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Carbon & Cattle Farmer

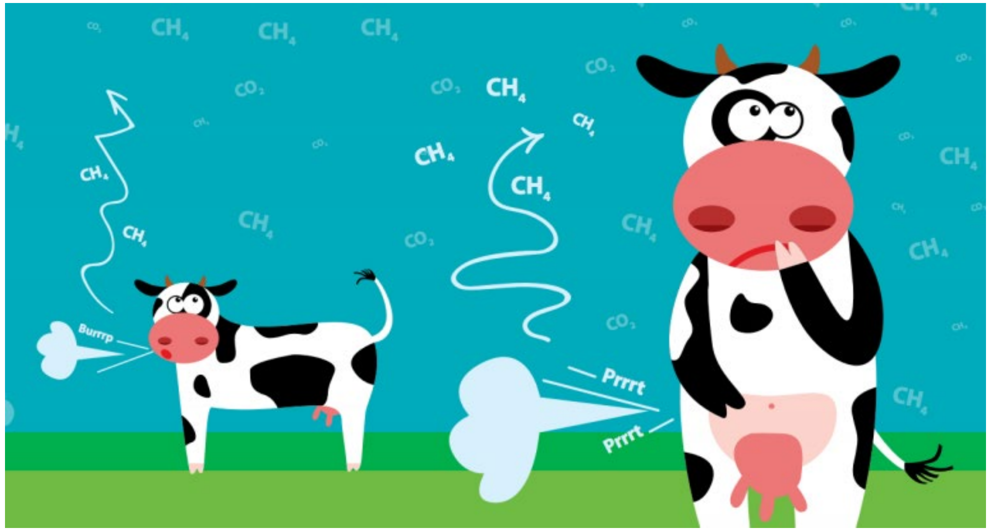
RegenerativeAg ALLIANCE

Resilience through farming together

Southern Cross University

Livestock and Emissions……
But Why?

- 16 % of global emissions are from agriculture
- 81% of those are from livestock
- 48% of which is beef



- Campaigners are moving to next target from fossil fuels to livestock!
- European Union already have carbon dioxide emissions tariffs on imports
- Carbon neutral Brazilian Beef
- NZ will have farm levy by Jan 25
- MLA carbon neutral targets - that means us

- IPPC report advocating diet as the solution - “eat less red meat”

Multi Nationals are leading the way in measuring and offsetting emissions, or be named and shamed.

- Fonterra
- Uni Lever
- Nestle
- Mars
- Kellogg
- Pfizer
- Wilmar
- Olam
- Mondelez

FAIRR Initiative

Coller Foundation Ltd

(70 Trillion membership company)

https://www.fairr.org/index

- View Company Rankings
- Measures ESG Factors
- Has a Protein Producer Index

Includes:

- AACo
- JBS

Assessment of strategies for reducing enteric methane
(Beauchemin, Ungerfeld, Eckard, & Wang, 2020)

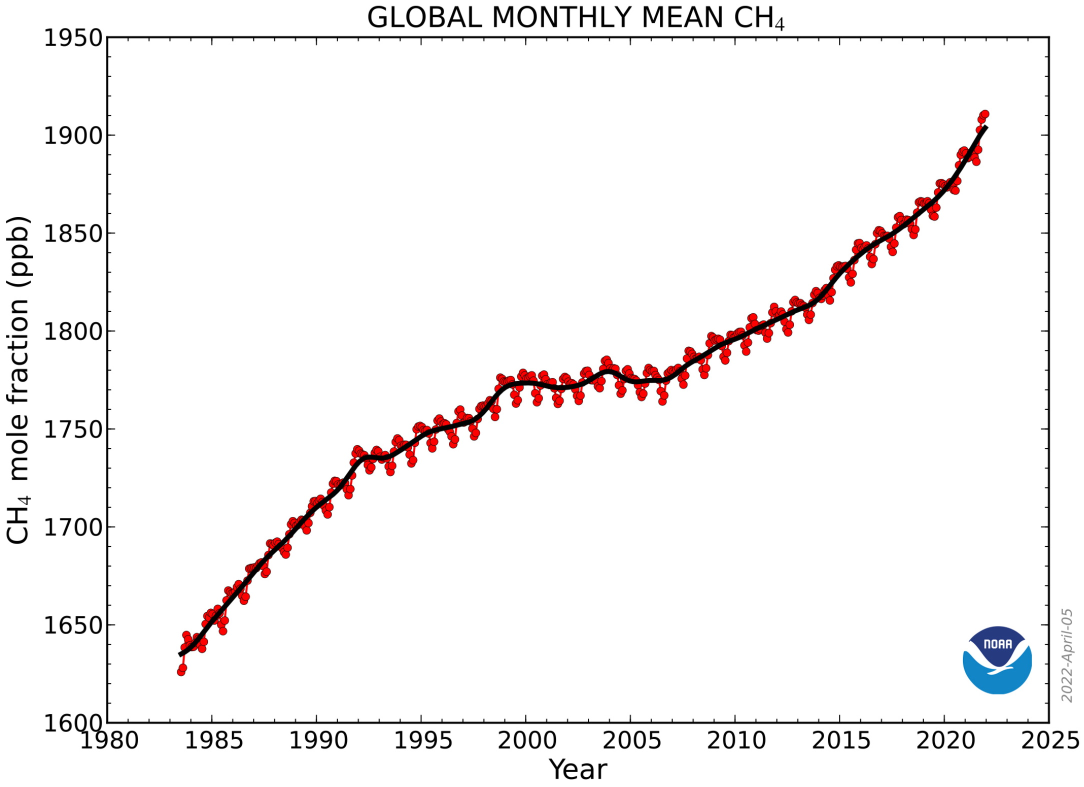
Strategy	CH_4 decrease potential: Amount (g/day)	CH_4 decrease potential: Intensity (g/kg product)	Expected availability	Feasibility of implementing on-farms	Limitations	Key references
Management and breeding						
Increased animal productivity (through nutrition, genetics, health and management)	Uncertain (can increase)	Low	Immediate	Potential greatest for production systems that are not already optimized	Adoption limited by knowledge transfer, economics, perception, limitation of resources and others	Capper *et al.* (2009); Hristov *et al.* (2013); Legesse *et al.* (2016)
Animal breeding for low-CH_4 production	Low	Low	Unknown, possibly within 10 years	Can be incorporated into multiple trait selection index	Need robust ways of measuring CH_4 of large numbers of individual animals. Relationships between CH_4 production and economically important traits are unknown. Need to know long-term persistency on different diets and effects on animal health	Pickering *et al.* (2015); Løvendahl *et al.* (2018)
Animal breeding for feed efficiency and residual feed intake	Low	Low	Immediate	Can be incorporated into multiple trait selection index	Existence of genotype × environment interactions needs to be determined. Relationship to productivity-related traits at pasture unknown. Lack of information on the biological regulation of the trait	Basarab *et al.* (2013); Kenny *et al.* (2018)
Nutrition						
Lipids	Medium	Medium	Immediate	Feasible for ruminants fed diets, but difficult to implement for grazing ruminants	Can be expensive. Potential negative effects on fibre digestibility. Need more information on fat × diet interactions. Effects on meat and milk quality need further study	Grainger and Beauchemin (2011); Patra (2013)
Concentrates	Low to medium	Low to medium	Immediate	Feasible, but limited scope for further increase in grain feeding	Decrease in enteric CH_4 does not always reduce total greenhouse gas emissions. Can increase risk of acidosis. Concentrates can be fed to other livestock and consumed by people	Hristov *et al.* (2013)
Improved forage quality	Highly variable	Low	Immediate	Feasible, but highly dependent upon weather and other environmental factors	Adoption limited by knowledge transfer and potential trade-off between yield and quality. Absolute emissions may increase, but improved animal performance decreases intensity	Hristov *et al.* (2013)
Rumen microbiome and fermentation manipulation						
Vaccine	Unknown, possibly low to medium	Unknown, possibly low to medium	Unknown	Experimental. Limited published results. Would be particularly relevant for grazing ruminants	Effects on CH_4 production, animal health and productivity will need to be established	Wedlock *et al.* (2010); https://www.nzagrc.org.nz/vaccine.html
Early life programming	Unknown	Unknown	Unknown	Experimental. Most feasible for intensive systems, difficult to implement for extensive pasture-based production systems	Research is in early stages. If effective, it may be economically attractive. Implications for animal health and performance unknown. Need to establish long-term persistency	Yáñez-Ruiz *et al.* (2015)
Chemical inhibitors (3-nitrooxypropanol)	High	High	Currently undergoing approval in some countries	Feasible for ruminants fed diets but difficult to implement for grazing ruminants	Need more information on animal performance, dose × diet effects and safety. Not approved by regulatory agencies. Unknown consumer acceptance	Dijkstra *et al.* (2018); Ungerfeld (2018)
Algae	Medium to high	Medium to high	Unknown, experimental	Few algae species contain active compounds. Need to dry material, which may require energy	Safety concerns related to bromoforms. Will need approval from regulatory authorities in most countries. Life cycle assessment needed to account for upstream emissions	Machado *et al.* (2014); Li *et al.* (2018)
Nitrate	Low to medium	Low to medium	Available, but requires approval by regulatory officials in some countries	Useful in low-protein diets. Can be used in place of urea, maximum of 2% of dietary DM. Can be used in blocks for grazing ruminants	Risk of toxicity to non-adapted animals. Potential increase in N excretion if N requirements of animals are exceeded. Not approved in some countries	van Zijderveld *et al.* (2011); Lee and Beauchemin (2014)
Tannins	Low to medium	Low to medium	Immediate	Extracts can be added to diets. Tannin-containing forages can be incorporated into pastures	Much of the research has been conducted in vitro. Need more information of effectiveness of different source and types of tannins for CH_4 reduction. Need information on whether digestibility and performance is negatively affected	Jayanegara *et al.* (2012); Cobellis *et al.* (2016)

What's coming

- **Macroalgae(Seaweed)** Dictyota (brown) **Asparagopsis (red)** most promising however CO2 emissions from producing, harvesting, drying and transporting?
- **Vaccines & chemical inhibitors** - early life programming–suppress the growth of methanogens but acceptable to consumers?
- **Phytocompounds** - essential oils, tannins, saponins, flavonoids and organosulphur compounds. Garlic most promising….tannins in legumes, also help parasites and N utilisation.
- **Nutrition** – lipids (fatty acids) and concentrates
- **Alternative sinks** such as Nitrates – animal and environmental issues around excess nitrate
- **Combinations** of strategies

But are they effective?

- Animal manipulation (10-15% effective)eg: breeding
- Diet manipulation (20% effective)eg: management
- Rumen manipulation (gut microbes are 50 million years of evolution ahead of us) eg: biological control and vaccines (effective ?)



Eckard, RJ and Clark, H 2018

What the farmer can do now about methane?

- ✓ **Measure** your emissions – can't mitigate what you don't know you emitting!

- ✓ Increasing **production efficiency**, replacing aged stock with young for efficiency. Fewer animals, turned off more quickly, less feed for a given amount of product
- ✓ Animal breeding and **genetics** based on feed conversion and efficiency
- ✓ **Mixed legume based pastures** – biodiversity makes sense
- ✓ **Holistic grazing** systems reduce the use of synthetic fertilisers by more effective use of nitrogen-fixing plants and manure through animal impact

What else can farmers do ?

✓ **Sequester carbon, because you can!**

Become carbon neutral by:

- Planting trees
- Soil carbon

✓ **Get paid for looking after your natural capital**

Focus on:

- Carbon sequestration,
- Abatement,
- Biodiversity,
- Water quality,
- Animal health

How:

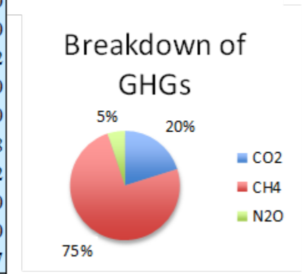
✓ Adopting Regenerative Agriculture Practices

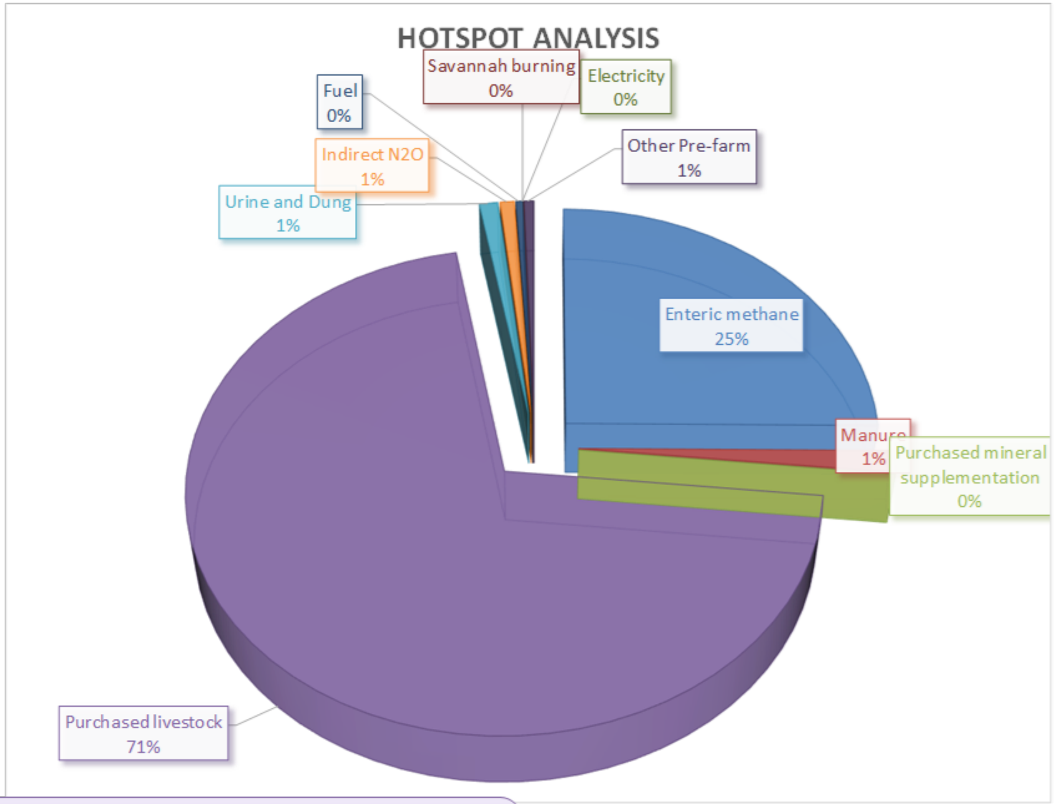
Moffat Falls Farm – (My Farm at Ebor, Northern NSW)

Beef & Sheep Greenhouse Accounting Tool

Outputs	beef t CO_2e/farm	sheep t CO2e/farm	total t CO2e/farm
Scope 1 Emissions			
CO_2 - Fuel	9.82	0.00	9.82
CO_2 - Lime	198.00	0.00	198.00
CO_2 - Urea	0.00	0.00	0.00
CH_4 - Fuel	0.00	0.00	0.00
CH_4 - Enteric	788.90	0.00	788.90
CH_4 - Manure Management	45.82	0.00	45.82
CH_4 - Savannah Burning	0.00		0.00
N_2O - Fertiliser	0.00	0.00	0.00
N_2O - Urine and Dung	32.58	0.00	32.58
N_2O - Atmospheric Deposition	3.42	0.00	3.42
N_2O - Leaching and Runoff	21.50	0.00	21.50
N_2O - Savannah Burning	0.00		0.00
N_2O - Fuel	0.07	0.00	0.07
Scope 1 Total	**1,100**	**0**	**1,100**
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 mineral supplementation	0.00	0.00	0.00
Purchased feed	0.00	0.00	0.00
Herbicides/pesticides	4.95	0.00	4.95
Electricity	0.00	0.00	0.00
Fuel	2.43	0.00	2.43
Lime	12.50	0.00	12.50
Purchased livestock	2216.50	0.00	2216.50
Livestock on agistment			
Scope 3 Total	**2236**	**0**	**2236**
Carbon Sequestration			
Carbon sequestration in trees	-4,765.50	0.00	-4,765.50
Net Farm Emissions	**-1,429**	**0**	**-1,429**
Emissions intensity			
Sheep meat (breeding herd) excl. sequestration		kg CO2-e / kg LW	
Sheep meat (breeding herd) inc. sequestration		kg CO2-e / kg LW	
Wool excl. sequestration		kg CO2-e / kg greasy	
Wool inc. sequestration		kg CO2-e / kg greasy	
Beef excl. sequestration	11.0	kg CO2-e / kg LW	
Beef inc. sequestration	-4.7	kg CO2-e / kg LW	

Summary	t CO2e/farm
CO_2	225
CH_4	835
N_2O	58





Citation: Lopez M.B., Dunn J., Wiedemann S., Eckard R. (2023). A Greenhouse Accounting Framework for Beef and Sheep properties based on the Australian National Greenhouse Gas Inventory methodology. Updated Feb 2023. http://piccc.org.au/Tools.

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Resilience through farming together

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