Building resilience and productivity

Strategies to reduce emissions and grow productivity for livestock

Richard Eckard

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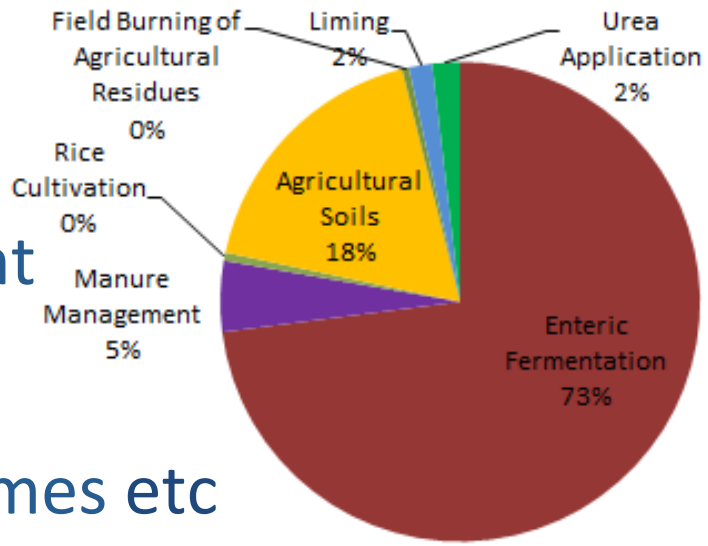
What are the GHG emissions from agriculture?



- Methane (10%)
  - Ruminants, waste management
- Nitrous Oxide (3%)
  - Fertilizer, excreta, waste, legumes etc
- Carbon Dioxide
  - Energy, lime, urea application and fertilizer production
- But agricultural land also has the capacity to sequester CO_2 in the soil and into trees

Another way of looking at the same issue

Methane loss:

- Largest inefficiency in animal production
  - Methane energy content - 55.22 MJ/kg
  - 6 to 10% of GEI lost

Animal Class	Methane (kg/year)	Effective annual grazing days lost
Mature ewe	6 to 10	26 to 43
Beef steer	50 to 90	33 to 60
Dairy cow	90 to 146	25 to 40

Eckard, Grainger & de Klein 2010

Another way of looking at the same issue

- Nitrous oxide losses from soils
  - Indicator of inefficient use of nitrogen
    - >60% N lost from grazing
    - >30% N lost from cropping
  - Improving NUE
    - Improves efficiency
    - Reduces N losses

Another way of looking at the same issue

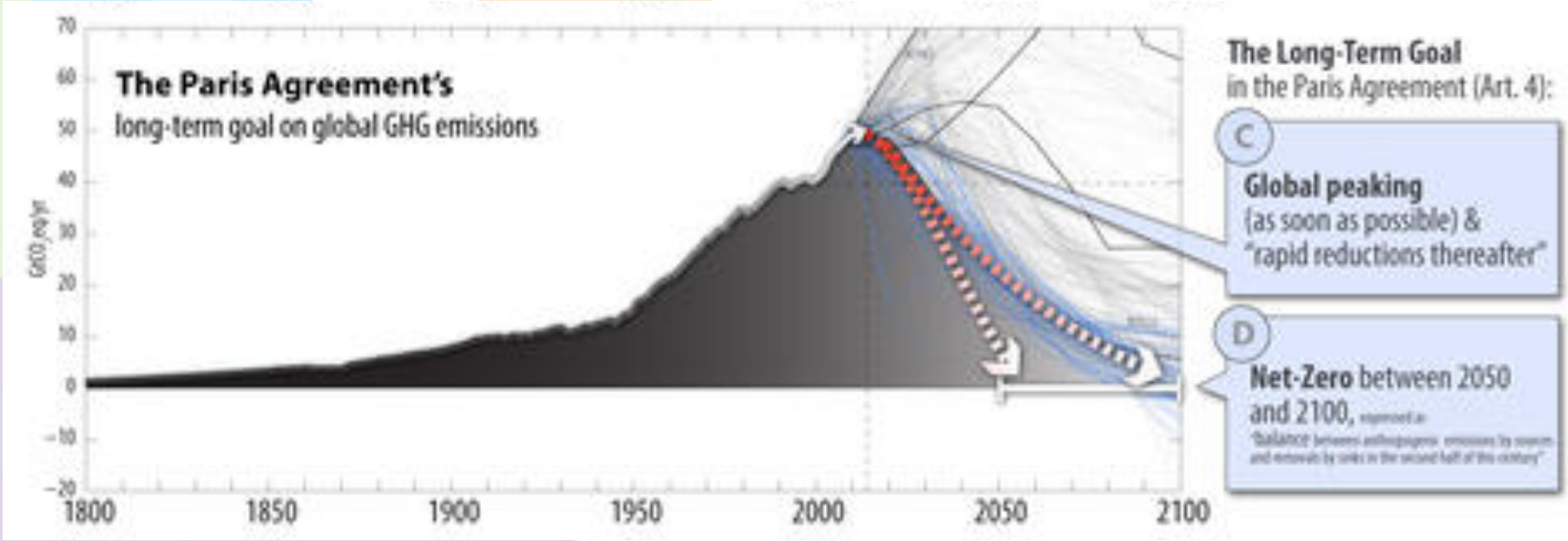
- Soil organic carbon
  - Building soil carbon is good practice
    - Healthy, more productive and resilient soils
    - Adaptation to climate change

Biological roles	Physical roles	Chemical roles
- Reservoir of nutrients	- Water retention	- Cation exchange
- Biochemical energy	- Structural stability	- pH buffering
- Increased resilience	- Thermal properties	- Complex cations
- Biodiversity	- Erosion	

Source: Jeff Baldock

Policy drivers
COP21 Paris Agreement

- Article 4
  - Peak GHG emissions as soon as possible
  - To achieve net zero emissions from 2050
    - *Any remainder GHG emissions in the second half of the century need to be balanced*



Policy Drivers
COP21 Paris Agreement

- Side event at COP21
  - "Tackling short-lived climate pollutants (SLCP) to raise ambition"
    - Methane has a GWP = 86 x CO_2 on a 20 year basis
    - Methane has a 12 year lifetime = SLCP
- Latest IPCC report
  - Diet change is part of the solution
- Livestock emissions will remain a key focus

The CN30 Challenge

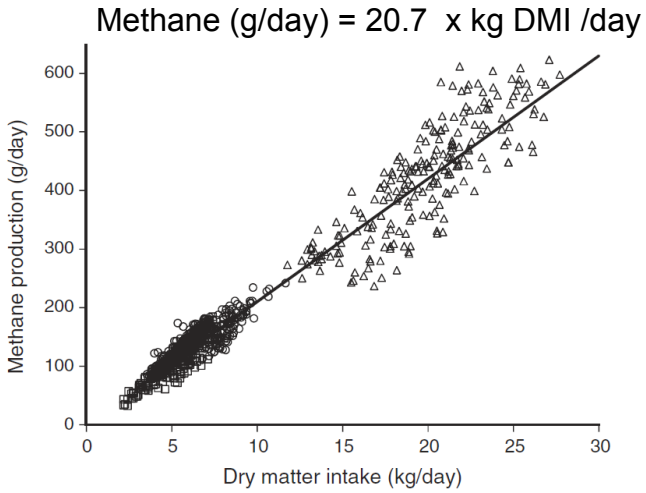
- Meat and Livestock Australia
  - Australian beef can be carbon neutral by 2030 (CN30)
  - Given the right industry, R&D and policy settings
    - Richard Norton, CEO
  - Australian beef sustainability framework
    - Climate change risk

Australian Beef Sustainability Framework

MEAT & LIVESTOCK AUSTRALIA

Factors affecting enteric methane loss

- Rumen passage rate
  - More/less time producing methane
  - Linked to forage quality
- Forage quality
  - Faster digestion
- Secondary compounds
  - Tannins (legumes), saponins, oils (by products)
- Rumen pH
  - Acid rumen (wheat)



Charmley *et al.* 2016

Options for reducing enteric methane

Now

- Forages/ feed
  - Balanced diet/ forage quality
  - Legumes (tannin)
    - Leucaena, Lucerne, Vetch, Lotus
  - Native Shrubs – *Eremophila*
- Management
  - Animal numbers
  - Health, fertility
- Supplements
  - Oils/ fats
  - Grape marc (oil + tannin)
- Breeding
  - Plants and animals (FCE)

Future

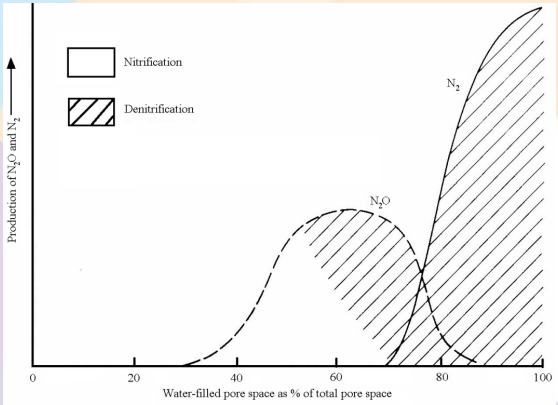
- Vaccine
- Red algae
  - *Asparagopsis*
- Chemicals/ inhibitors
  - 3NOP
- The methane free cow!

Eckard *et al.* 2010; Moate *et al.* 2010

Factors affecting N_2O

More N2O

- Excess soil N
- Warmer & wet soils
- High soluble carbon
  - e.g. pastures
- Compaction



Less N2O

- More efficient use of
  - Soil N
  - Soil water
- Lower soluble carbon
  - e.g. cropping soils
- More aerated soils
  - High SOM

In Summary

- Focus on best practices
  - Reduce emissions intensity
  - Increase profitability
  - Improved adaptation to a changing climate
- Longer-term
  - Need a methane free ruminant
  - More benign sources of nitrogen
  - Build soil organic carbon

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Primary Industries Climate Challenges Centre