

Prom Country Cheese Calculating the Carbon Footprint

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SE Region



Prom Country Cheese



- Burke and Bronwen Brandon
- 76.93 ha
- Sheep and cattle for meat
- Sheep for milk
- 14.4 ha revegetation
- Cheese production
- 6,900kg from own milk
- 4,600kg from imported milk
- 69,000L milk processed

Why do you want to assess your carbon footprint?

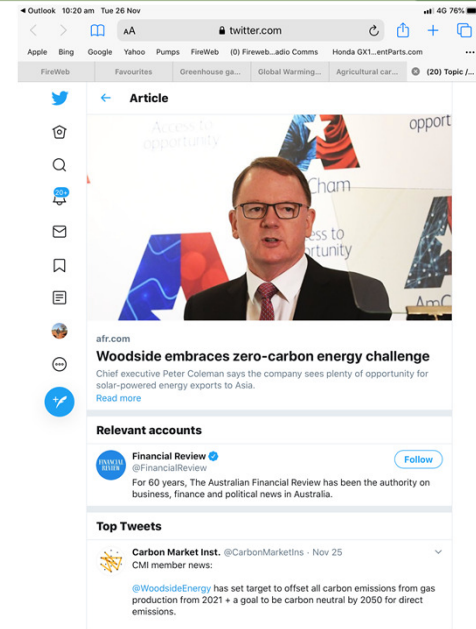


Some reasons proffered!

- Industry concerns
- Market advantage
- Personal concerns
- Starting point - assessing where you are at.



Australia's NAPCO
launches carbon neutral
beef in Singapore
November 13, 2019
[Remedios Lucio](#)



What is meant by Carbon Footprint

Definition

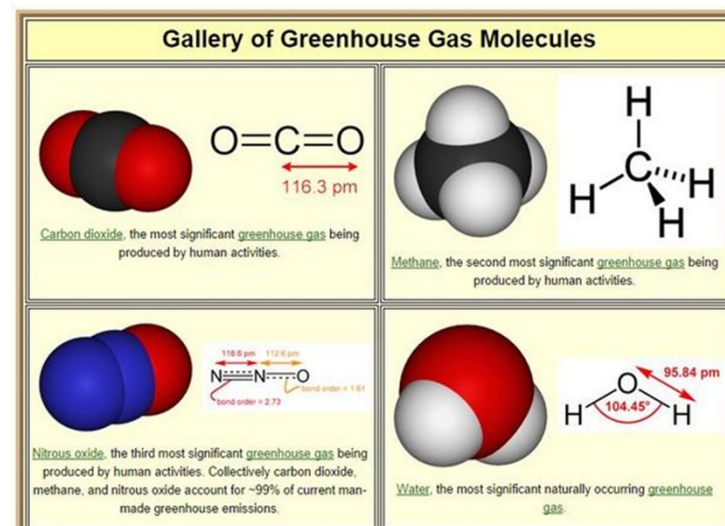
A carbon footprint can be defined as the total emissions caused by an individual, event, organization, or product, expressed as carbon dioxide equivalent.

Representation



Greenhouse gases – some basics

Greenhouse Gas	Symbol	CO ₂ Equivalent (CO ₂ e-)
Water Vapour	H ₂ O	-
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298
Fluorinated Gases hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride, nitrogen trifluoride	various	7000 - 23000



1 tonne of CO₂e



- Approx. 510 cubic metres
- Driving 6000km with a diesel car
- 1000kwh power consumption
- Return flight to Singapore from Melbourne (single passenger)

Something else to be aware of

- 1 tonne of C equates to 3.67t CO₂e
- If we sequester C into soil or trees we need to keep this in mind!
- Every tonne of C sequestered is 3.67t CO₂e
- The biggest source of mistakes: **C vs. CO₂**. ... The atomic weight of **carbon** is 12 atomic mass units, while the weight of **carbon dioxide** is 44, because it includes two oxygen atoms that each weigh 16. So, to switch from one to the other, use the formula: One ton of **carbon** equals $44/12 = 11/3 = 3.67$ tons of **carbon dioxide**.

The big emitters!



People

Enteric - 3kg CO₂e
per annum

All - 2-15t CO₂ per
annum



Cattle

1.250-
2.250t
CO₂e
per annum



Sheep

0.25-0.325t CO₂e
per annum

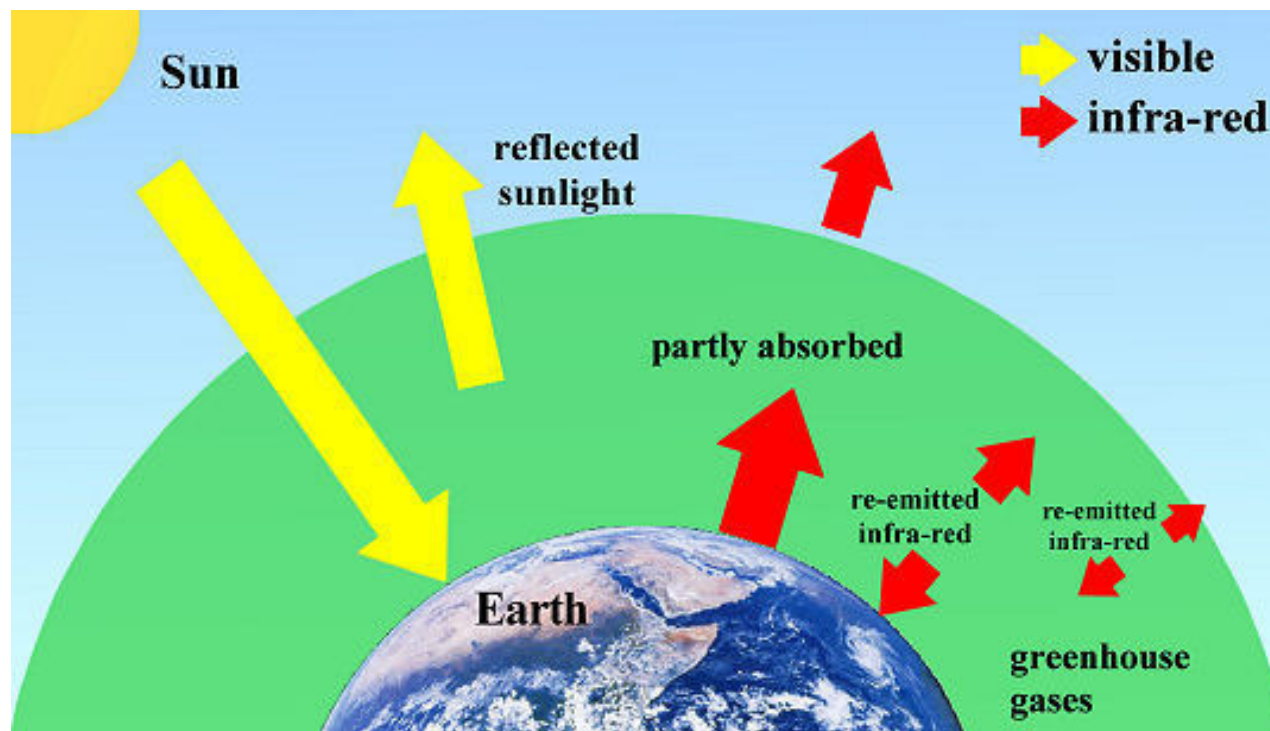


Cars

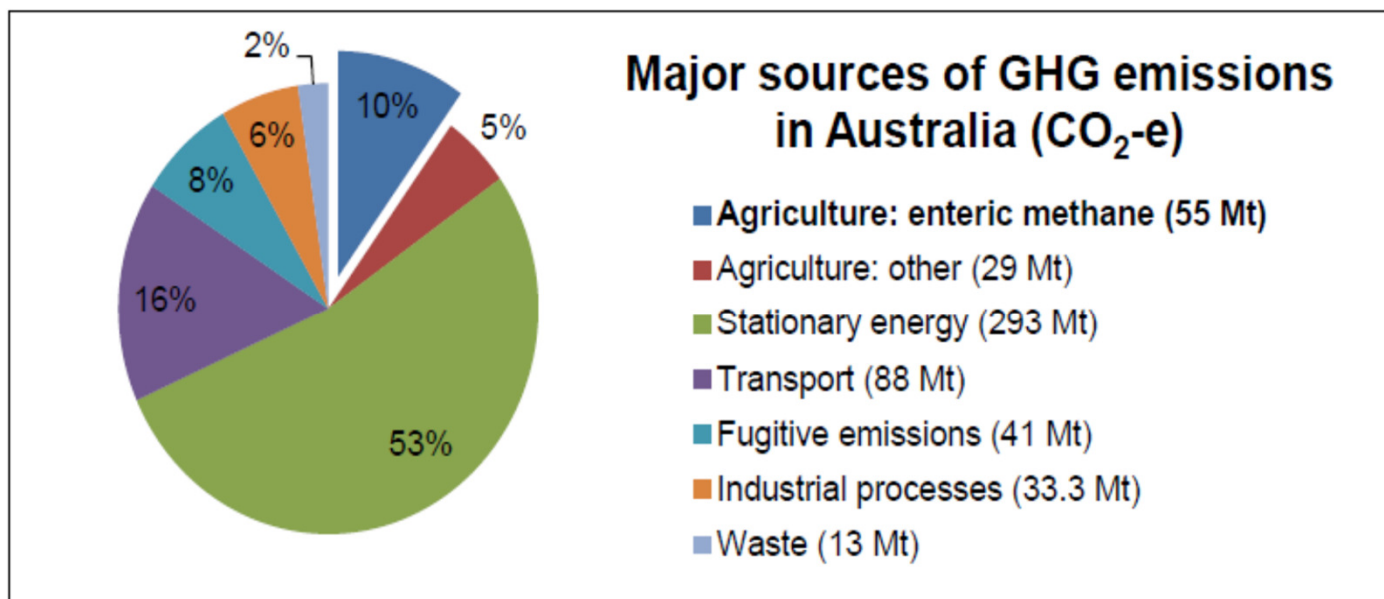
3.02t CO₂e per
Annum

AGRICULTURE VICTORIA

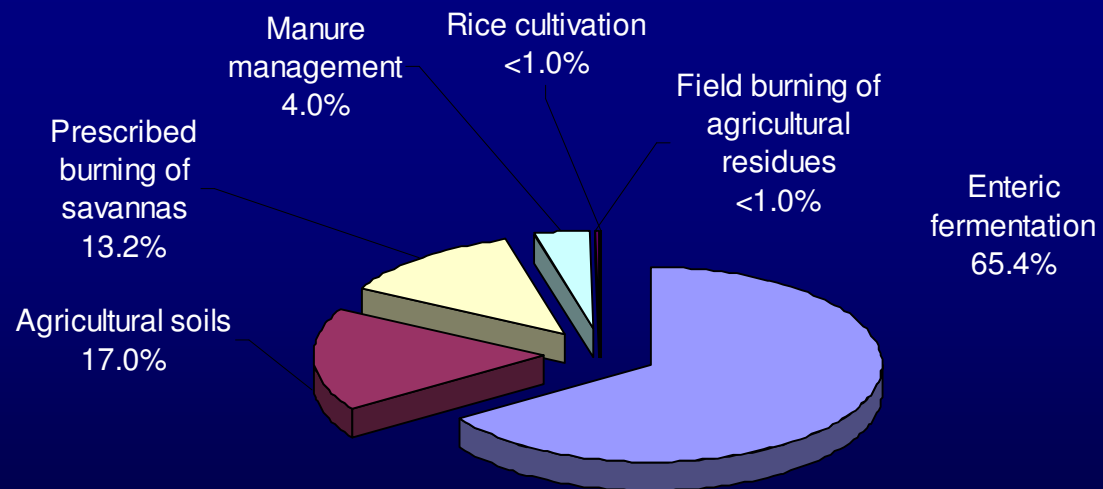
What Greenhouse Gases Do!



GHGs in Agriculture



Agricultural Emissions: Breakdown



The big ones:

Methane from ruminants, and Nitrous Oxide from soils

Current Scenario – Prom Country Cheese Farm

FARM OUTPUTS

Meat production

- 25 Cattle
- 40 Wethers
- 100 lambs
- 30 ewes

Milk production

- 6900milk solids
- Litres

Waste

organic and landfill

GHG gas emissions – methane, nitrous oxide

FARM INPUTS CREATING GHG EMISSIONS

Fuel

- Petrol cars / utes / quads 1420L/yr (10% personal?)
- Tractor 600L/yr (used mainly for mulching in Spring / Summer), and odd jobs with loader. No tilling, fertiliser spreading, haymaking or sowing.

Electricity

- 7870 kwh (house and dairy with solar input)

Fertiliser

- Lime 88t (5 years)
- Aussie Compost 120t (one off)
- Pig Manure 12t
- 58,000L whey recycled back onto farm plus waste water through worm farm.

Current Scenario – Prom Country Cheese Business

FARM OUTPUTS

Cheese production

- 6,900kg from our milk
- 4,600kg from imported milk
- 69,000L milk processed

BUSINESS INPUTS CREATING GHG EMISSIONS

Fuel

- Petrol cars / utes / quadbikes
2000L/yr (10% personal?)
- Courier \$11,500/yr for shared trip to
Melbourne region weekly c1,000l/yr

Electricity

- 25713 kwh with solar input

CALCULATING EMISSIONS on Farm

What's available

- FarmGAS (static GHG calculator)
- Sheep-GAF and Beef-GAF (static GHG calculator)
- GrassGro (dynamic GHG modelling tool)
- FullCAM (vegetation modelling tool)
- DairyGas (Dairy specific calculator)

CALCULATING EMISSIONS on Farm

What's available-FarmGAS (static GHG calculator)

The screenshot displays the FarmGAS web application interface. At the top, the Australian Farm Institute logo is on the left, and the farmgas logo is on the right. Below the logos is a navigation bar with links for Home, Change Details, and Logout. The main content area is titled "Welcome Nick!" and includes a message about the last login time and instructions for creating or selecting scenarios. The "Scenario Homepage" section shows the current scenario is "Baseline", created on 15/11/2019 at 07:54 am, and last saved on 26/11/2019 at 10:35 pm. The "Configuration" section has a checkbox for "Use Financial Tool?" which is currently unchecked. The "Farm Details" section shows the farm name as "Prom Country Cheese", the state/territory as "Victoria", and the region as "West/South Gippsland". The "Farm Information" section includes links for "ENTERPRISES", "GROSS MARGIN CALCULATORS", and "SUMMARY REPORTS - EMISSIONS & FINANCIAL". On the right side, there are three panels: "FARMGAS CALCULATOR ST" with a home icon, "TOOLS MENU" with a question mark icon and links for "Financial Tool" and "New User (guides available)", and "YOUR SCENARIOS" with a dropdown menu for selecting a scenario and buttons for "Load", "Copy", "New", and "Delete". Below these is a "MODEL SCENARIOS" panel with a dropdown menu for selecting a model scenario and a "Copy" button.

Australian Farm Institute

farmgas

Home Change Details Logout

Welcome Nick!
Your last login was on Wednesday, the 27th of November, 2019 at 03:40 pm
Create a new scenario, select a previously saved scenario or copy an existing scenario.
The Tools Menu to the right of screen provides links to the Financial Tool and learning resources for New Users.

Scenario Homepage
Scenario: Baseline
Created: 15/11/2019 07:54 am Last saved: 26/11/2019 10:35 pm

Configuration
☐ Use Financial Tool? note: this will turn-off financials in FarmGAS Calculator ST
[Setup](#) [Pastures](#)
[Emission Factors](#) [Overheads](#) (non-enterprise income and expense items)

Farm Details
Farm: Prom Country Cheese
State/Territory: Victoria Region: West/South Gippsland

Farm Information
+ ENTERPRISES
+ GROSS MARGIN CALCULATORS
+ SUMMARY REPORTS - EMISSIONS & FINANCIAL

FARMGAS CALCULATOR ST

TOOLS MENU
[Financial Tool](#)
[New User \(guides available\)](#)

YOUR SCENARIOS
Select a scenario
From Country Cheese - Ba
Load Copy New Delete

MODEL SCENARIOS
Select a scenario
Select a model scenario...
Copy

CALCULATING EMISSIONS on Farm

What's available-Beef and Sheep Greenhouse Calculators (UNIMELB)

[Copy of BeefGreenhouseV15 Prom Country Cheese.xlsx](#)

[SheepGreenhouseV7-1Prom Country.xlsx](#)

[Copy of BeefGreenhouseV15 Prom Country Cheese.xlsx](#)

[SheepGreenhouseV7-1Prom Country.xlsx](#)

FarmGAS Calculations

Outputs Farm	Sheep	Beef	TOTAL
	t CO ₂ e/D ₂ e/farm	t CO ₂ e/farm	
CO ₂ - Energy	10.37		10.37
CO ₂ - Transport	na	na	0
CO ₂ - Lime	na	na	0
CO ₂ - Urea Application	0	0	0
CH ₄ - Enteric	88.63	27.96	116.59
N ₂ O - Fertiliser	na	na	0
N ₂ O - Urine and Dung	16.53	5.06	21.59
N ₂ O - Atmospheric deposition	na	na	0
N ₂ O - Leaching and Runoff	na	na	0
N ₂ O - Energy	na	na	0
Total Farm Emissions	115.5	33.02	148.55
Total Revegetation Sequestration			43.54
Net Farm Emissions			105.01

Beef and Sheep Greenhouse Calculations

Outputs Farm	Sheep	Beef	TOTAL
	t CO ₂ e/farm	t CO ₂ e/farm	t CO ₂ e/farm
CO ₂ - Energy	10.37		10.37
CO ₂ - Transport	1.27	0.42	1.69
CO ₂ - Lime	6.02	0.5	6.52
CO ₂ - Urea Application	0	0	0
CH ₄ - Enteric	92.72	21.56	114.28
N ₂ O - Fertiliser	1.23	0.23	1.46
N ₂ O - Urine and Dung	18.5	2.52	21.02
N ₂ O - Atmospheric deposition	0.12	0.28	0.4
N ₂ O - Leaching and Runoff	1.38	1.68	3.06
N ₂ O - Energy	0.01	0	0.01
Total Farm Emissions	131.62	27.19	158.81
Total Revegetation Sequestration			43.54
Net Farm Emissions			115.27

Summary t CO₂e/farm

CO ₂	8.21
CH ₄	114.28
N ₂ O	25.95

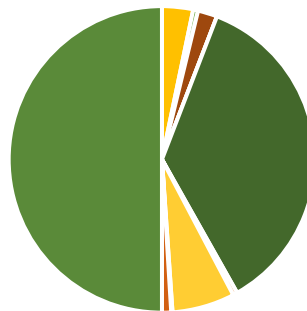
Slide 19

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Nick C Dudley (DEDJTR), 27/11/2019

Beef and Sheep Greenhouse Calculations

TOTAL



- | | | |
|-----------------------------|--------------------------|--------------------------------|
| ■ | ■ CO2 - Energy | ■ CO2 - Transport |
| ■ CO2 - Lime | ■ CO2 - Urea Application | ■ CH4 - Enteric |
| ■ N2O - Fertiliser | ■ N2O - Urine and Dung | ■ N2O - Atmospheric deposition |
| ■ N2O - Leaching and Runoff | ■ N2O - Energy | ■ Total Farm Emissions |

Farm and Factory Calculations

Outputs Factory		TOTAL
		t CO ₂ e/farm
CO ₂ - Energy	25082kwh	26.84
CO ₂ - Waste	6.2t	2.18
CO ₂ - Transport	3250l	7.8
Total Extra Factory Emissions		36.82
Total Farm and Factory Emissions		195.63
Total Revegetation Sequestration	14.4ha	43.54
Net Farm and Factory Emissions		152.09

Emissions Intensities

TOTAL

Emissions Intensity Farm /ha	76.93	115.27	1.50	t CO₂e/hectare
Emissions Intensity Milk Solids	6.9	115.27	16.71	t CO₂e/tonne
Emissions Intensity Cheese	11.5	152.09	13.23	t CO₂e/tonne

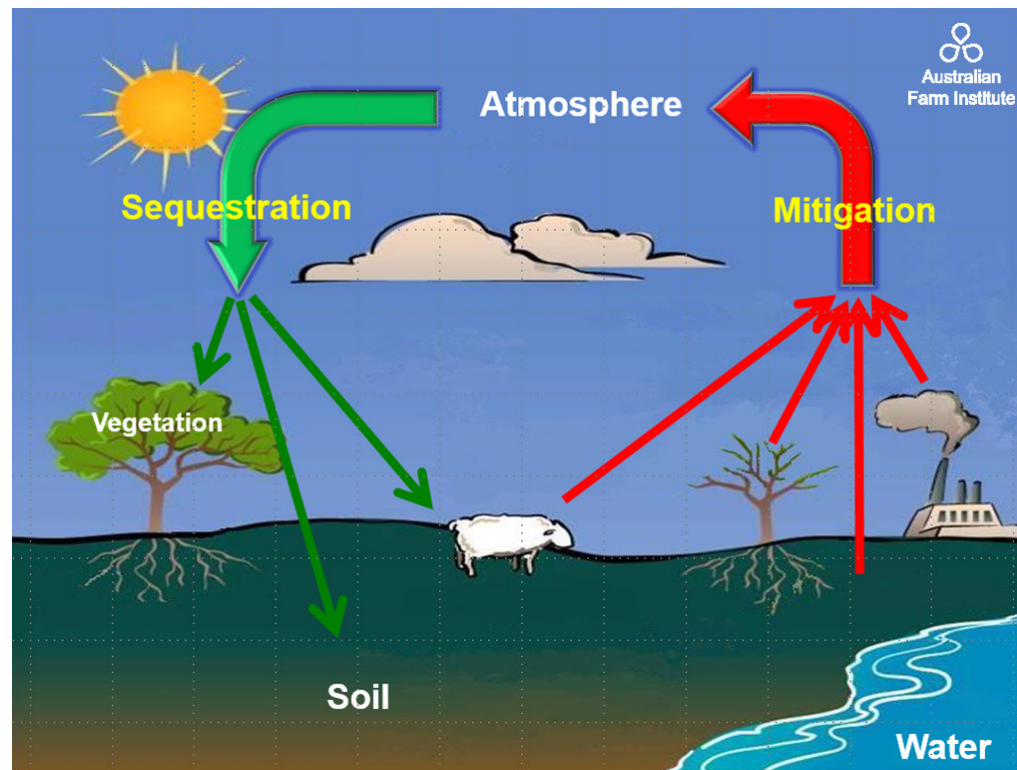
■ CO2 - Energy
 ■ CO2 - Transport
 ■ CO2 - Lime

CALCULATING EMISSIONS on Farm Issues

- Different systems give different results
- Uncertainties associated with agricultural estimates are high as:
 - most of the research on methane and nitrous oxide loss are based on studies conducted in the northern hemisphere; their direct application to Australian agriculture is questionable and requires local research before industries can be held accountable for their emissions;
 - national inventories rely accuracy of input data like animal numbers and nitrogen fertiliser use, and
 - biological systems are inherently variable and by definition and national inventory method can only integrate and approximate using available data.

Eckhard 2005

Balancing the Carbon Cycle



What can we do to do manage emissions

Mitigation

(Reducing or avoiding emissions)

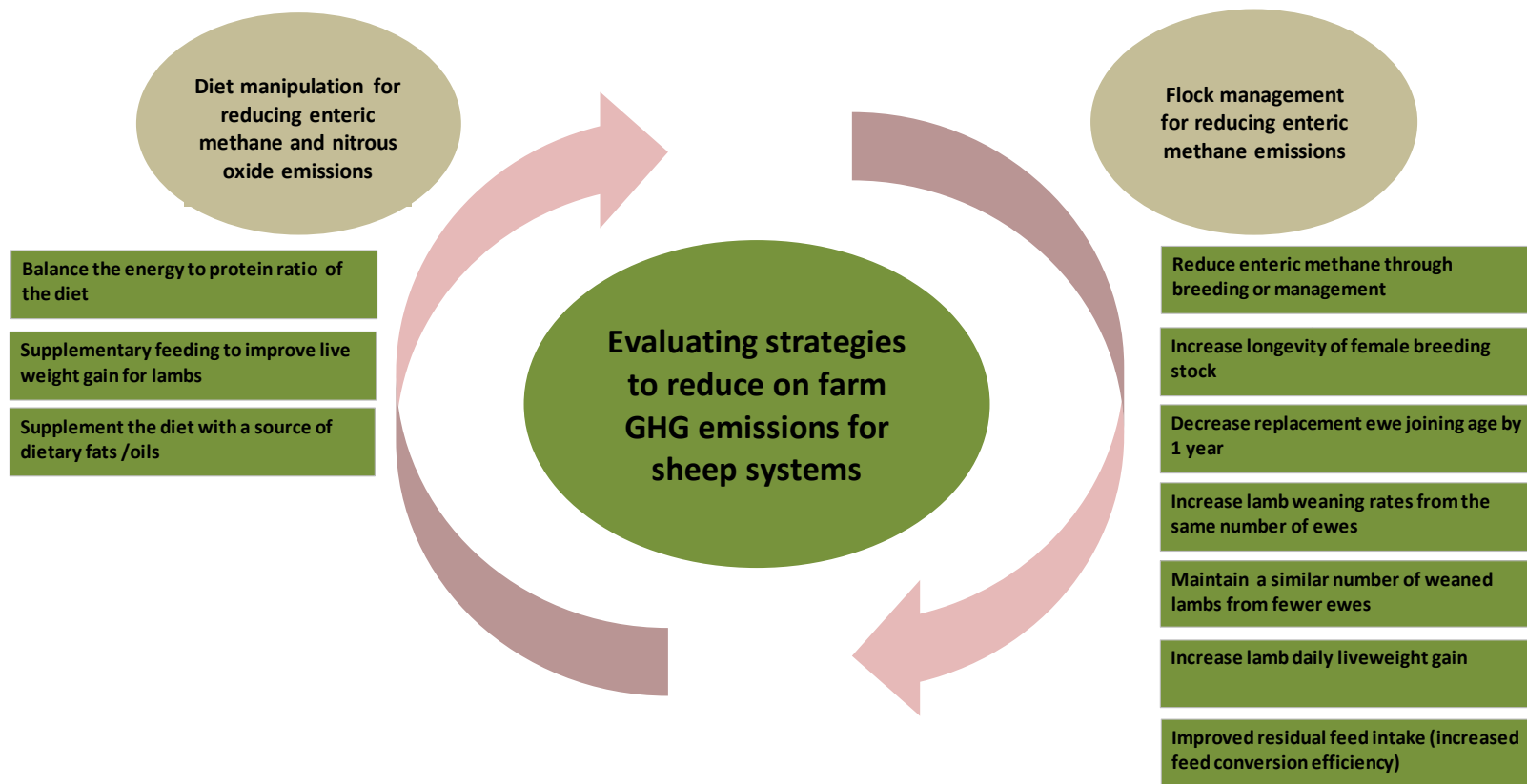
- Feed additives and supplements
- Better quality feed (rotational grazing v set stocking)
- Genetics and breeding (EBVs)
- Herd /flock management (eg. Early weaning, extended lactation, early finishing)

Sequestration

(capturing emissions)

- Building soil carbon
- Vegetation carbon capture
- Put more on the sheep's back!

Strategies for reducing GHG emissions; Sheep



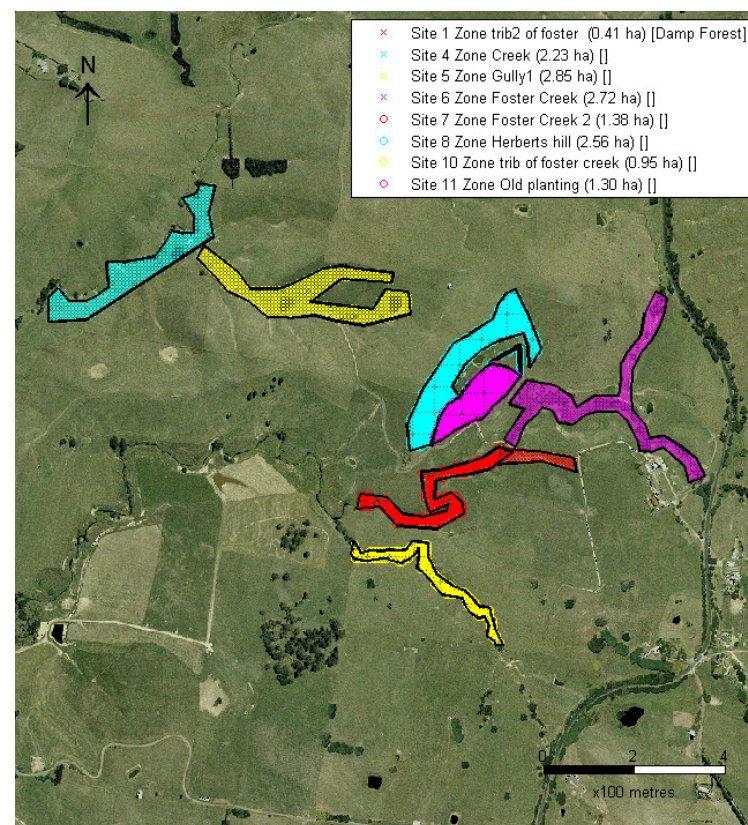
Soil Carbon –opportunity for sequestration

Depth (cm)	TOC (Mg/ha)	POC (Mg/ha)	HOC (Mg/ha)
0-10	42.5	11.5	17.9
10-20	29.7	4.3	14.0
20-30	19.4	2.0	10.5
0-30	91.7	17.8	42.4

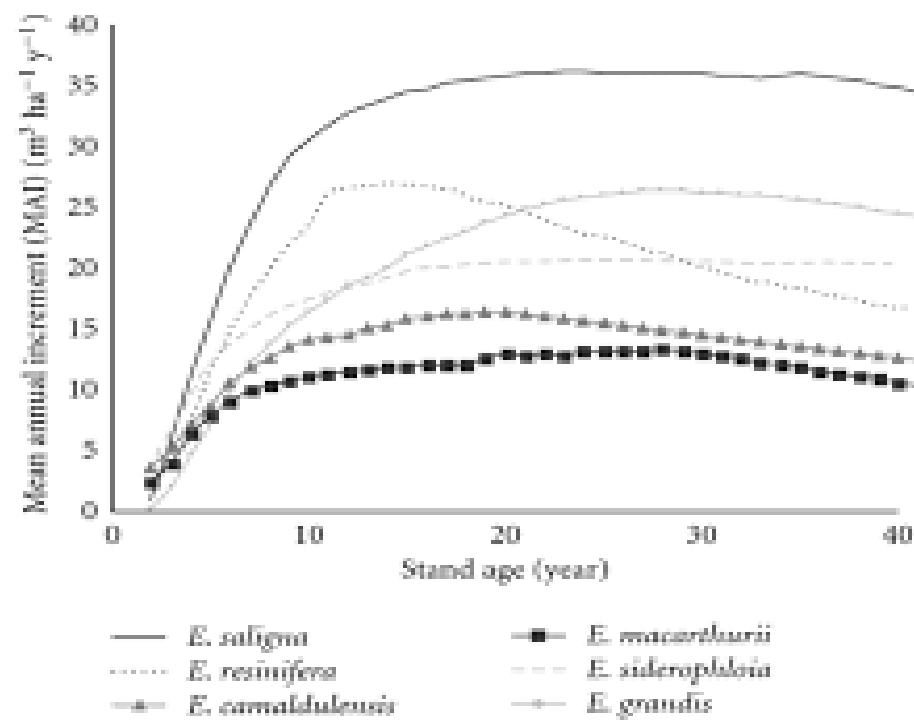
- Previous investigations during the SCARP project
- 90 farms in Southern Gippsland
- TOC range (30-212 TOC)
- If we could increase by 20 tonnes/ha
- $20 \times 3.67 = 73.4 \text{tCO}_2\text{e?}$
- NOW FOR THE DEBATE?

Vegetation: Sequestration

- 14.4ha plantation
- Damp forest EVC could reasonably expect much higher C sequestration than predicted by the model
- Clinton we need your help!
- What's possible? MAI of \$30 cubic metres = 15tC = 55tCO₂e??????



Vegetation: Sequestration



AgVIC Resources

- Agriculture Victoria website has a range of information
<http://agriculture.vic.gov.au/agriculture/farm-management/>
- The Fast Break and Very Fast Break still operating. Seasonal climate risk information.
<http://agriculture.vic.gov.au/agriculture/weather-and-climate/newsletters/the-fast-break-victoria/the-fast-break-victoria-may-2018>



Further reading:

- <https://www.scoopnest.com/user/NOAAClimate/509719646883160065-teachingclimate-this-gallery-depicts-chemical-properties-of-8-greenhouse-gas-molecules>
- <https://www.greenvehicleguide.gov.au/Vehicle/ViewMatchingVariants?vehicleDisplayId=27436>
- https://www.mla.com.au/globalassets/mla-corporate/blocks/research-and-development/01200075-program-fact-sheet_nlmp_final.pdf
- http://www.makingmorefromsheep.com.au/literature/150063/MLA_Greenhouse_Gas_Red_meat
- https://www.agric.wa.gov.au/climate-change/reducing-livestock-greenhouse-gas-emissions?page=0%2C0#smartpaging_toc_p0_s1_h2
- <https://www.greenvehicleguide.gov.au/pages/Help/FAQ#lifecycle>
- <https://carbonneutral.com.au/carbon-calculator/#gas>

Key Messages

- Carbon accounting is quite complex
- Different Calculators give different results
- Knowing some basics is useful
- Calculations are “ball park” only
- More regional data is required to assist with calculations
- If you are going try and reduce on–farm emissions you need some idea of your total farm emissions
- C sequestration in vegetation invariably underestimated in West and South Gippsland





Questions