Carbon neutrality: opportunities for livestock farms

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What does carbon neutrality really mean?

- All farms have *sources* and *sinks* of greenhouse gas emissions
- *Sources* include methane from livestock and manure, nitrous oxide from fertilisers and urine and carbon dioxide from fuel, liming, electricity…
- *Sinks* directly remove carbon dioxide from the atmosphere, e.g. carbon sequestration in trees and soils
- Carbon neutrality is the point at which emissions from sources = emissions from sinks = net-zero
- A farm could be a high emitter but still could be carbon neutral due to high carbon sinks

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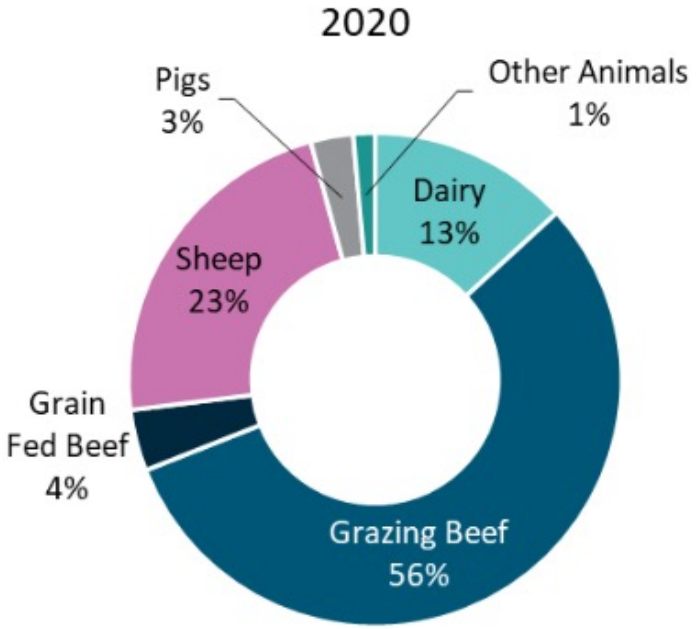
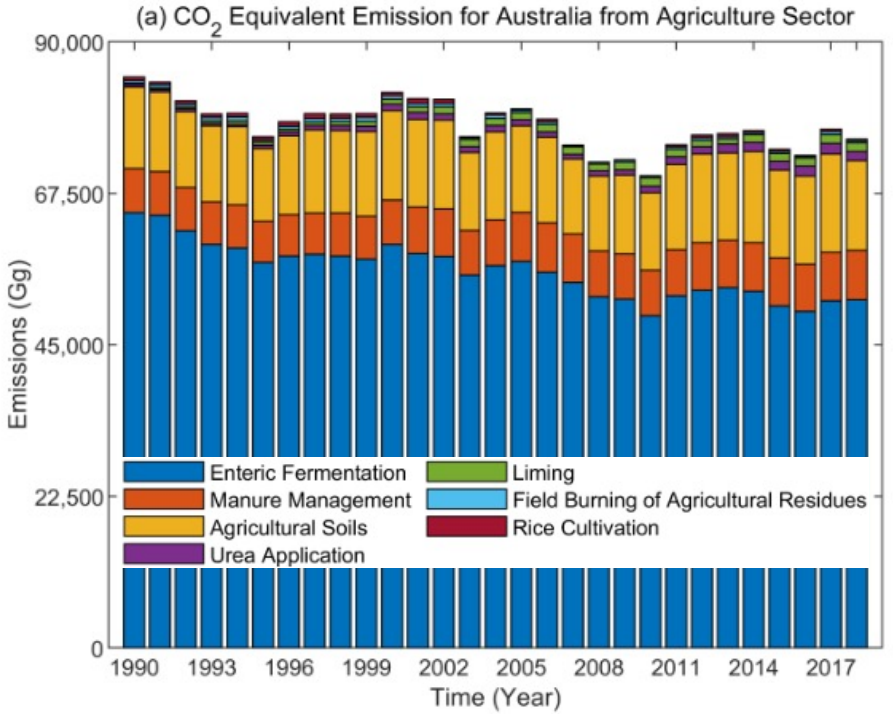
Australian agricultural GHG emissions



The majority of ruminant emissions are associated with grass fed beef, sheep and dairy



Methane and **nitrous oxide** dominate agricultural emissions

https://www.industry.gov.au/sites/default/files/2020-12/australias-emissions-projections-2020.pdf;
https://res.mdpi.com/d_attachment/agriculture/agriculture-11-00085/article_deploy/agriculture-11-00085-v2.pdf

Why reduce emissions?

- Income from carbon (the carrot)
- Carbon prices may increase in future – current price $AU18/t CO_2-e, current EU prices ~$80/t CO_2-e (the carrot)
- Income from conservation of biodiversity (the carrot). QLD already has the Land Restoration Fund, a number of biodiversity pilot programs are underway (payments for management of vegetation)
- Government introduces a future carbon pollution tax on agriculture (the stick)

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Options for reducing carbon sources

- Animal management
  - Improving growth rates of juvenile animals
  - Reducing age of first mating (beef and sheep)
  - Reducing juvenile and adult mortalities
  - Matching stocking rate to long-term ground cover
  - Using high fecundity ewe genotypes
- Supplements
  - Chemical inhibitors (3-nitrooxypropanol)
  - Red algae
  - Anti-methanogenic legumes (leucaena, Desmanthus)
- Manure management: Anaerobic digestion, decreased storage time
- Genetics: Research underway to develop breeds with lower methane emissions
- Methane vaccine, rumen bolus: Not yet available but much research underway

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Options for increasing carbon sinks

- Transitioning from cropping to permanent pastures
- Improving soil fertility and pasture productivity
- Incorporating legumes into pastures
- Incorporating deep-rooted perennials into pastures
- Planting trees (reforestation, afforestation, agroforestry)
- Restoring overgrazed or eroded paddocks
- Spreading biochar or feeding biochar as a supplement

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Carbon farming trade-offs

- Can be difficult to improve soil carbon where it is already high
- Not all management practices that reduce emissions are officially recognised by the Commonwealth
- Mitigation and sequestration activities usually come with a cost
- Need to ensure carbon *permanence* for sequestration projects – can be set back by drought or bushfires etc.
- Need to ensure *additionality* i.e. show that GHG mitigation would not have occurred in the absence of a carbon market
- Improved feed conversion efficiency may allow higher stocking rates, leading to an increase in net emissions per unit area

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Carbon farming co-benefits

- Improved livestock productivity can improve profitability in some contexts
- Environmental plantings can help conserve biodiversity, improve water quality
- Improved soil carbon may increase water holding capacity, providing drought resilience
- Supplementing with oils/fats can add energy to the diet
- Some supplements that inhibit enteric methane may improve feed-use efficiency

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What about profitability?

- Very much depends on existing conditions, environment and production system
- Improving ewe fecundity can increase productivity, reduce net emissions and increase profit, but risk may increase
- Incorporating deep rooted legumes (e.g. leucaena, Desmanthus) can improve productivity by up to 20% and improve profitability
- Low-cost supplements and/or pasture feeds that improve liveweight gain often increase profitability

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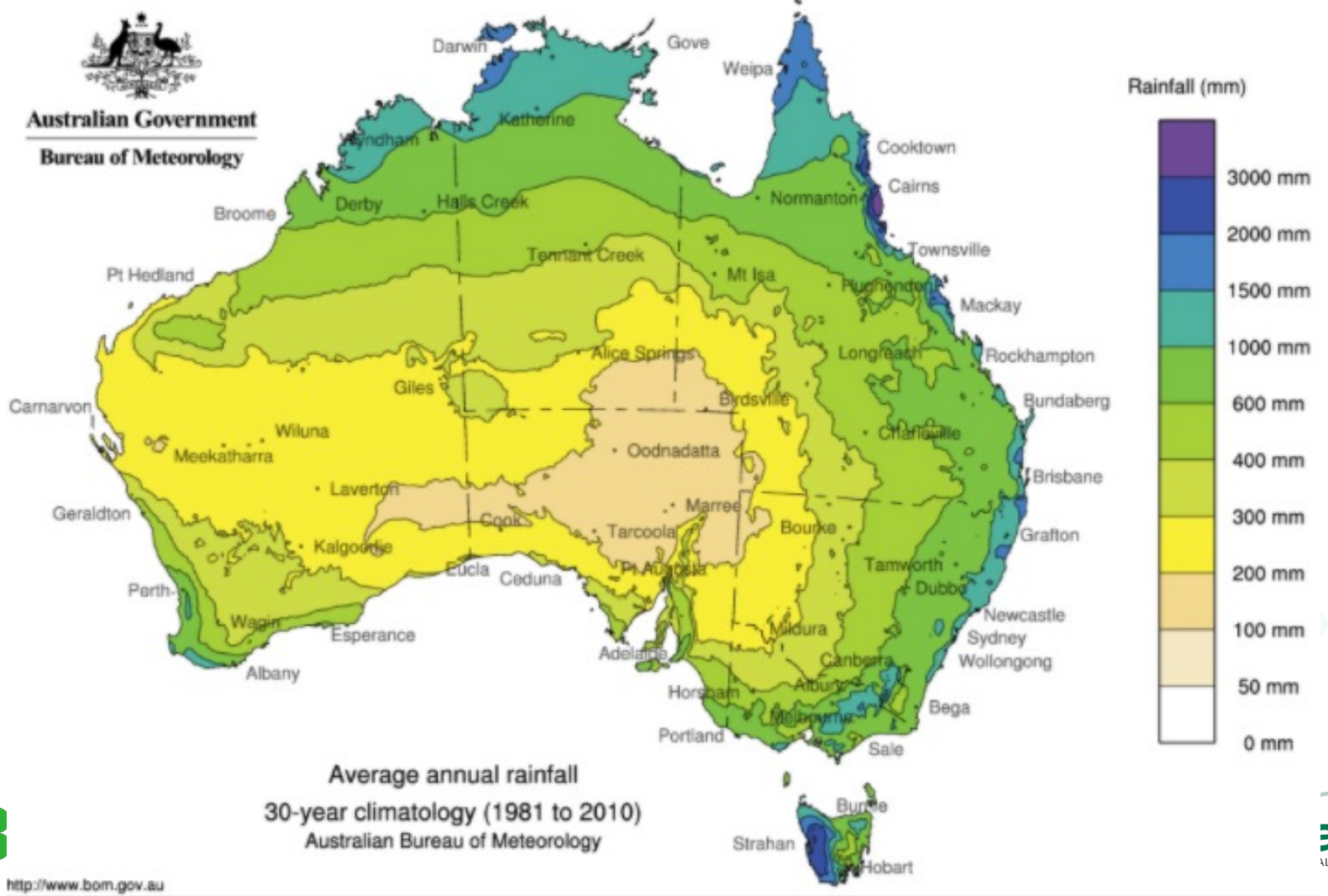
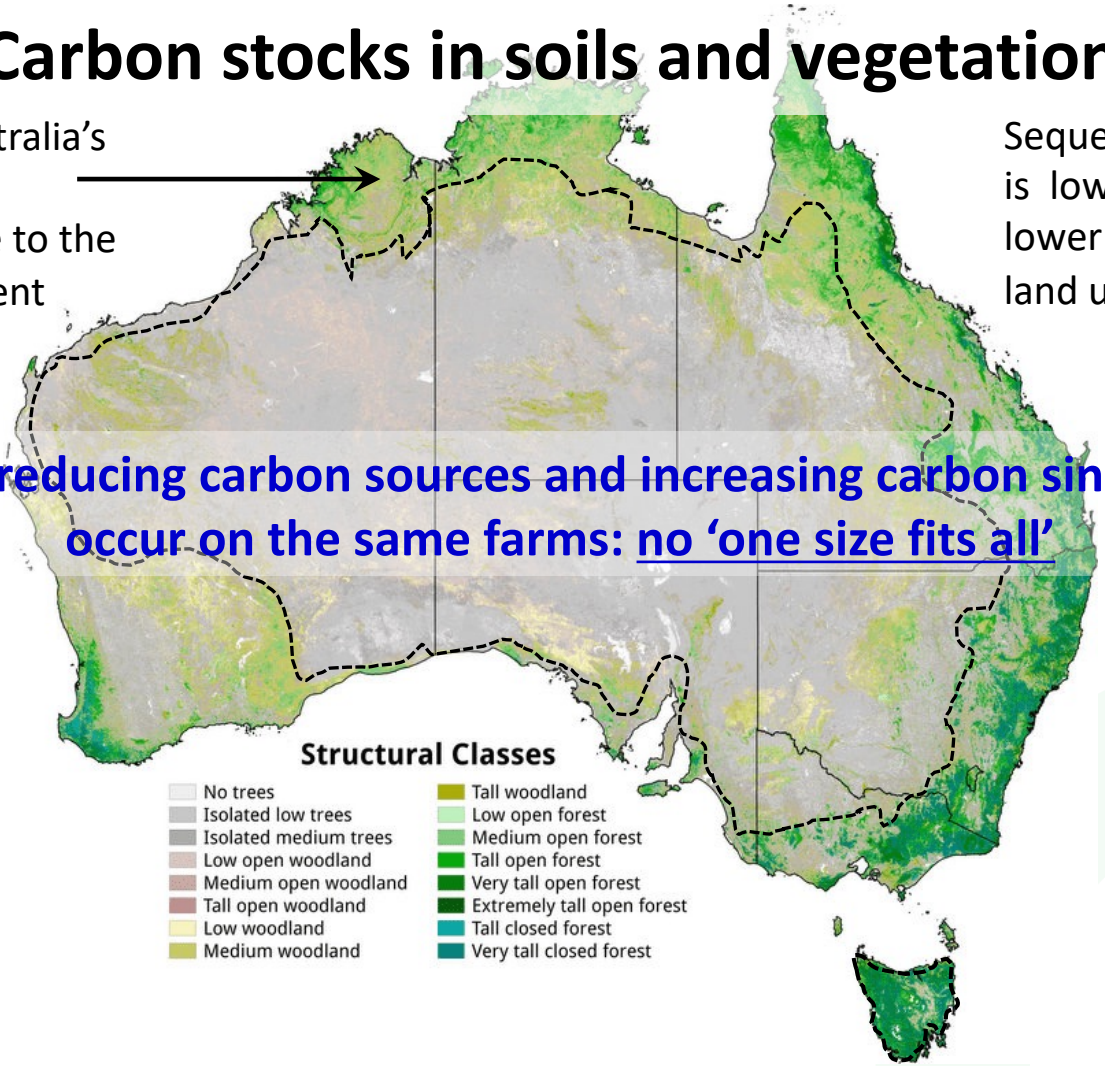

Australian Government
Bureau of Meteorology
Darwin
Gove
Weipa
Katherine
Cooktown
Cairns
Normanton
Broome
Derby
Halls Creek
Townsville
Tennant Creek
Mt Isa
Pt Hedland
Mackay
Alice Springs
Longreach
Rockhampton
Giles
Birdsville
Bundaberg
Carnarvon
Wiluna
Meekatharra
Oodnadatta
Brisbane
Laverton
Marree
Geraldton
Cook
Tarcoola
Bourke
Grafton
Kalgoorlie
Eucla
Ceduna
Tamworth
Perth
Dubbo
Newcastle
Mildura
Esperance
Sydney
Adelaide
Canberra
Albany
Horsham
Wollongong
Albury
Bega
Portland
Sale
Strahan
Hobart
Rainfall (mm)
3000 mm
2000 mm
1500 mm
1000 mm
600 mm
400 mm
300 mm
200 mm
100 mm
50 mm
0 mm
Average annual rainfall
30-year climatology (1981 to 2010)
Australian Bureau of Meteorology
http://www.bom.gov.au

Carbon stocks in soils and vegetation

The majority of Australia's C stocks in soils and vegetation are close to the edges of the continent

Sequestration potential is lower where rainfall is lower (depending on land use and soil type)



Key point: reducing carbon sources and increasing carbon sinks need not occur on the same farms: no 'one size fits all'

Take-home messages

- Carbon neutrality can be attained by *reducing* emissions, *increasing* carbon sequestration, or both
- Many options exist for carbon sequestration (soils, vegetation) and emissions reduction (supplements, herd management)
- There are no panaceas: ability to reduce emissions depends on location and enterprise
- The value of co-benefits (improved production, biodiversity conservation, shading, shelter, cleaner water) may be worth more than the income from carbon *per se*
- Practices that improve production efficiency are often highly effective at reducing emissions and increasing profitability

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Need more information?

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