in read-only mode

P9

## Enter your farm data for each animal class and season

Farm name: Faraway Station

Choose your region in Australia: Qld

7

Is your property north of the Tropic of Capricorn? No 2

Is your property in orange zone? (Ref Map. 1) Yes 1

Excel for the web does not support running

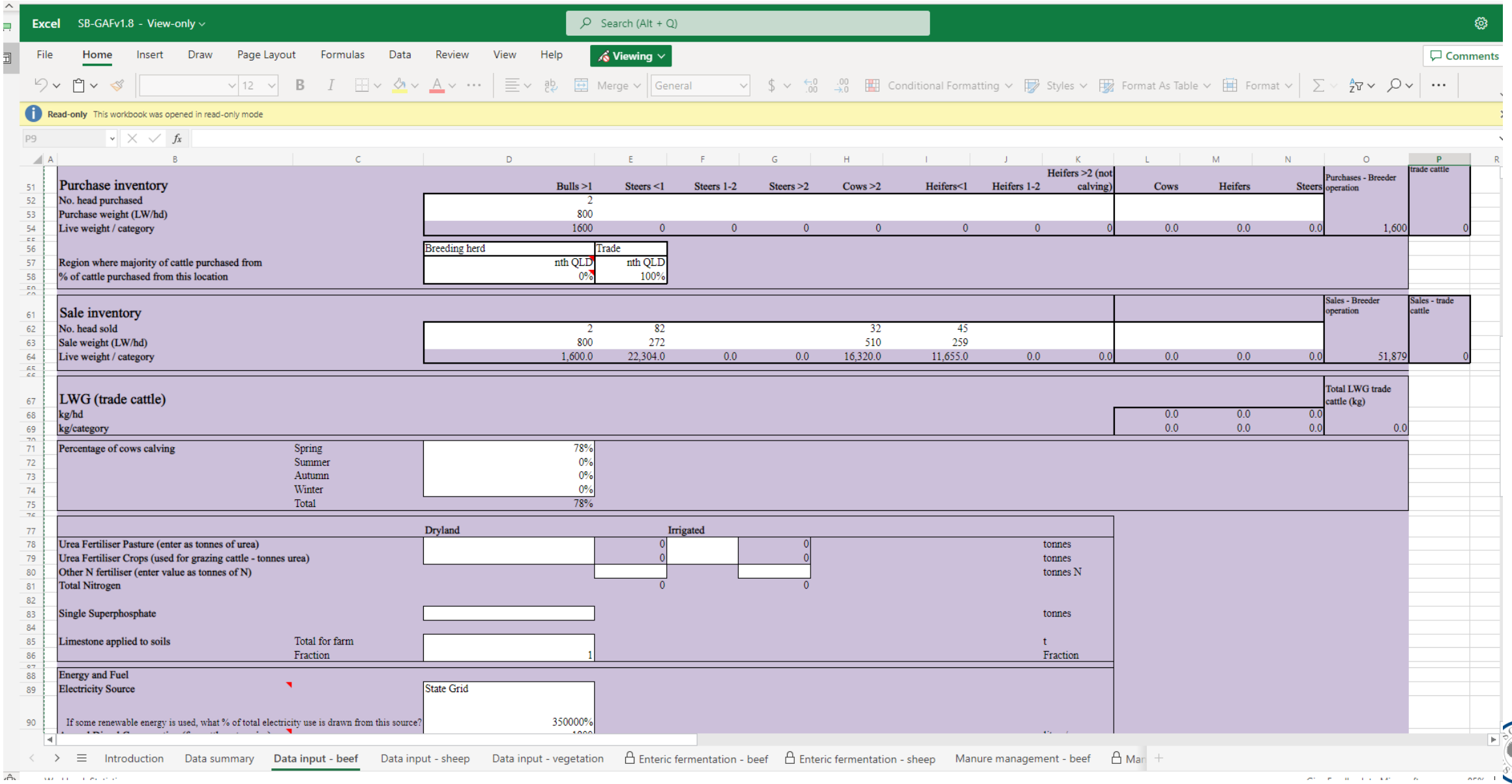
## Livestock inventory

| | | Breeder cattle and owner bred cattle | | | | | | | | Traded cattle | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bulls >1 | Steers <1 | Steers 1-2 | Steers >2 | Cows >2 | Heifers<1 | Heifers 1-2 | Heifers >2 (not calving) | Cows | Heifers | Steers | Units |
| Livestock Numbers | Spring | 8 | 82 | | | 211 | 82 | 37 | | | | | head |
| | Summer | 8 | 82 | | | 209 | 82 | 37 | | | | | head |
| | Autumn | 8 | 82 | | | 208 | 82 | 37 | | | | | head |
| | Winter | 8 | | | | 175 | 37 | 37 | | | | | head |
| | Average | 8 | 82 | | | 201 | 71 | 37 | | | | | head |
| Liveweight | Spring | 800 | 81 | | | 475 | 81 | 318 | | | | | kg/head |
| | Summer | 800 | 172 | | | 489 | 167 | 373 | | | | | kg/head |
| | Autumn | 800 | 245 | | | 513 | 236 | 423 | | | | | kg/head |
| | Winter | 800 | | | | 529 | 277 | 464 | | | | | kg/head |
| | Average | 800 | 166 | | | 501 | 190 | 394 | | | | | kg/head |
| Liveweight gain (LWG) | Spring | 0.00 | 1.00 | | | 0.00 | 1.00 | 0.60 | | | | | kg/hd/day |
| | Summer | 0.00 | 1.00 | | | 0.30 | 0.90 | 0.60 | | | | | kg/hd/day |
| | Autumn | 0.00 | 0.60 | | | 0.24 | 0.60 | 0.50 | | | | | kg/hd/day |
| | Winter | 0.00 | | | | 0.10 | 0.30 | 0.40 | | | | | kg/hd/day |
| | Average | 0.00 | 0.87 | | | 0.16 | 0.70 | 0.53 | | | | | kg/hd/day |
| Crude Protein (CP) | Spring | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | % |
| | Summer | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | 13.00 | % |
| | Autumn | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | % |
| | Winter | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | 6.00 | % |
| | Average | 9.0 | 0.0 | 9.0 | 0.0 | 0.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | % |
| Dry matter digestibility (DMD) | Spring | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | 53.00 | % |
| | Summer | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | 57.00 | % |
| | Autumn | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | 55.00 | % |
| | Winter | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 | % |
| | Average | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | 54.0 | % |

Heifers >2 (not

Introduction | Data summary | Data input - beef | Data input - sheep | Data input - vegetation | Enteric fermentation - beef | Enteric fermentation - sheep | Manure management - beef | Mar

Government of South Australia
Department of Primary Industries and Regions



Excel SB-GAFv1.8 - View-only

Search (Alt + Q)

File Home Insert Draw Page Layout Formulas Data Review View Help Viewing Comments

Read-only This workbook was opened in read-only mode

P9

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | **Purchase inventory** | | | Bulls >1 | Steers <1 | Steers 1-2 | Steers >2 | Cows >2 | Heifers<1 | Heifers 1-2 | Heifers >2 (not calving) | Cows | Heifers | Steers | Purchases - Breeder operation | trade cattle | | | |
| 52 | No. head purchased | | | 2 | | | | | | | | | | | | | | | |
| 53 | Purchase weight (LW/hd) | | | 800 | | | | | | | | | | | | | | | |
| 54 | Live weight / category | | | 1600 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 1,600 | 0 | | | |
| 56 | | | | Breeding herd | Trade | | | | | | | | | | | | | | |
| 57 | Region where majority of cattle purchased from | | | nth QLD | nth QLD | | | | | | | | | | | | | | |
| 58 | % of cattle purchased from this location | | | 0% | 100% | | | | | | | | | | | | | | |
| 61 | **Sale inventory** | | | | | | | | | | | | | | Sales - Breeder operation | Sales - trade cattle | | | |
| 62 | No. head sold | | | 2 | 82 | | | 32 | 45 | | | | | | | | | | |
| 63 | Sale weight (LW/hd) | | | 800 | 272 | | | 510 | 259 | | | | | | | | | | |
| 64 | Live weight / category | | | 1,600.0 | 22,304.0 | 0.0 | 0.0 | 16,320.0 | 11,655.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51,879 | 0 | | | |
| 67 | **LWG (trade cattle)** | | | | | | | | | | | | | | Total LWG trade cattle (kg) | | | | |
| 68 | kg/hd | | | | | | | | | | | 0.0 | 0.0 | 0.0 | | | | | |
| 69 | kg/category | | | | | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | | | | |
| 71 | Percentage of cows calving | | Spring | 78% | | | | | | | | | | | | | | | |
| 72 | | | Summer | 0% | | | | | | | | | | | | | | | |
| 73 | | | Autumn | 0% | | | | | | | | | | | | | | | |
| 74 | | | Winter | 0% | | | | | | | | | | | | | | | |
| 75 | | | Total | 78% | | | | | | | | | | | | | | | |
| 77 | | | | Dryland | | | Irrigated | | | | | | | | | | | | |
| 78 | Urea Fertiliser Pasture (enter as tonnes of urea) | | | | 0 | | 0 | | | | tonnes | | | | | | | | |
| 79 | Urea Fertiliser Crops (used for grazing cattle - tonnes urea) | | | | 0 | | 0 | | | | tonnes | | | | | | | | |
| 80 | Other N fertiliser (enter value as tonnes of N) | | | | | | | | | | tonnes N | | | | | | | | |
| 81 | Total Nitrogen | | | | 0 | | 0 | | | | | | | | | | | | |
| 83 | Single Superphosphate | | | | | | | | | | tonnes | | | | | | | | |
| 85 | Limestone applied to soils | | Total for farm | | | | | | | | t | | | | | | | | |
| 86 | | | Fraction | 1 | | | | | | | Fraction | | | | | | | | |
| 88 | Energy and Fuel | | | | | | | | | | | | | | | | | | |
| 89 | Electricity Source | | | State Grid | | | | | | | | | | | | | | | |
| 90 | If some renewable energy is used, what % of total electricity use is drawn from this source? | | | 350000% | | | | | | | | | | | | | | | |

Introduction | Data summary | Data input - beef | Data input - sheep | Data input - vegetation | Enteric fermentation - beef | Enteric fermentation - sheep | Manure management - beef | Ma

Government of South Australia
Department of Primary Industries and Regions

# Carbon Farming Demonstration pilot

Livestock data:

- Number head
- Liveweight
- Liveweight gain
- Pasture/ feed data (quality and quantity)
- Purchase inventory
- Sale inventory
- Wool clip
- Reproduction rates
- Purchased feed

Urea, glyphosate and lime application (or alternative)

Vegetation

Electricity

Fuel

Government of South Australia

Department of Primary Industries and Regions

# Carbon Farming Demonstration pilot

- The Growing Carbon Farming Pilot is a $1 million initiative to encourage carbon farming adoption and build the carbon market in South Australia.
- Will provide grants of up to $100,000 for projects that can:
  - Demonstrate a carbon farming method and or practice that has application for the South Australian primary industry sector.
  - Demonstrate how carbon farming activities contribute to revenue and jobs in South Australia.
  - Demonstrate and quantify the co-benefits of carbon farming.
  - Improve knowledge and capability, particularly small to medium farm enterprises and larger businesses and other organisations yet to engage with carbon markets.

Government of South Australia
Department of Primary Industries and Regions


Thank you