AGRICULTURE VICTORIA

Prom Country Cheese
Calculating the Carbon Footprint

Nick Dudley Meat and Wool Services and Land Heath
SE Region

Economic Development,
Jobs, Transport
and Resources

Prom Country Cheese

- Burke and Bronwen Brandon

- 76.93 ha
- Sheep and cattle for meat
- Sheep for milk

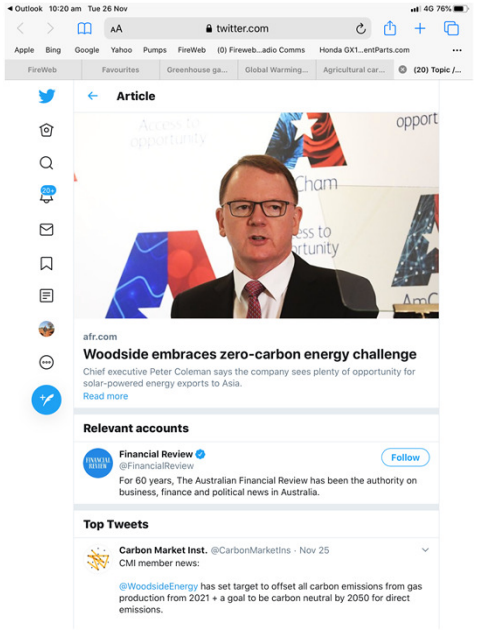
- 14.4 ha revegetation

- 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

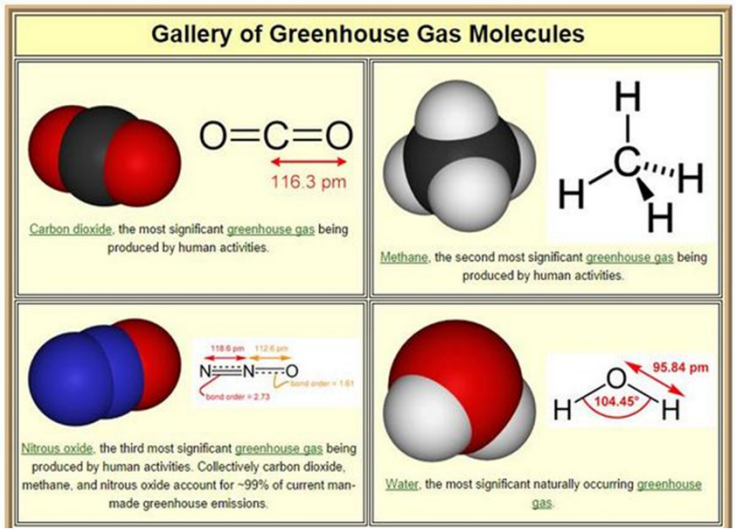
Definition

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_2e-)
Water Vapour	H_20	-
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_20	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 form Melbourne (single passenger)

Something else to be aware of

- 1 tonne of C equates to 3.67t CO_2e
- If we sequester C into soil or trees we need to keep this in mind!
- Every tonne of C sequestered is 3.67t CO_2e

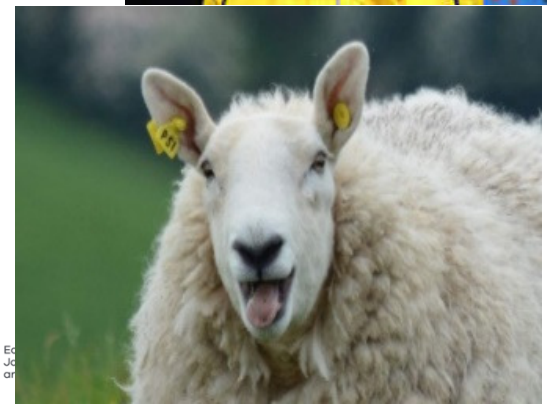
- The biggest source of mistakes: **C vs**. **CO2**. ... The atomic weight of **carbon** is 12 atomic mass units, while the weight of **carbon dioxide** is 44, because it includes two oxygen atoms that each weigh 16. So, to switch from one to the other, use the formula: One ton of **carbon** equals 44/12 = 11/3 = 3.67 tons of **carbon dioxide**.

The big emitters!

People

Enteric - 3kg CO_2e per annum

All - 2-15t CO_2 per annum



Sheep

0.25-0.325t CO_2e per annum

Cattle

1.250-2.250t CO_2e per annum

Cars

3.02t CO_2e per Annum

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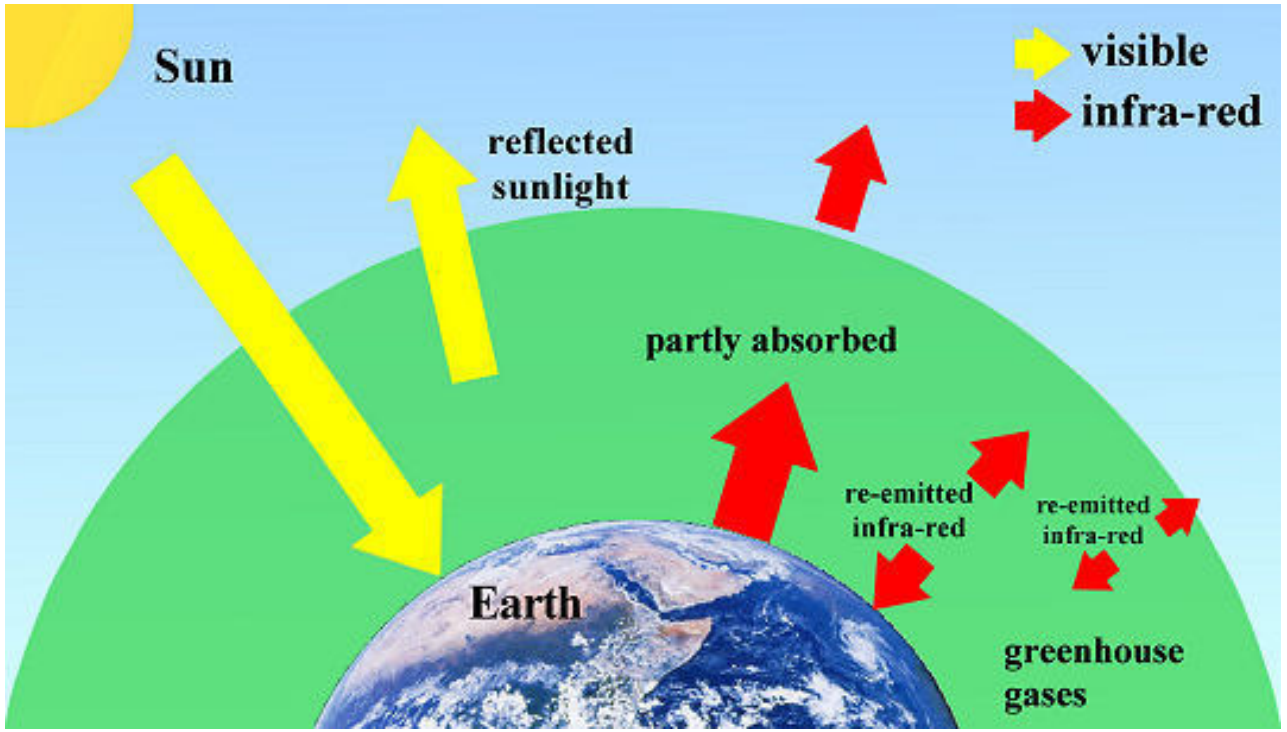
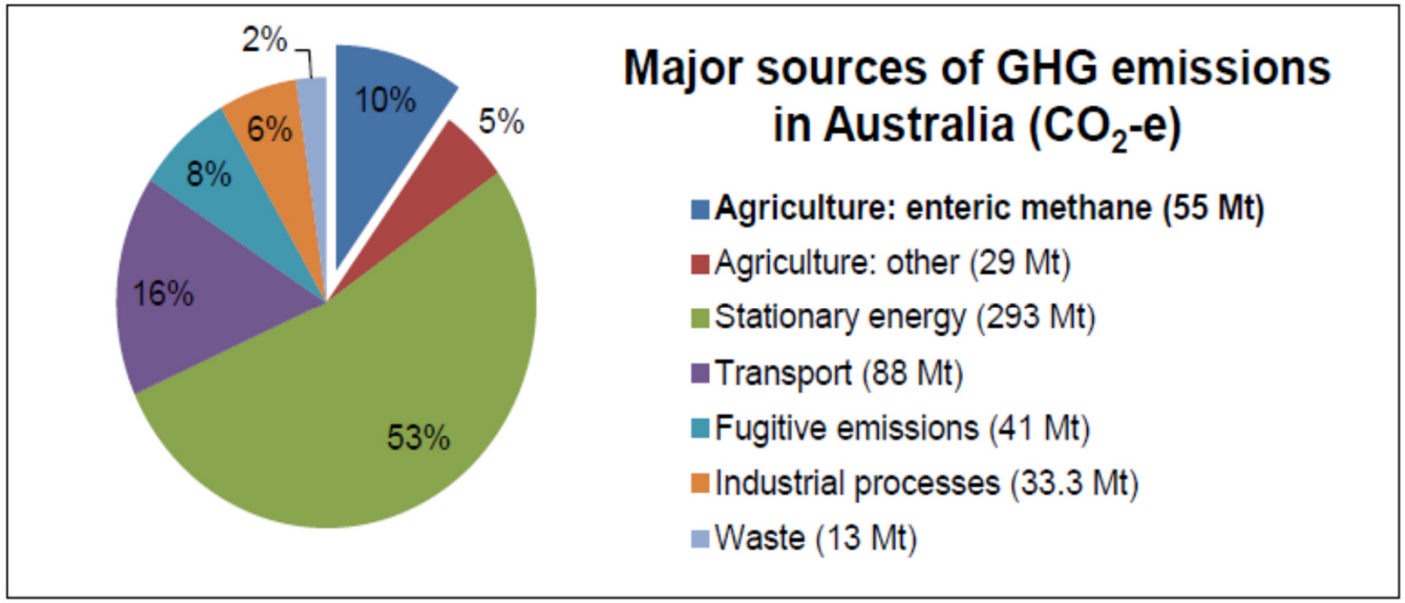
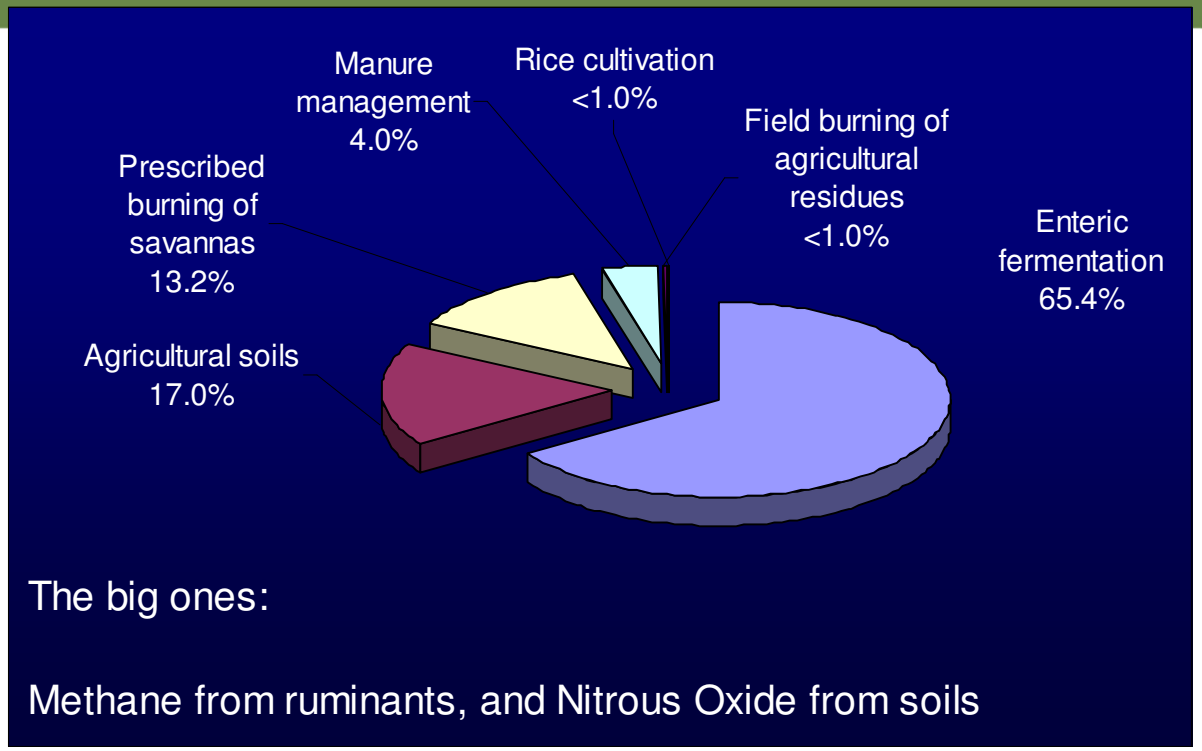
What Greenhouse Gases Do!



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)

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_2e/fD_2e/farm		t CO_2e/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_2O - Fertiliser	na	na	0
N_2O - Urine and Dung	16.53	5.06	21.59
N_2O - Atmospheric deposition	na	na	0
N_2O - Leaching and Runoff	na	na	0
N_2O - Energy	na	na	0
Total Farm Emissions	**115.5**	**33.02**	**148.55**
Total Revegetation Sequestration			**43.54**
Net Farm Emissions			**105.01**

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Beef and Sheep Greenhouse Calculations

Outputs Farm	Sheep	Beef	TOTAL
	t CO_2e/farm	t CO_2e/farm	t CO_2e/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_2O - Fertiliser	1.23	0.23	1.46
N_2O - Urine and Dung	18.5	2.52	21.02
N_2O - Atmospheric deposition	0.12	0.28	0.4
N_2O - Leaching and Runoff	1.38	1.68	3.06
N_2O - 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_2O	25.95

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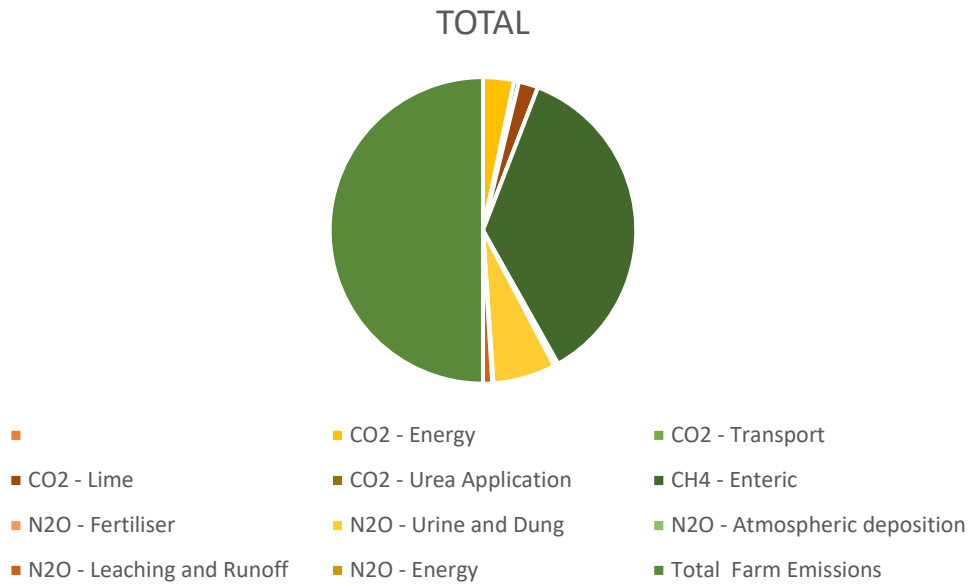
NCD(1 Nick C Dudley (DEDJTR), 27/11/2019

Beef and Sheep Greenhouse Calculations



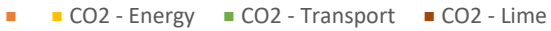
Farm and Factory Calculations

Outputs Factory		**TOTAL**
		t CO_2e/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 CO_2e/hectare**
Emissions Intensity Milk Solids	**6.9**	**115.27**	**16.71**	**t CO_2e/tonne**
Emissions Intensity Cheese	**11.5**	**152.09**	**13.23**	**t CO_2e/tonne**

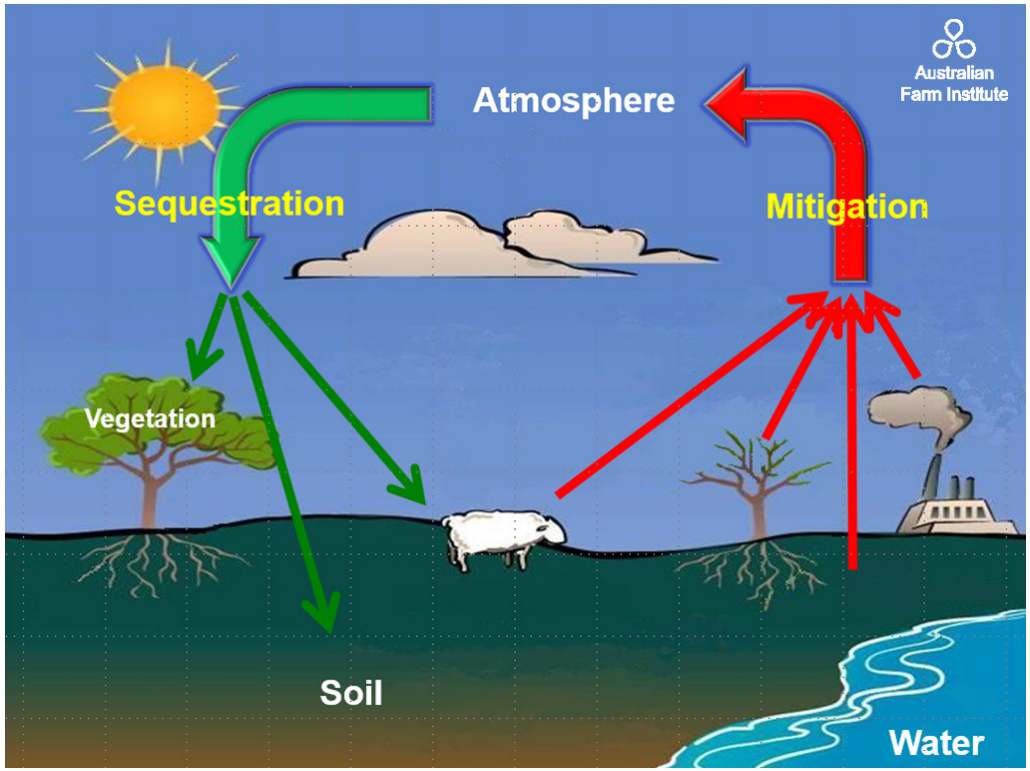


CALCULATING EMISSIONS on Farm
Issues

- 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

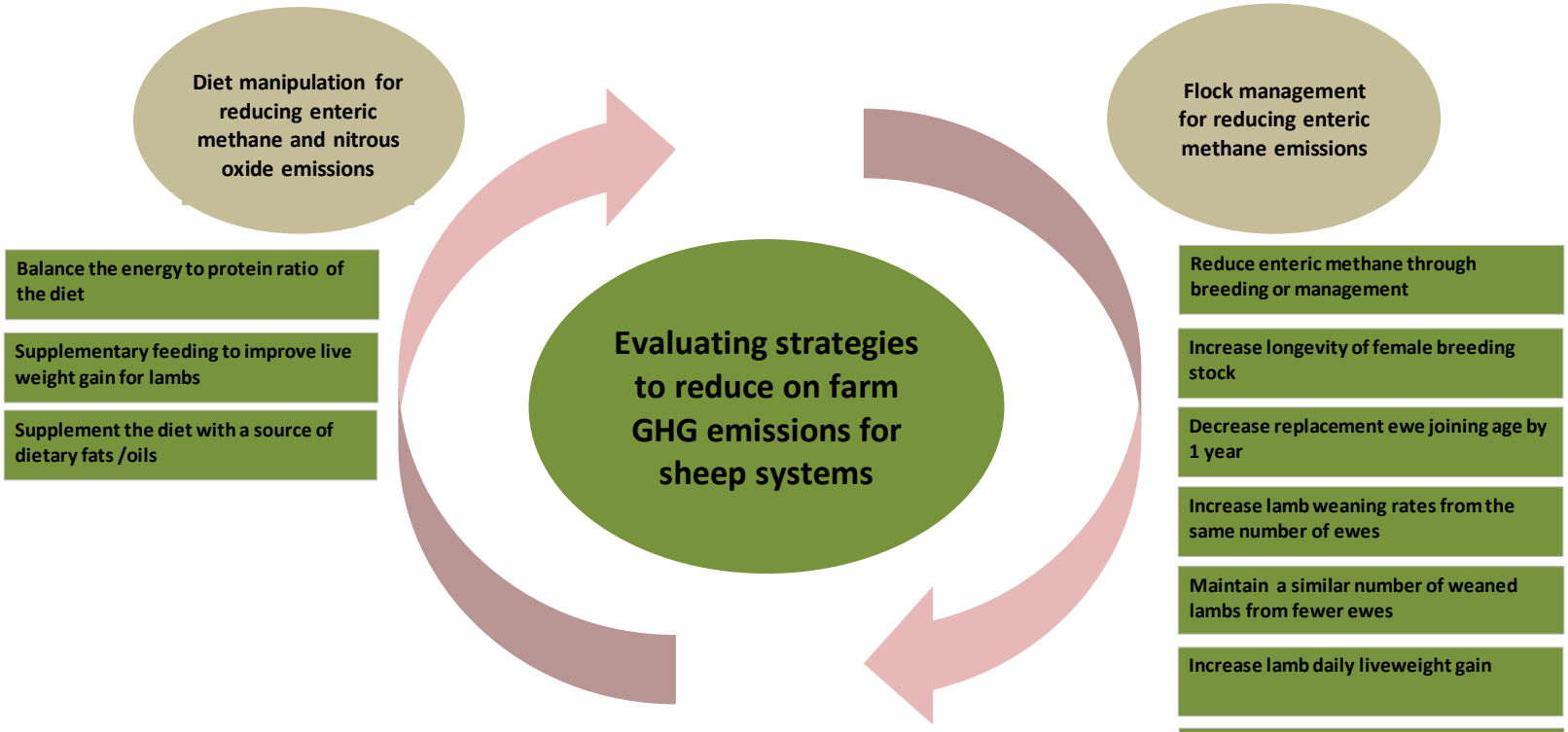
Mitigation
(Reducing or avoiding emissions)

- 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



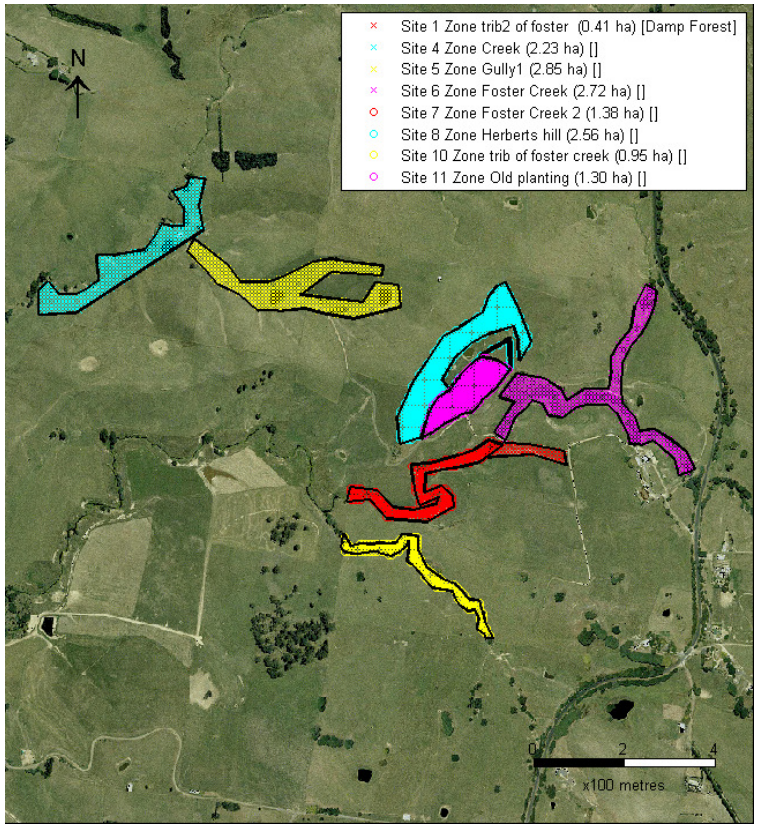
Soil Carbon –opportunity for sequestration

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

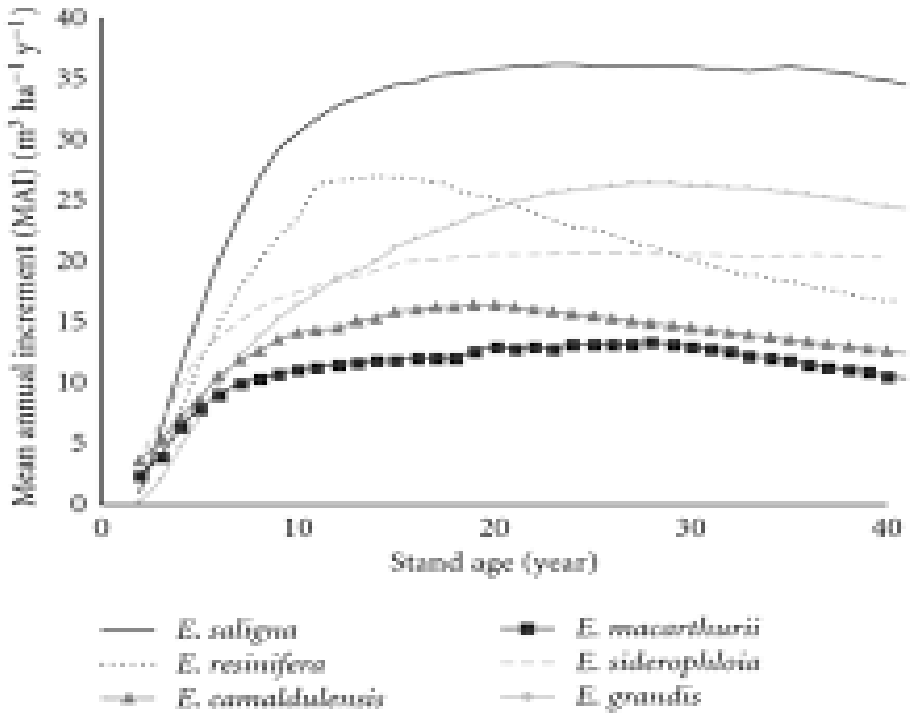
- Previous investigations during the SCARP project
- 90 farms in Southern Gippsland
- TOC range (30-212 TOC)
- If we could increase by 20 tonnes/ha
- 20x3.67 = 73.4tCO_2e?
- NOW FOR THE DEBATE?

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 = 55tCO_2e??????



Vegetation: Sequestration



AgVIC Resources

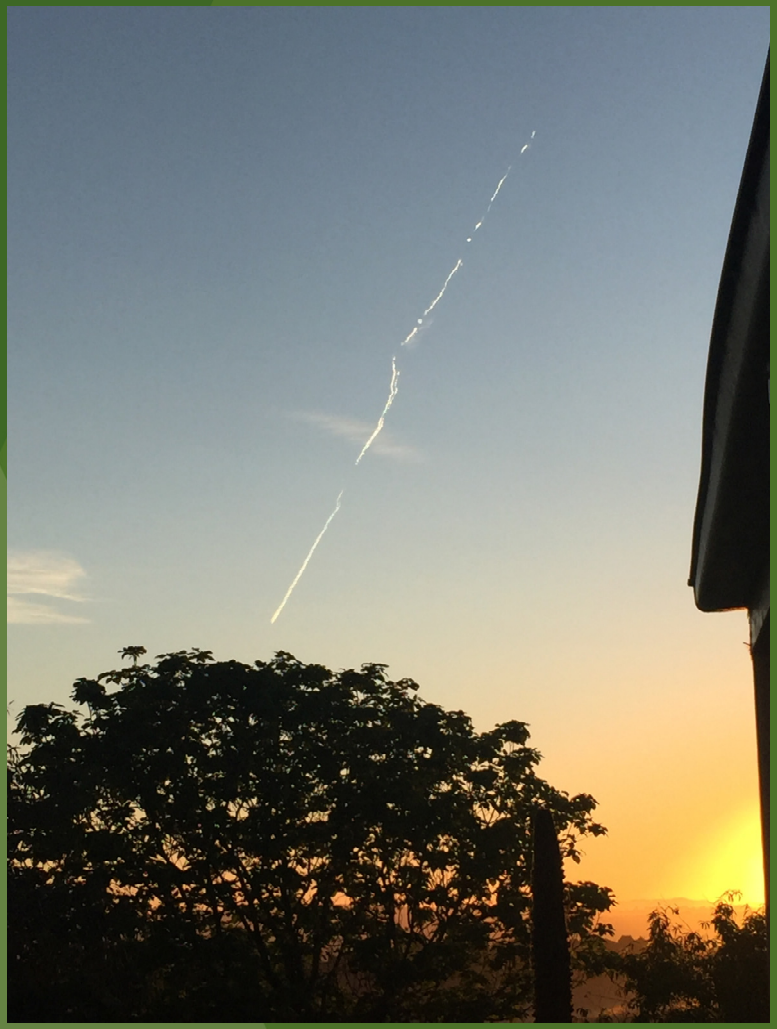
- Agriculture Victoria website has a range of information http://agriculture.vic.gov.au/agriculture/farm-management/
- The Fast Break and Very Fast Break still operating. Seasonal climate risk information. http://agriculture.vic.gov.au/agriculture/weather-and-climate/newsletters/the-fast-break-victoria/the-fast-break-victoria-may-2018

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