

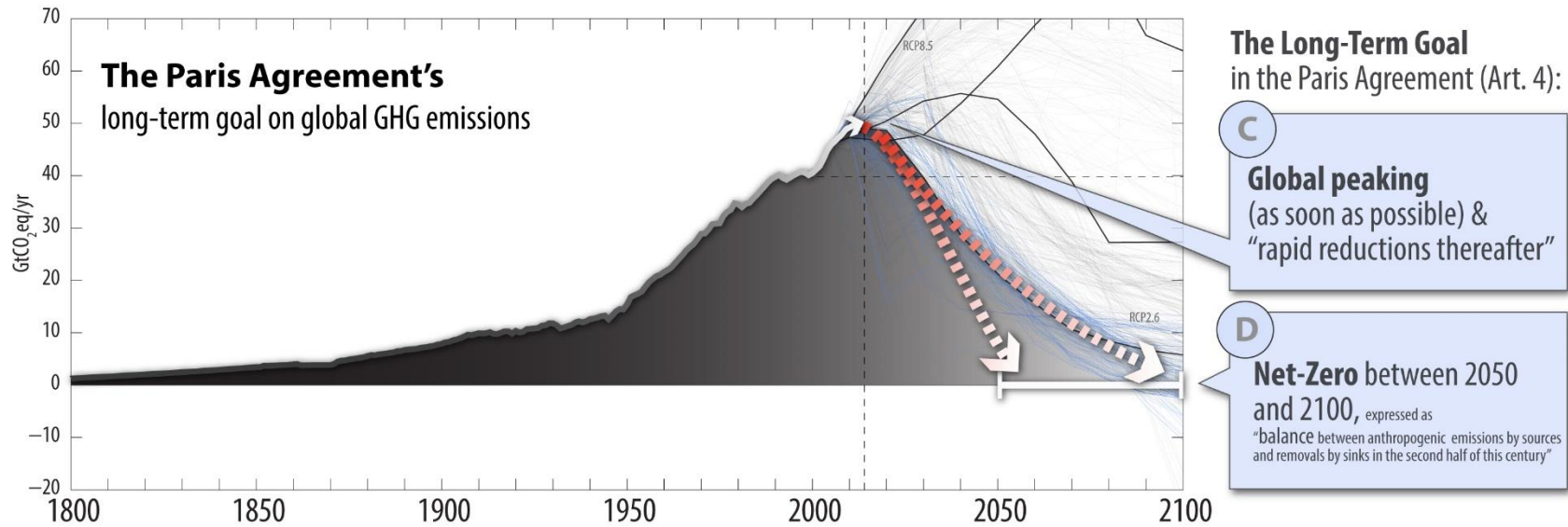
# meatup

FORUM

**For the latest in red meat R&D**

# Carbon neutral by 2030 – what can be done in your production system to reach the industry target?

Dr Richard Eckard  
University of Melbourne



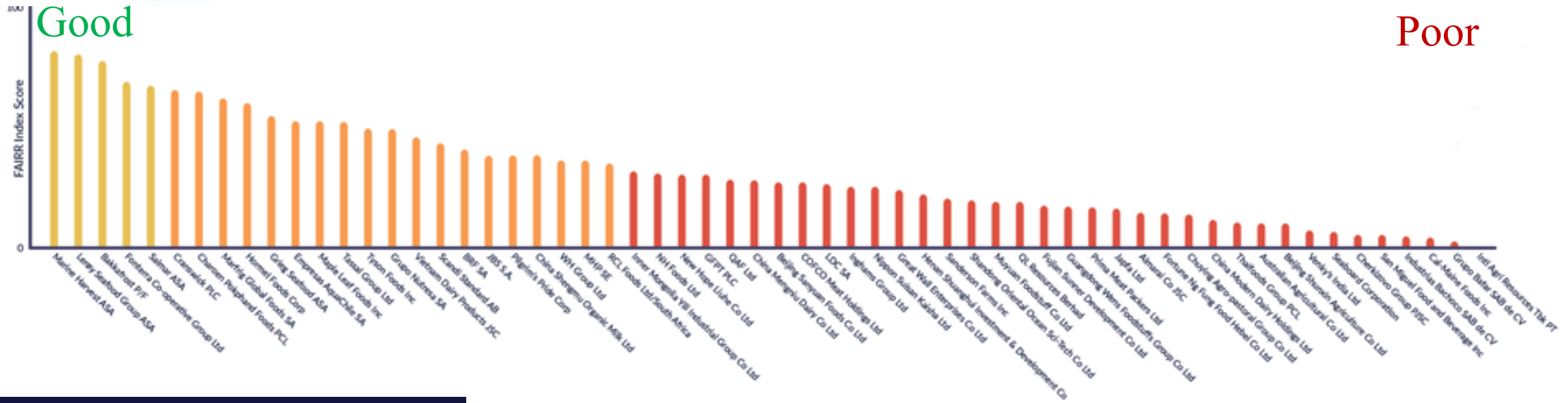
- Reach global peaking GHG emissions as soon as possible
  - Achieve a balance between anthropogenic emissions by sources and removals by 2050
  - COP26
    - Increased 2030 ambition

To meet 1.5 °C, methane must reduce by

- 11-30% by 2030
- 24-47% by 2050

(Arndt et al. 2022)

- Fonterra
    - Climate-neutral growth to 2030 for pre-farmgate emissions from a 2015 base year
  - Unilever \*\*
    - Reducing the GHG impact of their products by 50% by 2030, compared to baseline of 2010
  - Mondelez
    - Reduce absolute GHG from manufacturing 15%
    - 100% renewable energy
  - Nestle \*\*
    - Zero environmental impact in our operations
  - JBS
    - Net-zero GHG by 2040 and zero deforestation across its global supply chain by 2035
  - Heineken
    - Carbon neutral barley-malt supply chain
  - Rabobank & NAB
    - Net zero financed emissions by 2050
    - Hold 50% of Australia agri-debt market
  - Mars
    - Reduce GHG across our value chain 27% by 2025 and 67% by 2050 (from 2015 levels)
  - Kellogg Company \*\*
    - 65% reduction by 2050
    - 100% renewable energy
  - Pfizer
    - 60 to 80% by 2050
  - Wilmar international
    - 89.72% less GHG from 2013 to 2020
    - 100% renewable energy
  - Olam
    - Reduce GHGs by 50% by 2030 both in our own operations and in our supply chain
    - By 2050, we aspire to be carbon positive in operations, requiring a 5% emissions reduction per year from 2031 – 2050
- \*\*committed to increasing plant-based protein
- Of the 100 largest economies, 69 are companies and 31 are countries



**FAIRR** FARM ANIMAL INVESTMENT RISK & RETURN  
A COLLER INITIATIVE

## Coller FAIRR Protein Producer Index Report

Benchmarking intensive livestock and fish farming on environmental, social and governance issues

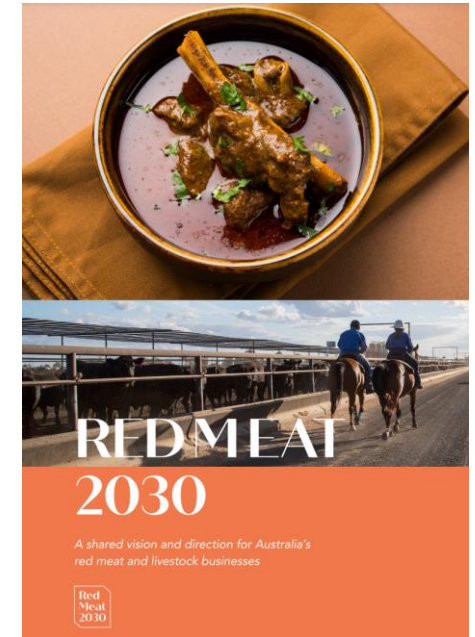
FAIRR – an index of livestock production against the Sustainable Development Goals (SDGs).  
A resource for institutional investors on risk of investment in livestock.

- Danone purchased SILK/Whitewave in 2017
  - \$12.5B Silk brands
  - Danone media quotes:
    - *“Accelerate our towards sustainable and profitable growth”*
    - *“Healthier and more **sustainable** eating”*
  
- Norco Co-Op & CSIRO
  - Milk from yeast precision fermentation
  - *Eden Brew was created to help build a **sustainable** food future by creating a dairy solution that is **environmentally sustainable** and **less resource-intensive***





- Australian Red Meat Industry (RMAC 2030 strategy)
  - Australian red-meat can be carbon neutral by 2030 (CN30)
- Mato Grosso do Sul (MS), Brazil
  - “MS carbon neutral” initiative
- New Zealand
  - Net zero by 2050
  - Non-zero methane target
    - Up to 47% by 2050
  - All farms required to complete a carbon audit by 2022
    - Research levy on methane
- California SB 32
  - 40 % less methane by 2030 over 1990
- Global Methane Pledge at COP26
  - 30% less methane by 2030 by 105 countries (plus Australia)



- Livestock

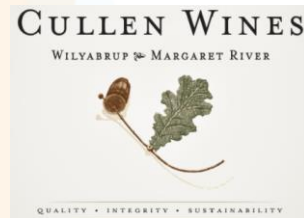
- Arcadian Organic & Natural's Meat Co
- Flinders + Co Meats
- NAPCO
- COLES

- Wine

- Ross Hill
- Tulloch
- Cullen

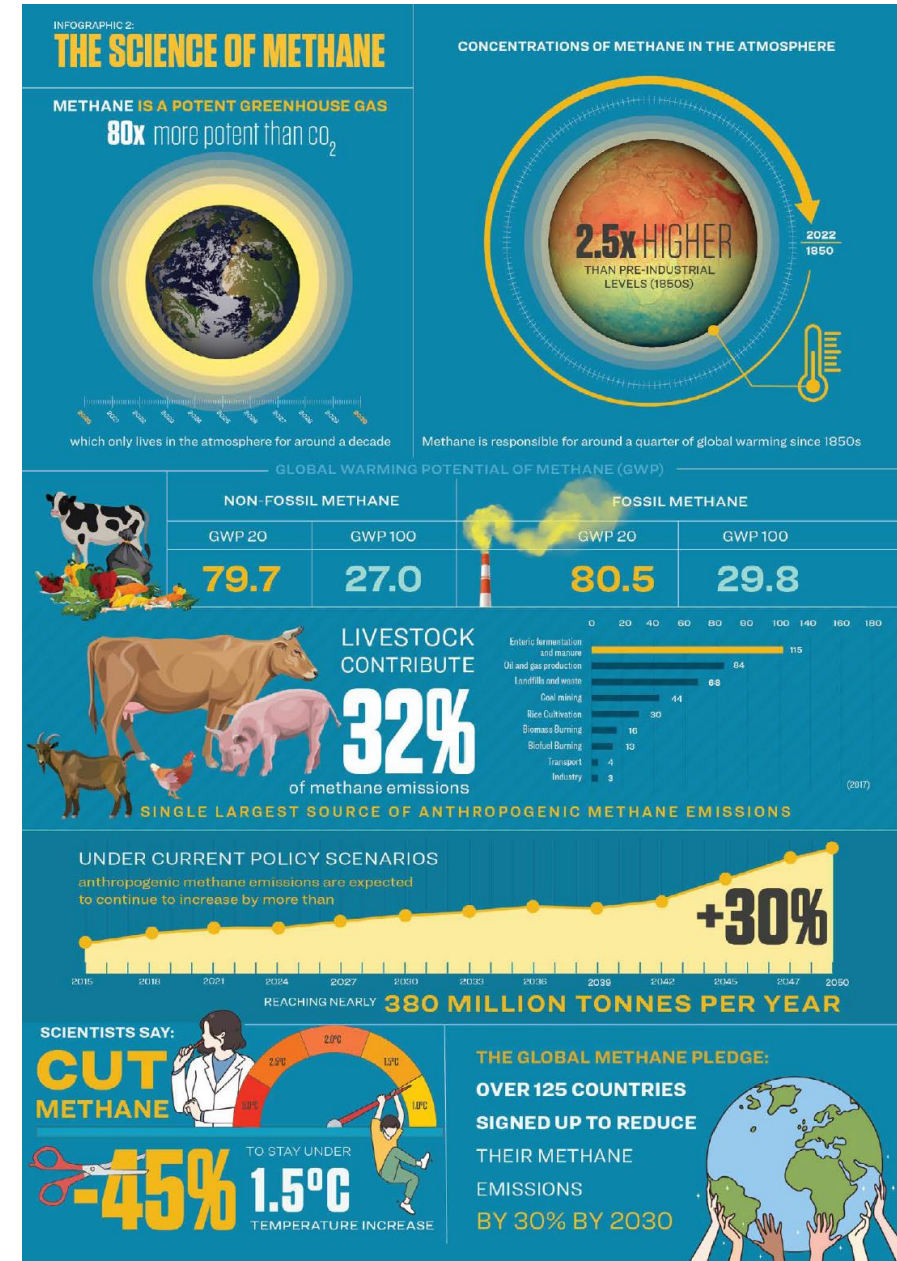


CERTIFICATION #NC370



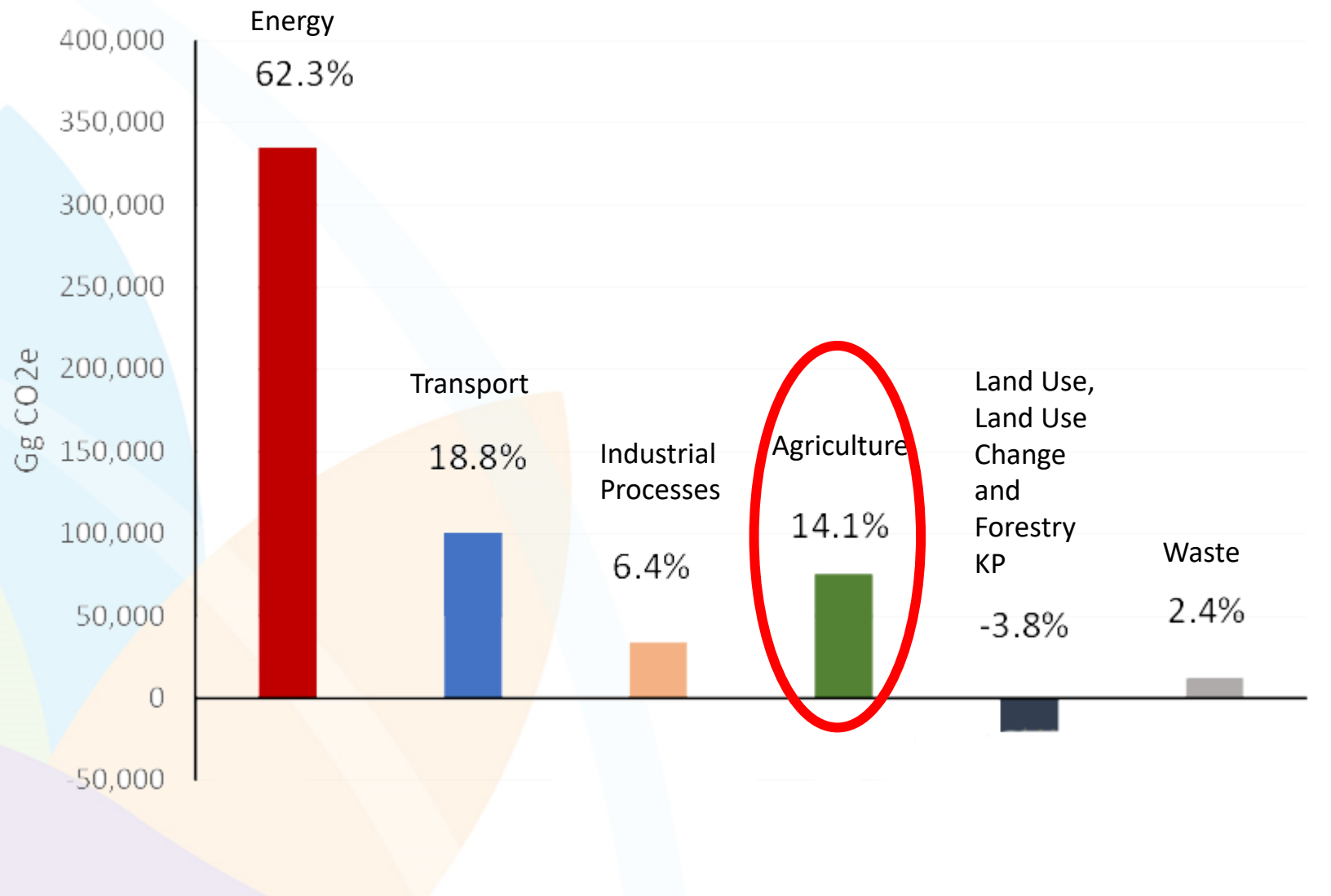


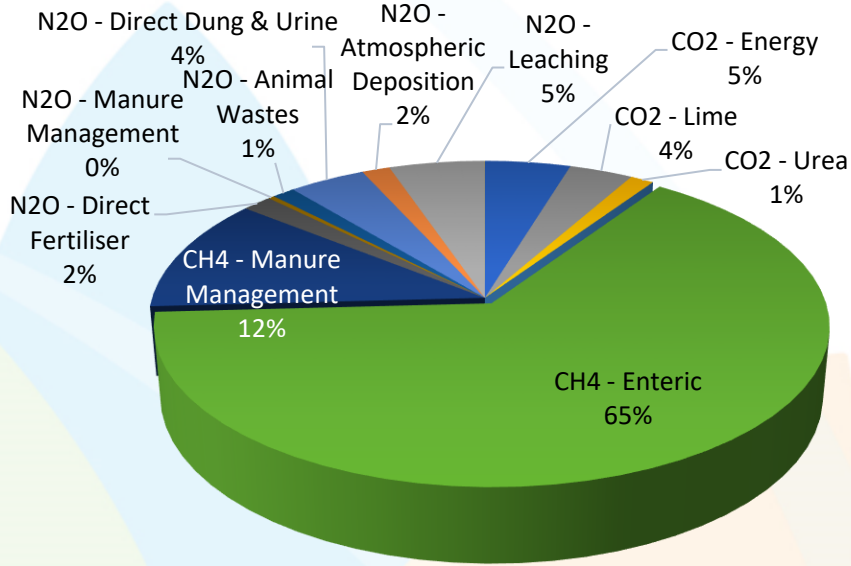
- Industry bodies
  - Emissions intensity targets
  - Arguing for lesser targets for methane
    - GWP\* vs GWP100
    - Biogenic vs fossil methane
    - Climate neutral vs carbon neutral
- International policy
  - Key policy lever to avoid 1.5<sup>o</sup> overshoot
  - Binding methane reduction targets (e.g. NZ)
  - Separate methane reduction targets (e.g. NZ)
  - *Reduce animal numbers in line with a just transition policy for the transformation of the animal agriculture sector*



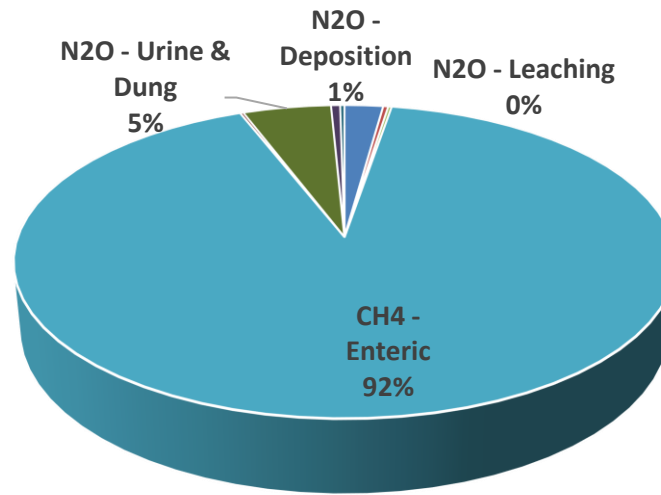
- To 2030
  - Access to premium markets e.g. carbon neutral wool
- Post 2030
  - Future compliance with supply chain targets
    - **Insetting** not offsetting
  - Carbon credits only allowed in “hard to abate” sectors
- Fundamental difference between
  - Carbon sequestration offset
    - Finite accumulating stock
    - Will need these stocks as an INSET
  - Emissions avoidance offset = flux
    - Could sell these up to the day neutrality is required



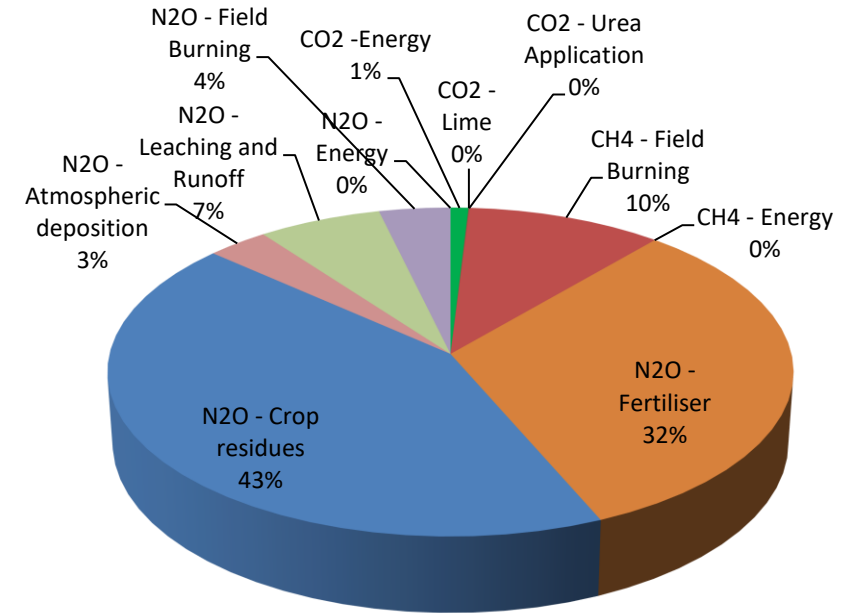




Dairy

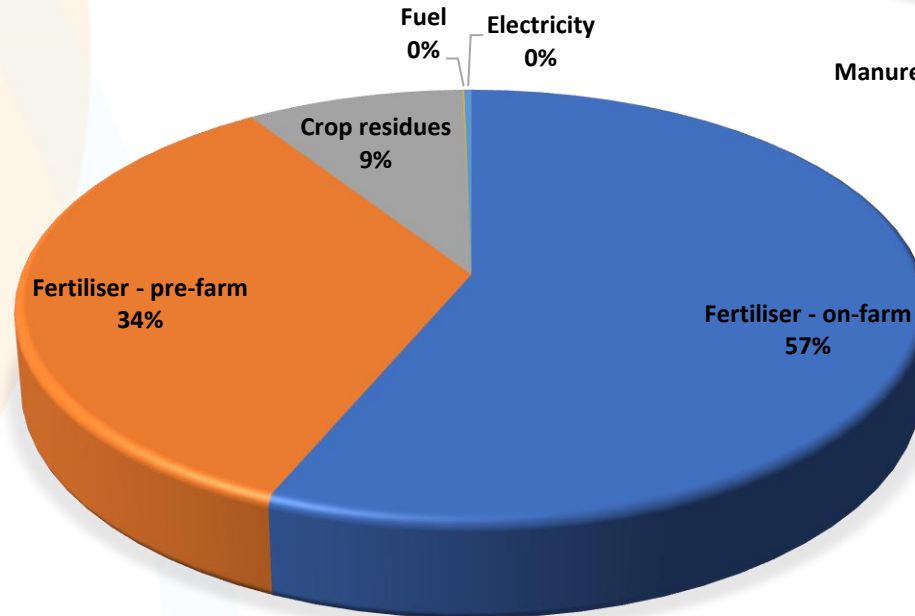
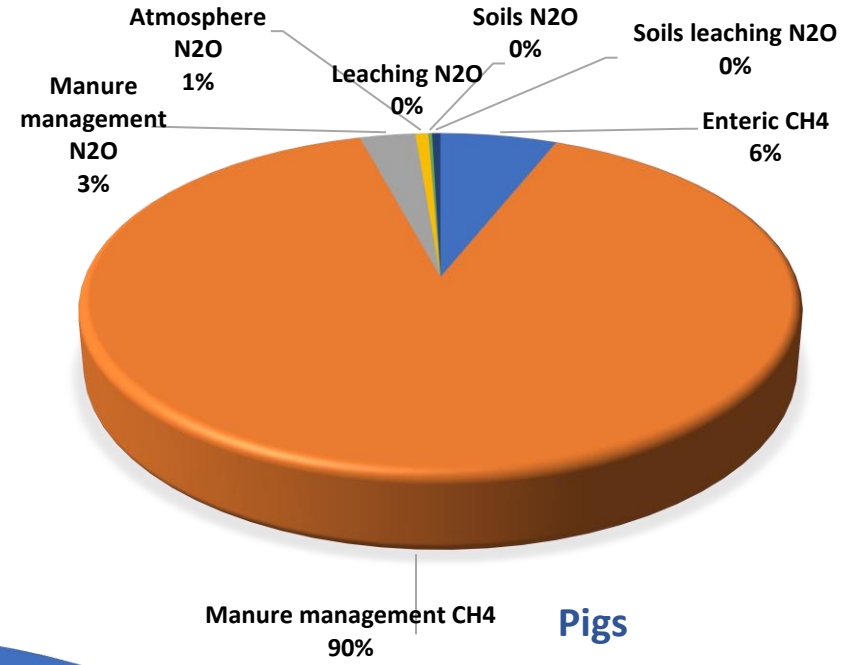
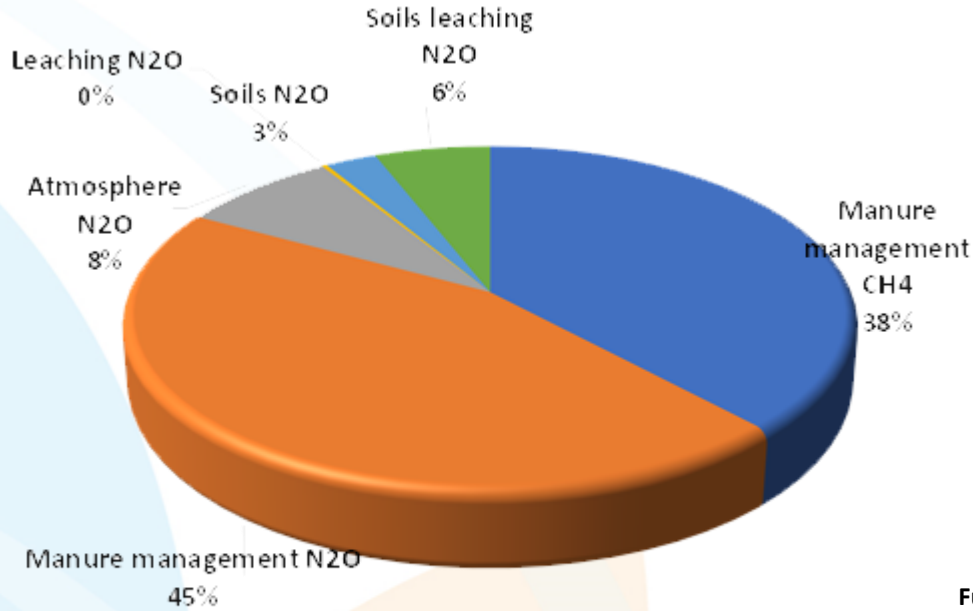


Rangeland Beef



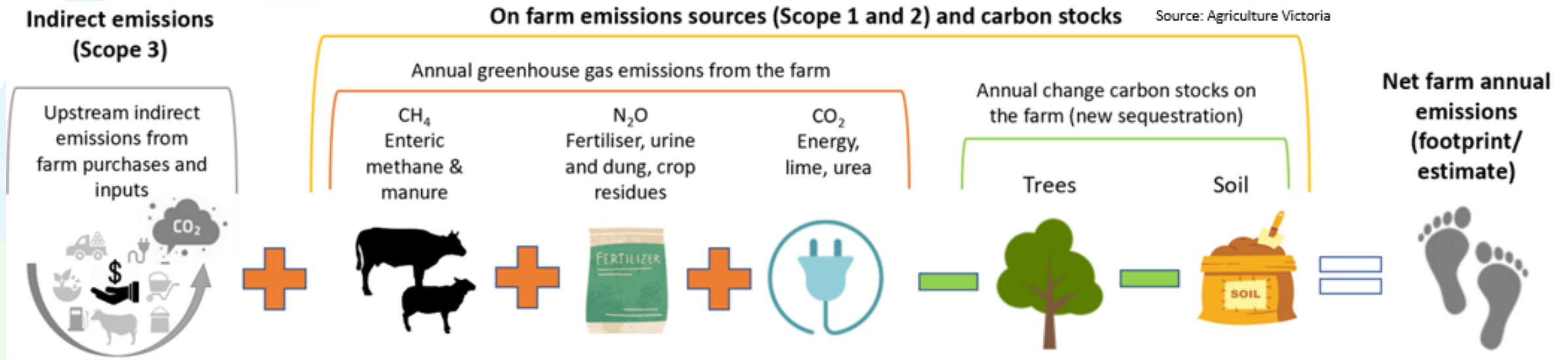
Wheat





Cotton

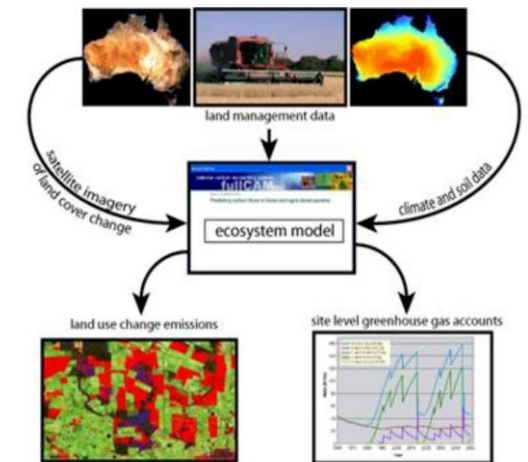
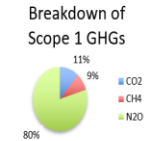




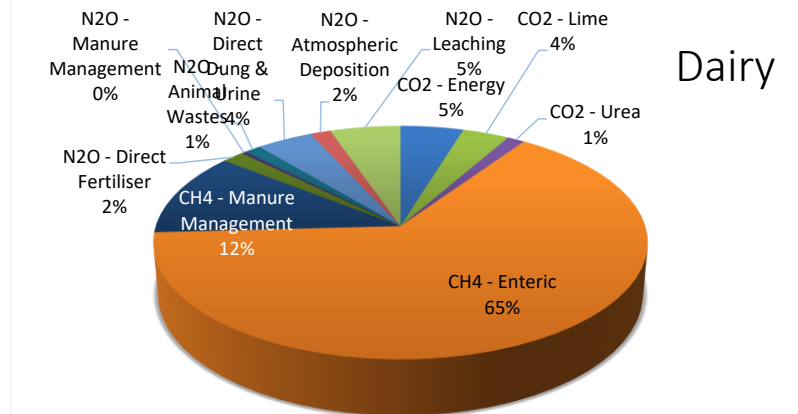
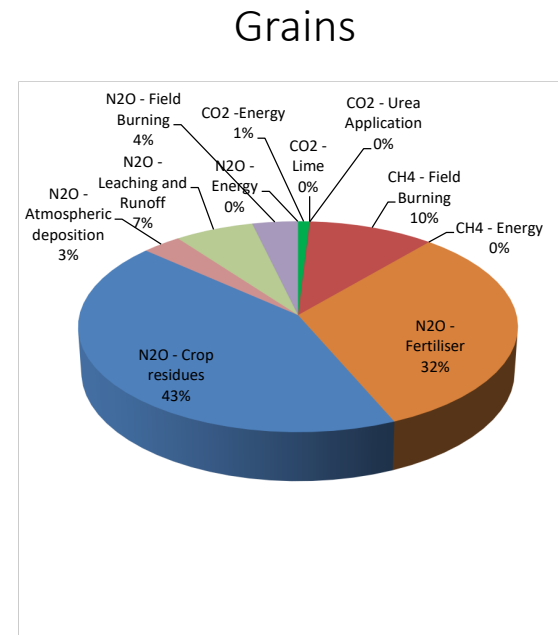
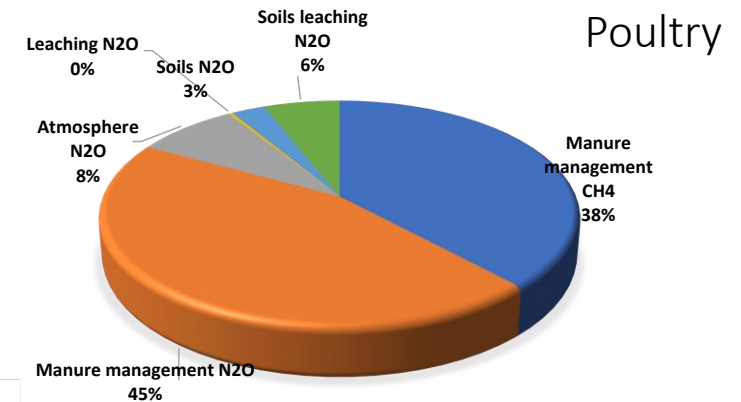
- Greenhouse Gas emissions
  - Sheep & Beef (SB-GAF)
  - Cropping (G-GAF)
  - Dairy (D-GAF/DGAS)
  - Feedlot, Pork, Poultry
  - Buffalo, Deer, Goats
  - Sugar, Cotton, Horticulture
- Carbon stocks and fluxes
  - Direct measurement and/ or
  - An approved model

[www.piccc.org.au/Tools](http://www.piccc.org.au/Tools)

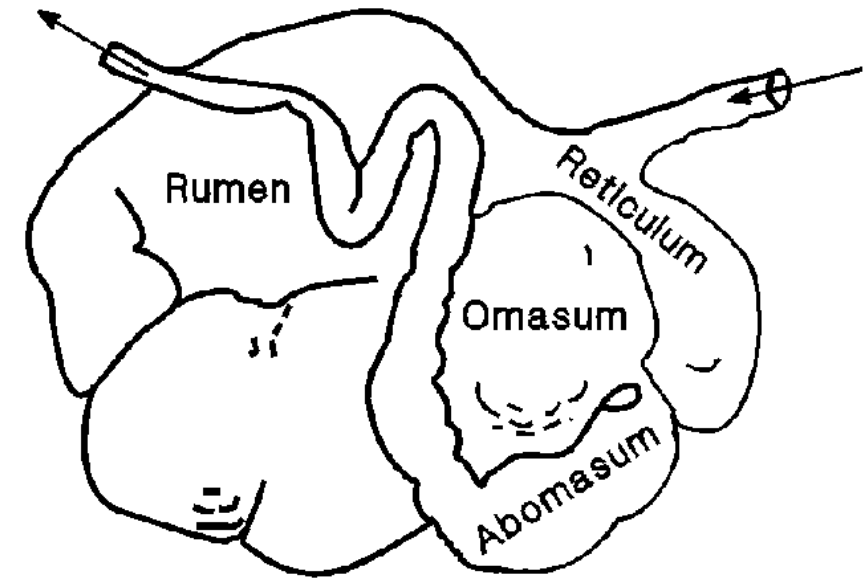
Grains Greenhouse Accounting Tool					
Crop	Wheat	Barley	Pulses	Oilseeds	Summary
Outputs	t CO <sub>2</sub> e/farm	t CO <sub>2</sub> e/farm	t CO <sub>2</sub> e/farm	t CO <sub>2</sub> e/farm	t CO <sub>2</sub> e/farm
<b>Scope 1 Emissions (on-farm)</b>					
CO <sub>2</sub> - Fuel					7.63
CO <sub>2</sub> - Lime	0.20	0.00	0.20	0.00	0.40
CO <sub>2</sub> - Urea	36.67	0.00	0.00	0.00	36.67
CH <sub>4</sub> - Field burning	99.35	0.00	0.00	0.00	99.35
CH <sub>4</sub> - Fuel					0.02
N <sub>2</sub> O - Fertiliser	49.97	35.40	0.00	226.54	311.91
N <sub>2</sub> O - Atmospheric Deposition	5.50	3.89	0.00	24.92	34.31
N <sub>2</sub> O - Field Burning	36.09	0.00	0.00	0.00	36.09
N <sub>2</sub> O - Crop Residues	120.05	18.88	57.92	196.97	393.83
N <sub>2</sub> O - Leaching and Runoff	0.00	7.10	15.29	122.36	144.75
N <sub>2</sub> O - Fuel					0.05
<b>Scope 1 Total</b>	<b>348</b>	<b>65</b>	<b>73</b>	<b>571</b>	<b>1,065</b>
<b>Scope 2 Emissions (off-farm)</b>					
Electricity					3.24
<b>Scope 2 Total</b>					<b>3.24</b>
<b>Scope 3 Emissions (pre-farm)</b>					
Fertiliser (urea + Superphosphate)					90.83
Herbicides/pesticides					0.29
Electricity					0.36
Fuel					0.40
Lime					0.01
<b>Scope 3 Total</b>					<b>92</b>
<b>Carbon Sequestration</b>					
Carbon sequestration in trees	-16.40	-6.84	-1.37	-2.73	-27.34
<b>Net Farm Emissions</b>	<b>335</b>	<b>58</b>	<b>72</b>	<b>568</b>	<b>1,133</b>
<b>Emissions intensity</b>	<b>0.11</b>	<b>0.02</b>	<b>0.04</b>	<b>0.19 t CO<sub>2</sub>e/t crop</b>	



- Chicken meat
  - 3 to 5 kg CO<sub>2</sub>e/kg LWT
- Pigs
  - 4 to 7 kg CO<sub>2</sub>e/kg LWT
- Grain production:
  - 0.1 to 0.5 kg CO<sub>2</sub>e/kg grain
- Dairy
  - 8 to 21 t CO<sub>2</sub>e/t MS
- Beef:
  - 11 to 18 kg CO<sub>2</sub>e/kg LWT
- Sheep:
  - 6 to 8 kg CO<sub>2</sub>e/kg LWT
- Wool:
  - 21 to 28 kg CO<sub>2</sub>e/kg wool
- Wine:
  - 0.6 to 1.5 kg CO<sub>2</sub>e/L

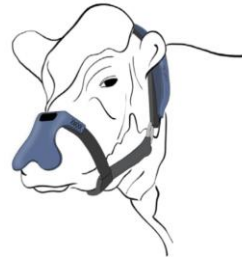


- Ruminants evolved 4 stomachs about 50M years ago
  - We aim to change this in 30 years
  - Adaptation to mitigants is a challenge
- Rumen = Microbial fermentation
  - 40-60% bacteria & protozoa
    - $10^{11}$  &  $10^6$  cells/ml over 200 species
  - 5-10% fungi
    - $10^6$  zoospores/ml
  - 3% Archaea (methanogens)
    - $10^8$  cells/ml



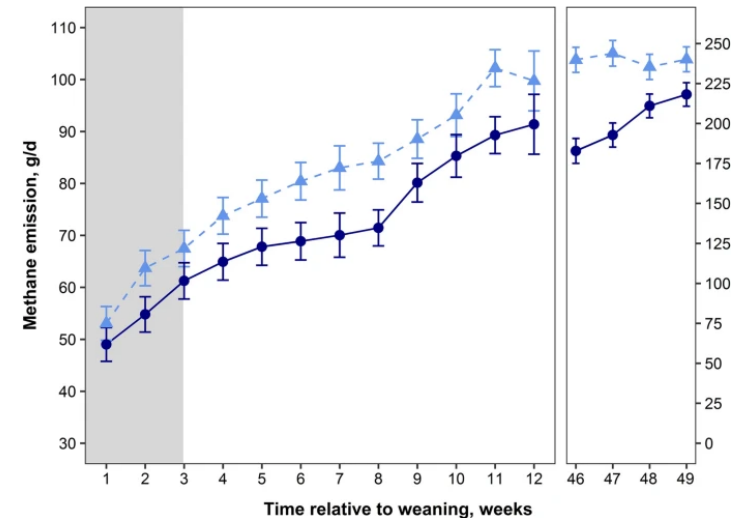
## Do Now

- Management (10%)
  - Efficiency, health, fertility
- Legumes (15%)
  - Leucaena, lucerne, vetch, lotus
- Supplements (20%)
  - Oils, tannins e.g. grape marc
  - Mootral, Agolin
- Breeding (1%/yr)
  - Plants – tannin/oil
  - Animals
- Wearable device (ZELP – 50%?)



## Do in 5-10 years

- Vaccine (20%)
- Inhibitors (*up to 80%*)
  - Seaweed
  - 3-NOP
- Early life programming

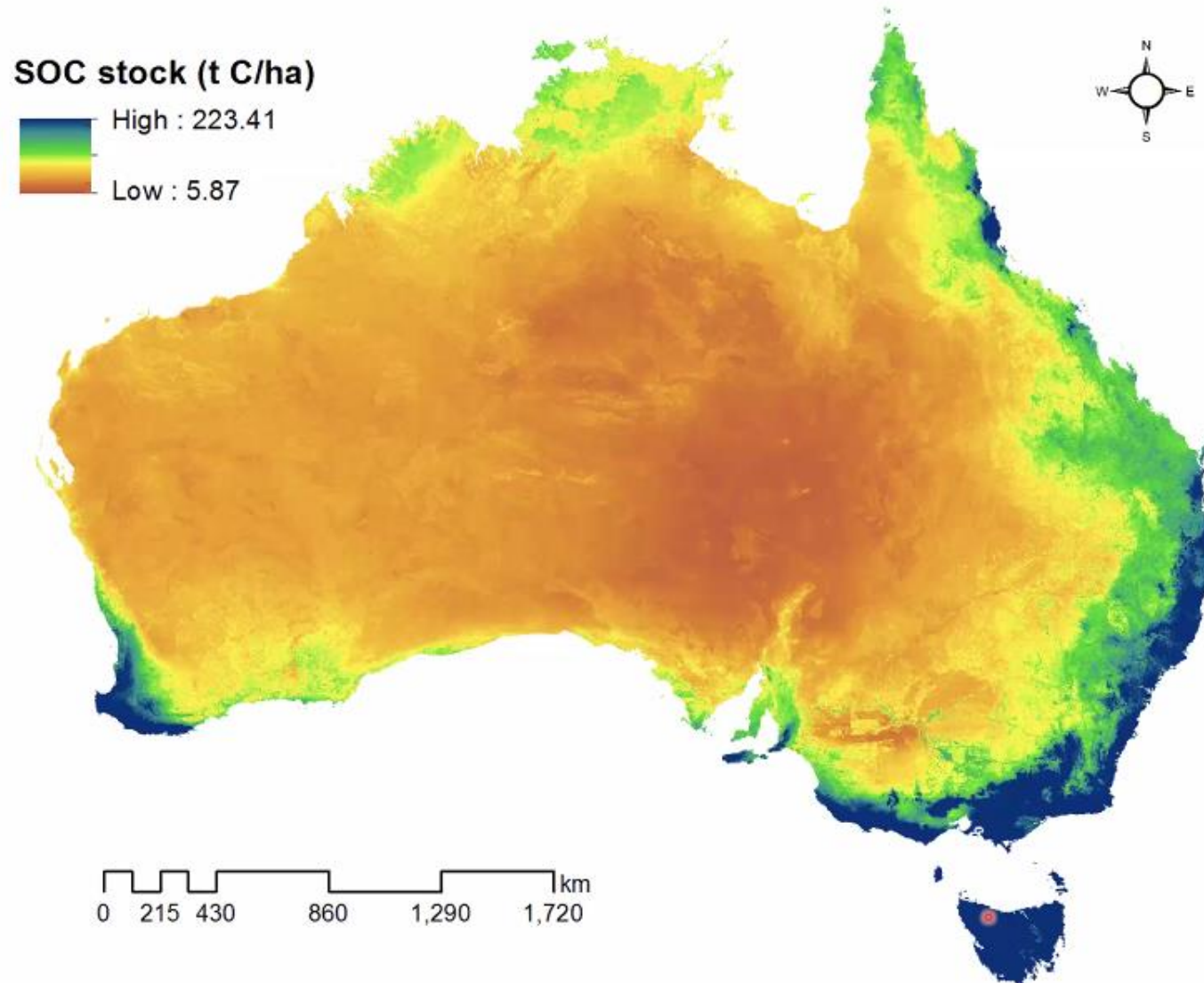


Charmley *et al.* 2016; Grainger *et al.* (2009); Moate *et al.* (2011; 2014; 2016); Williams *et al.* (2019); Van Nevel and Demeyer (1996); Machado *et al.* (2014); Li *et al.* (2018); Eckard and Clark (2018); Li *et al.* (2018), Meale *et al.* (2021)

- Ruminants excrete 75 to 95% of N intake
  - N content of urine
    - Dairy: 800 - 1300 kg N/ha in a patch
    - Beef: 200 - 400 kg N/ha in a patch
  - Urine N mainly urea
    - <30% utilised for production but >60% lost
  - Balancing ME:CP
  - Legumes with tannin







$$\text{Soil organic carbon content} = f \left[ \begin{array}{l} \text{Inputs of} \\ \text{organic carbon} \end{array} , \begin{array}{l} \text{Losses of} \\ \text{organic carbon} \end{array} \right] + \text{TIME}$$

## Inputs

- Plant Growth
- Imported C

High rainfall = high

Drought = lower



## Outputs

- Microbial turnover

High rainfall = high

Drought = **still high**

In Australia rainfall has a dominant impact  
*Perhaps think of SOC in decadal time-steps*

- Organic carbon fractions

- Plant residues on soil surface
- Buried plant residues (>2 mm)
- Microbial biomass

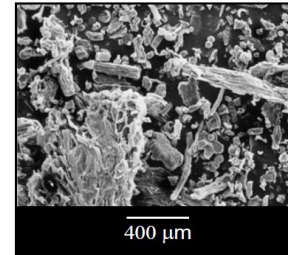
- Particulate organic carbon (2.0 – 0.05 mm)
  - Mineral associated carbon (<0.05 mm)
  - Resistant organic carbon: charcoal
- Soil Organic Carbon

- Don't confuse roots with SOC

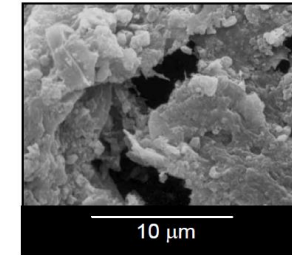
- Soil carbon analysis removes
  - Surface litter
  - Sieves out all litter & roots >2mm

Rapidly degraded organic matter  
- important, but not SOM/SOC

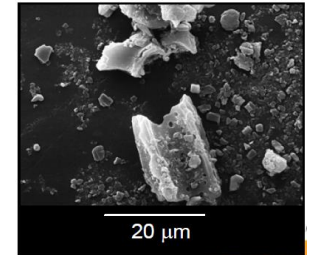
Particulate carbon  
(2mm – 0.05 mm)



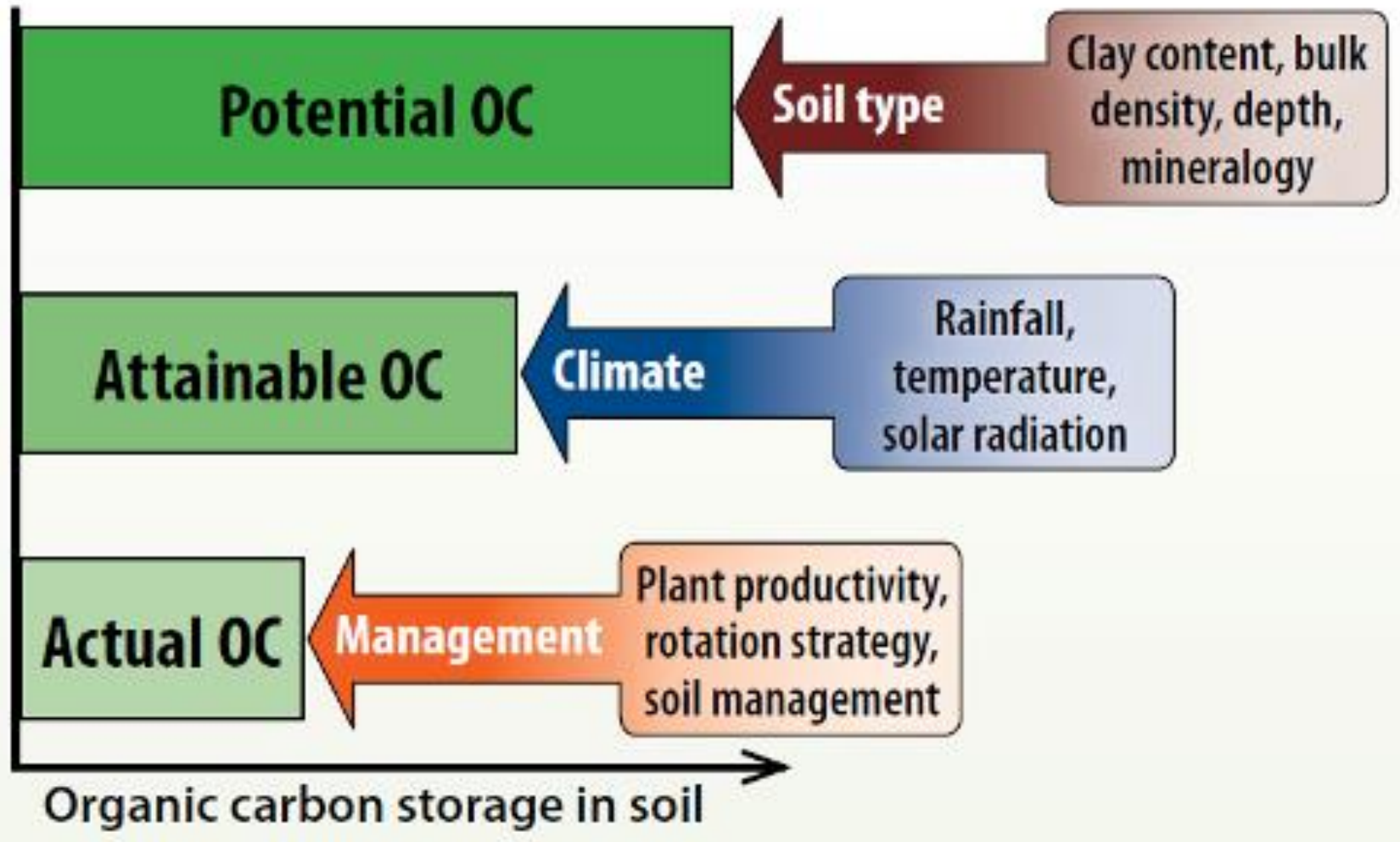
Mineral Assoc C  
(<0.05mm)



Resistant  
(charcoal <2mm)



# Soil organic carbon – potential, attainable, actual



- Building SOM is just good practice
  - Healthy, more productive and resilient soils
  - Adaptation to climate change
  - Payment is there already?

## Biological roles

- Reservoir of nutrients
- Biochemical energy
- Increased resilience
- Biodiversity

## Physical roles

- Water retention
- Structural stability
- Thermal properties
- Erosion

## Chemical roles

- Cation exchange
- pH buffering
- Complex cations



- Know your baseline
  - A basic farm carbon audit (*or at least know what data to keep*)
  - Note:
    - CN30 does not mean each farm needs to be carbon neutral by 2030
    - Supply chain targets are not requiring your farm needs to be **carbon neutral** by 2030
- Plan the first steps
  - Start with the “Do-now” strategies – these are all no-regrets
  - Trees and soil are only short-term options
    - Only include these if the **co-benefits** are the main driver
- Carbon credits trading vs low carbon (cannot do not both!!)
  - Get independent advice - beware of snake oil
  - Don't sell soil or tree carbon – you **WILL** need to **INSET** this to access your supply chain by 2030!





# Tools and resources

[www.piccc.org.au](http://www.piccc.org.au)

+

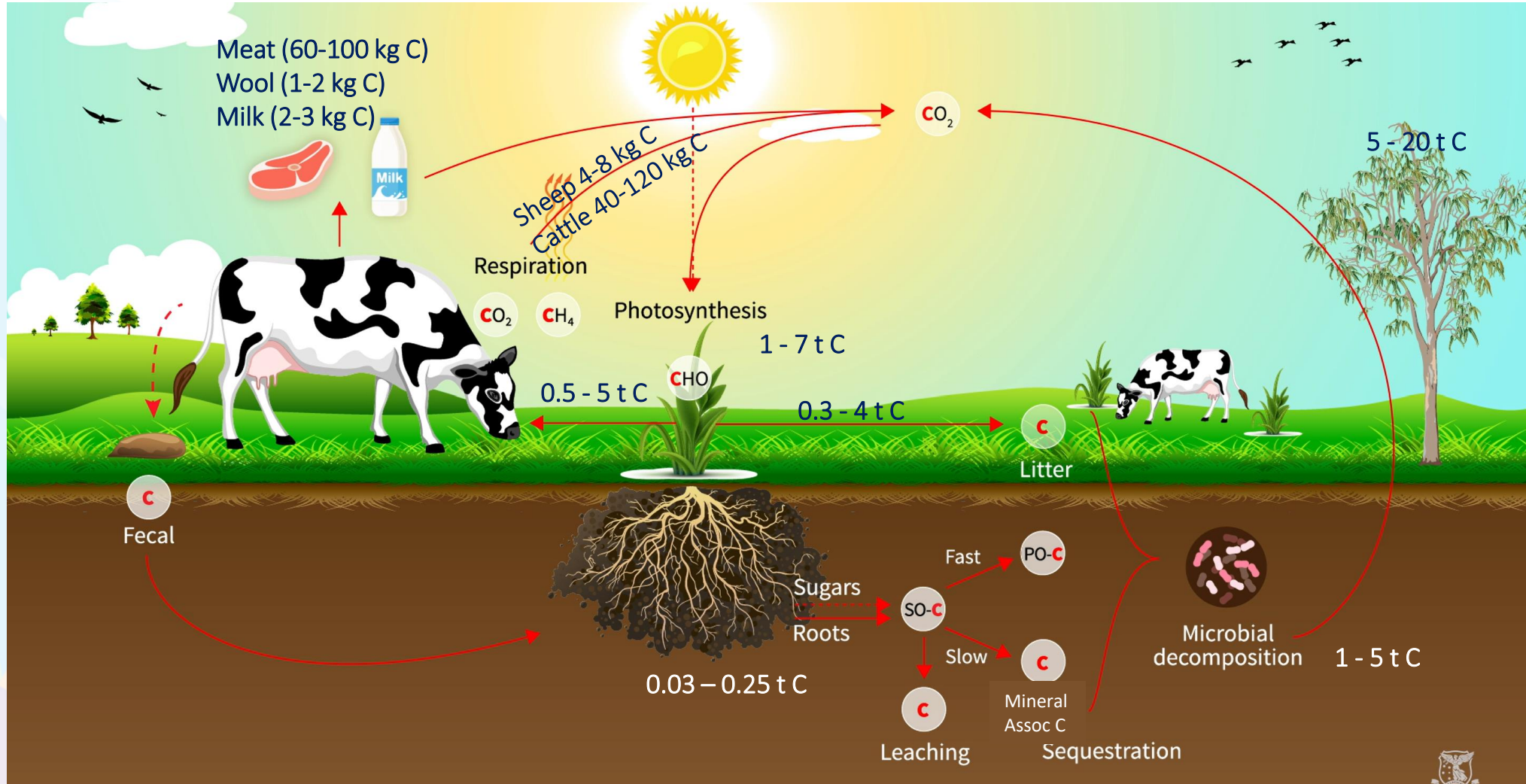
[piccc.org.au/Tools](http://piccc.org.au/Tools)

+

[piccc.org.au/education/carbonneutraltraining](http://piccc.org.au/education/carbonneutraltraining)







# Tools and resources

[www.piccc.org.au](http://www.piccc.org.au)

+

[piccc.org.au/Tools](http://piccc.org.au/Tools)

+

[piccc.org.au/education/carbonneutraltraining](http://piccc.org.au/education/carbonneutraltraining)



# meatup

FORUM

**For the latest in red meat R&D**