SESSION 2:

CAN WE FEED THE WORLD WITH NET ZERO EMISSIONS?

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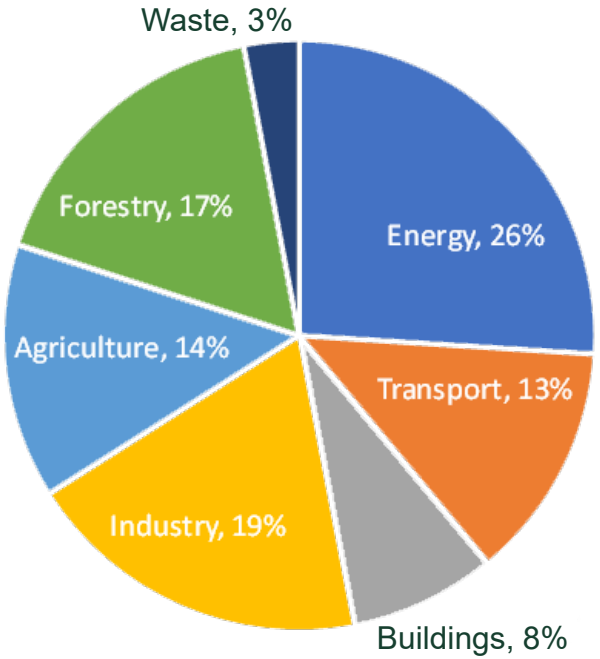
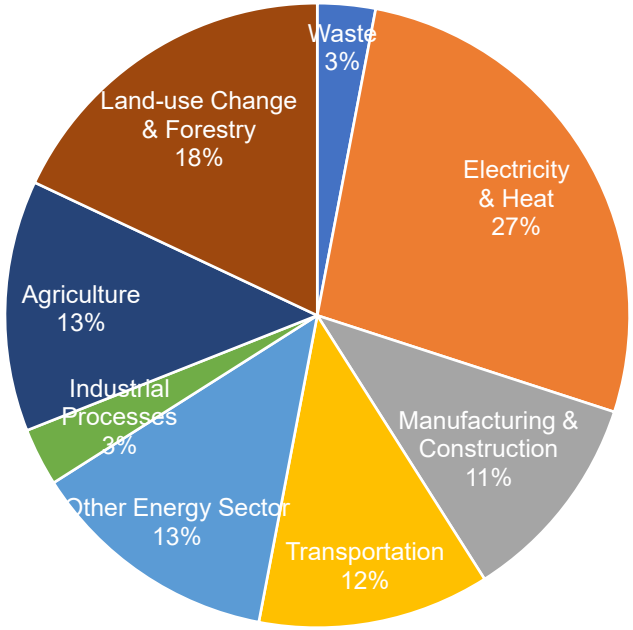
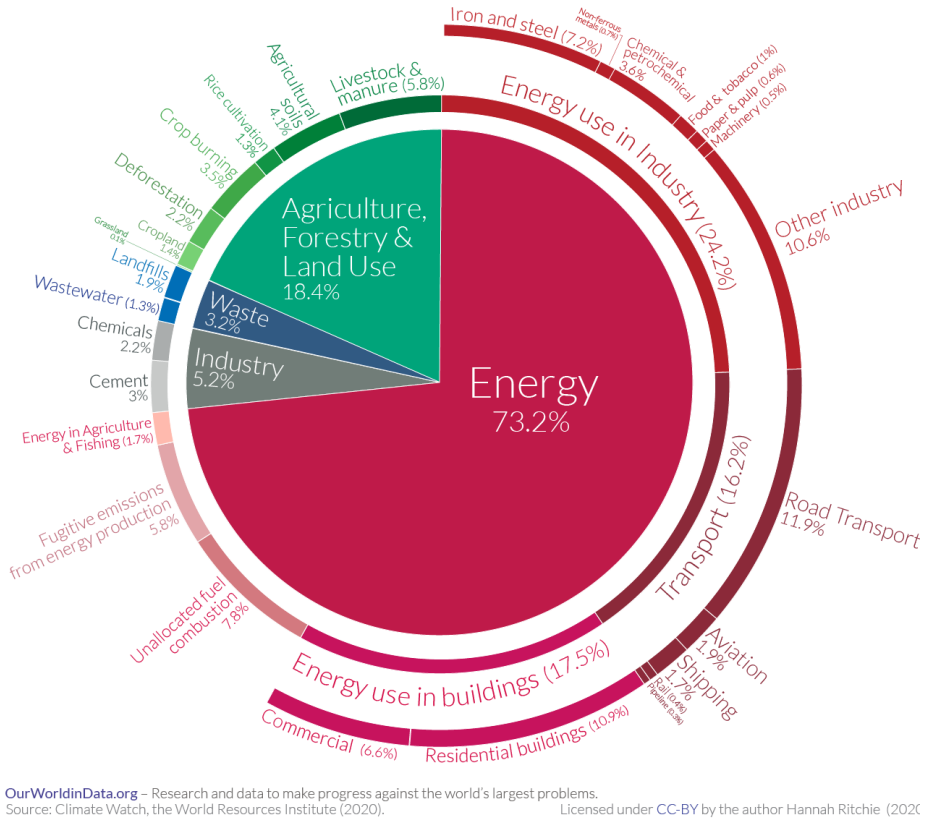
The University of Melbourne

Greenhouse gas emissions from agriculture

Agriculture accounts for 12 - 14% of global GHGe







OurWorldinData.org – Research and data to make progress against the world's largest problems.
Source: Climate Watch, the World Resources Institute (2020). Licensed under CC-BY by the author Hannah Ritchie (202

IPCC 2014; World Resources Institute; Rosa and Gabrielli (2023)

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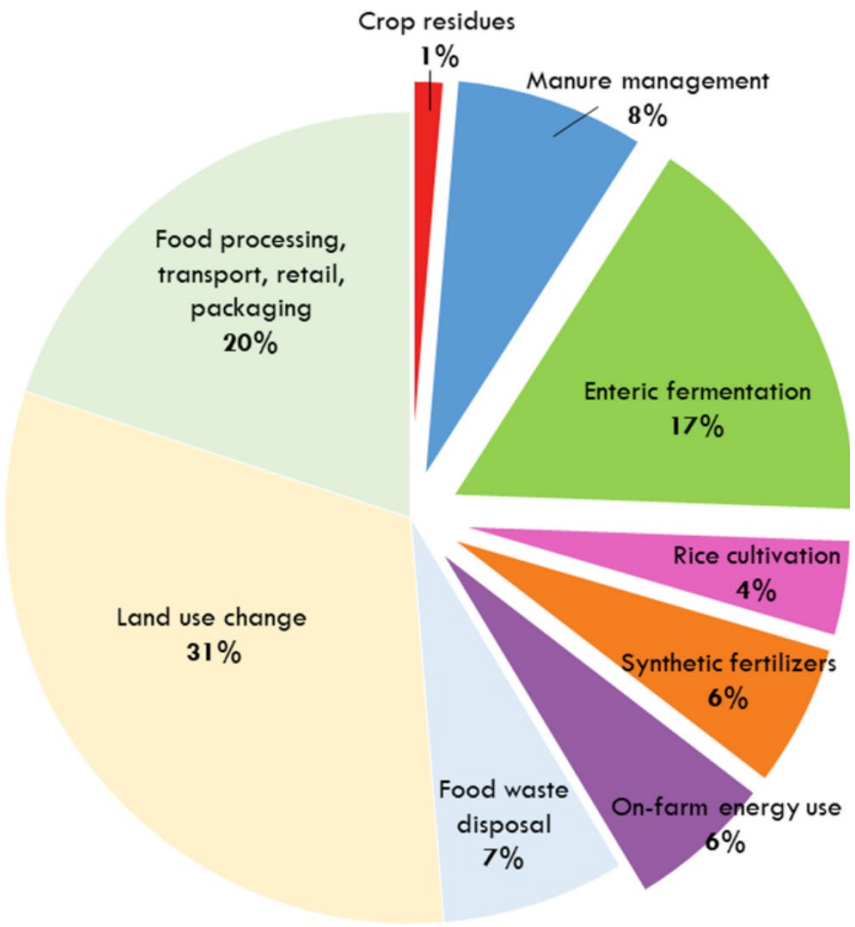
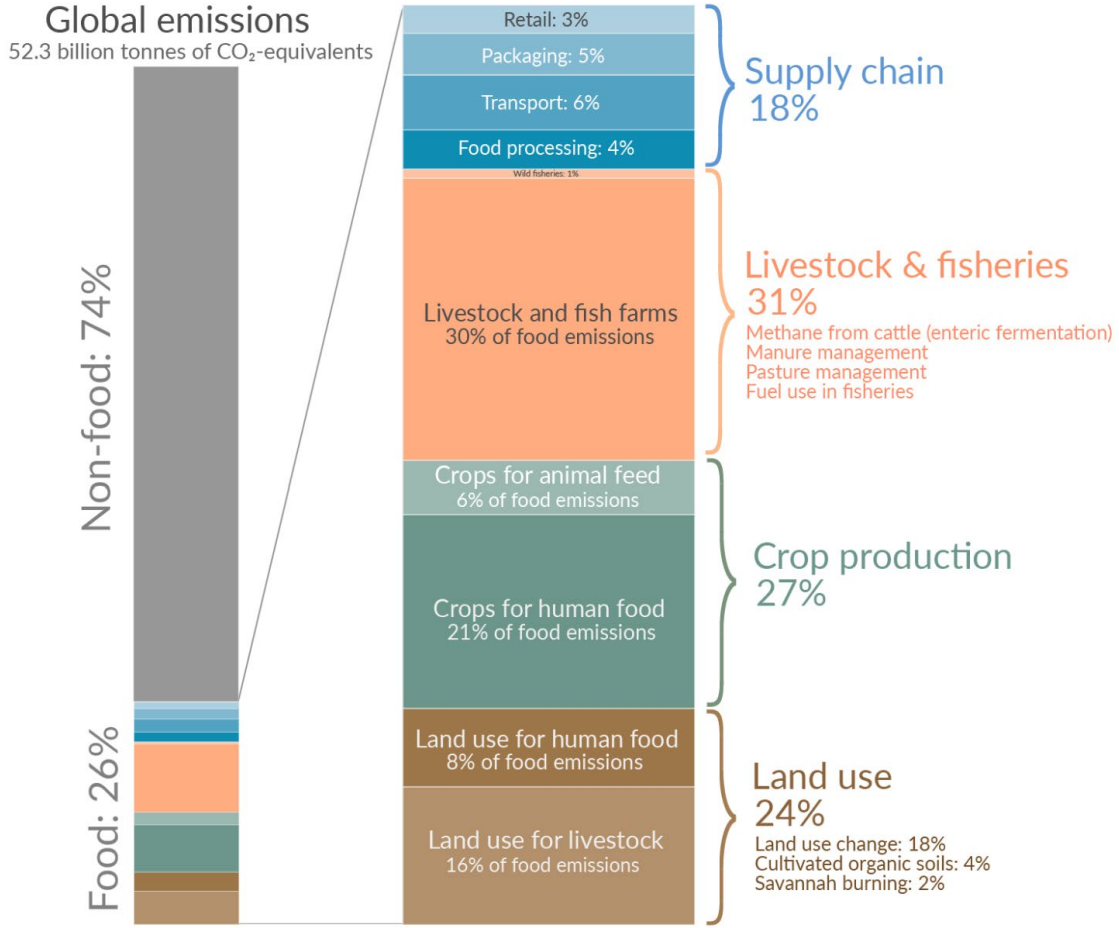
Greenhouse gas emissions from agriculture

The Food System = ~26% of global GHG



Global emissions from food systems, 2020



Data source: Joseph Poore & Thomas Nemecek (2018). Reducing food's environmental impacts through producers and consumers. Published in *Sci*

Rosa and Gabrielli (2023); Poore & Nemecek (2018)

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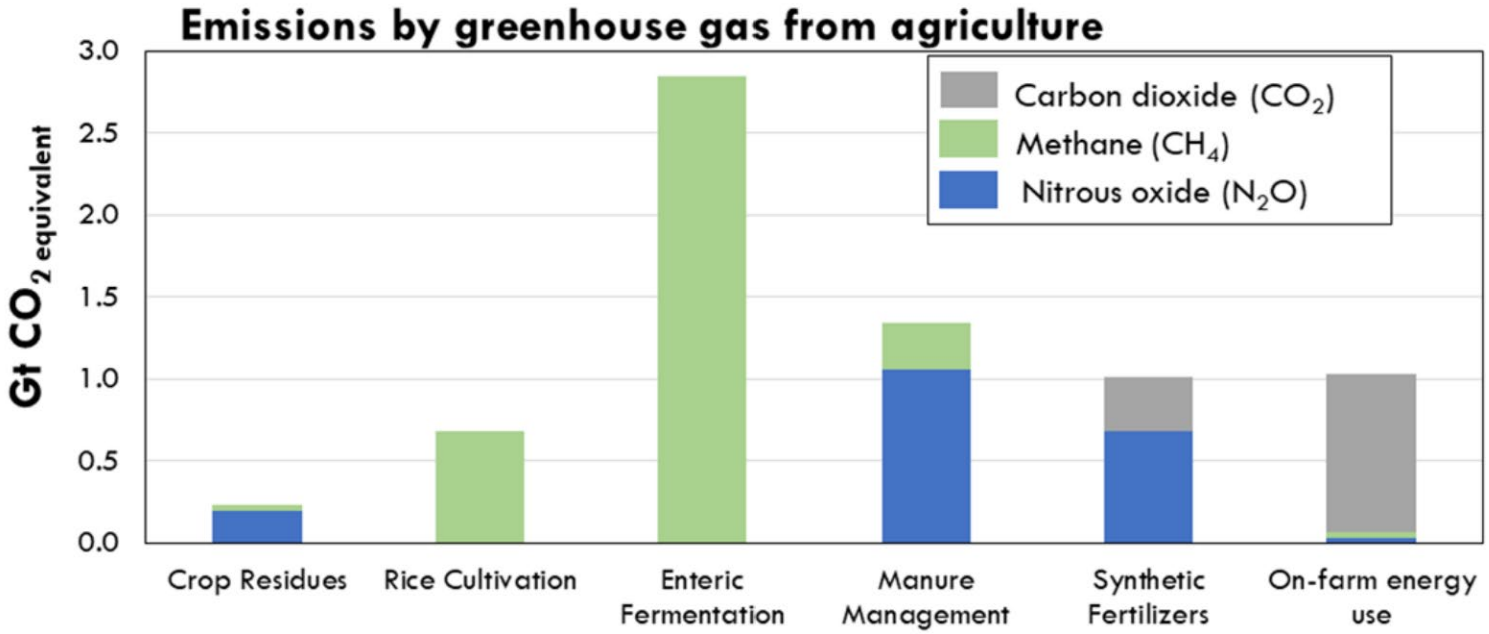
What are the major emissions from the agricultural sector?

- Methane (54%)
  - Livestock production
  - Rice
  - Manure management
- Nitrous oxide (28%)
  - Fertilisers
  - Residues
  - Legumes
  - Manure
- Carbon dioxide (18%)
  - Lime
  - Energy
- Mainly biological processes

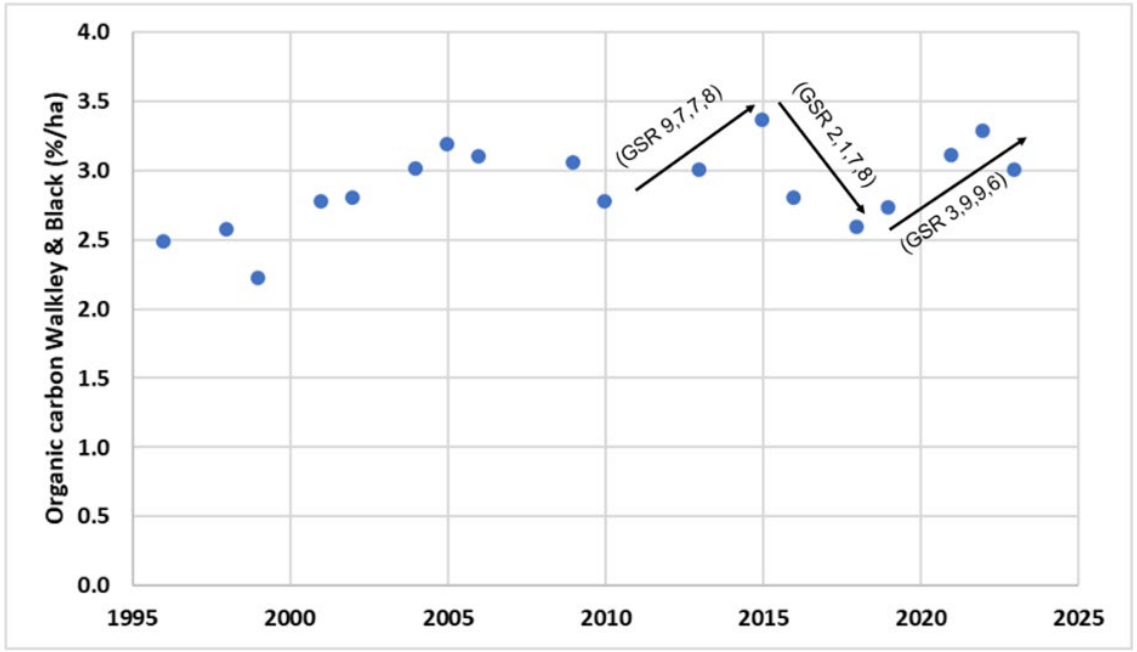


Rosa and Gabrielli (2023)

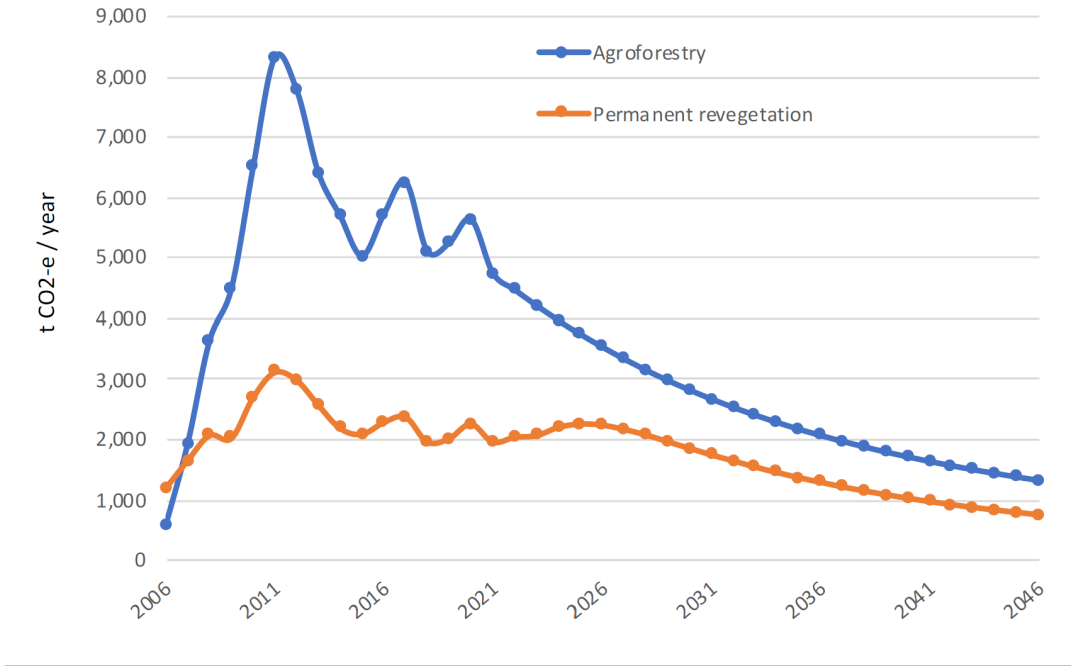
What are the major sequestration options?

- Soil organic matter & trees in agricultural landscapes
  - But cannot accumulate in perpetuity

SOC @ Knewleave



Trees @ Jigsaw farms



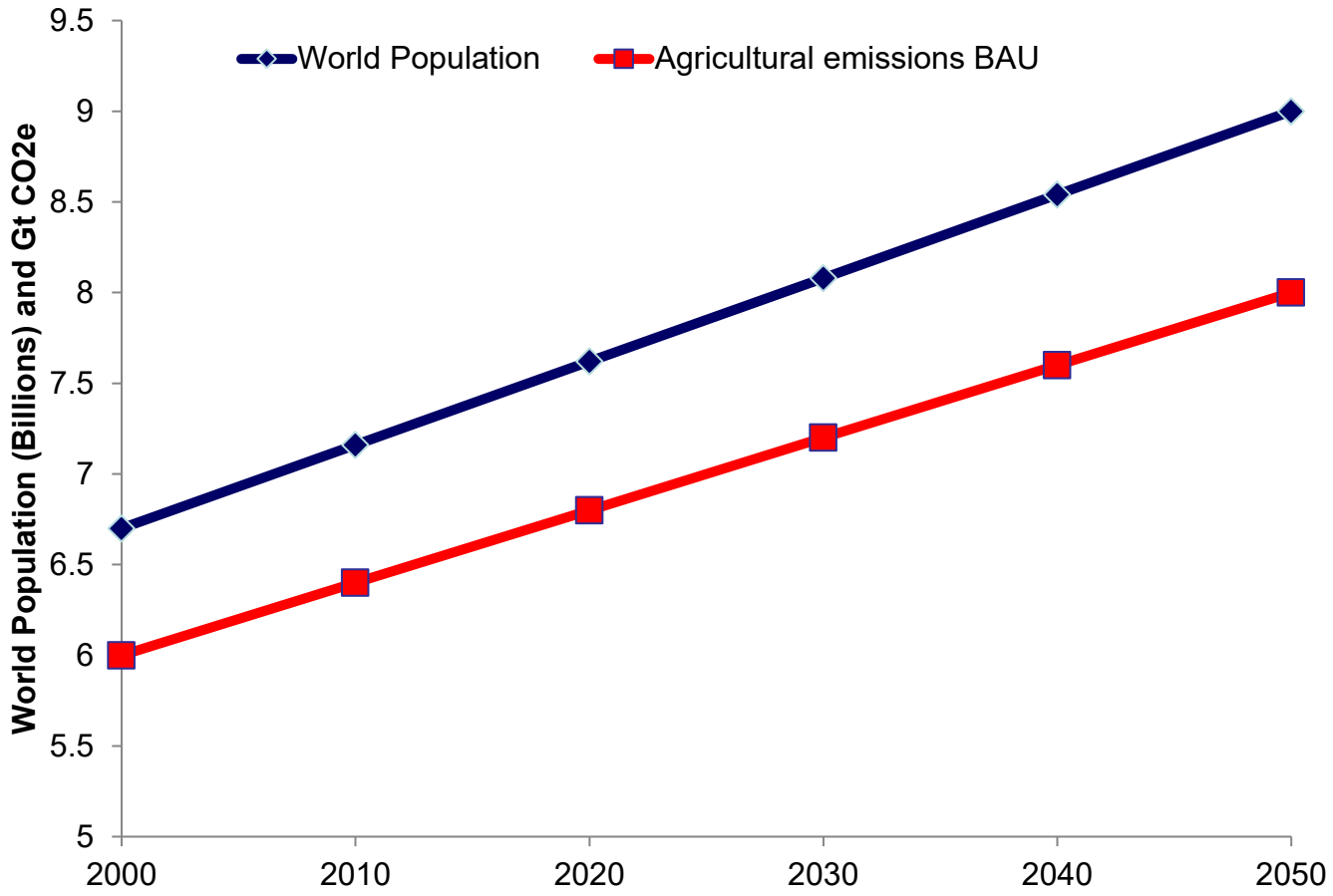
MacDonald *et al.* (2025); Fiona Conroy & Cam Nicolson

Reducing livestock numbers?

- Mainly in lower socio-economic regions and integral to food security and rural livelihoods
  - Only <16% of world population have choice over their diet
- Multi-functionality of smallholder dairying in Kenya
  - Weiler et al. (2014)
  - Emissions intensity of meat or milk lower than our most efficient commercial dairy systems

People = Food = Protein = N Input = Nitrous Oxide

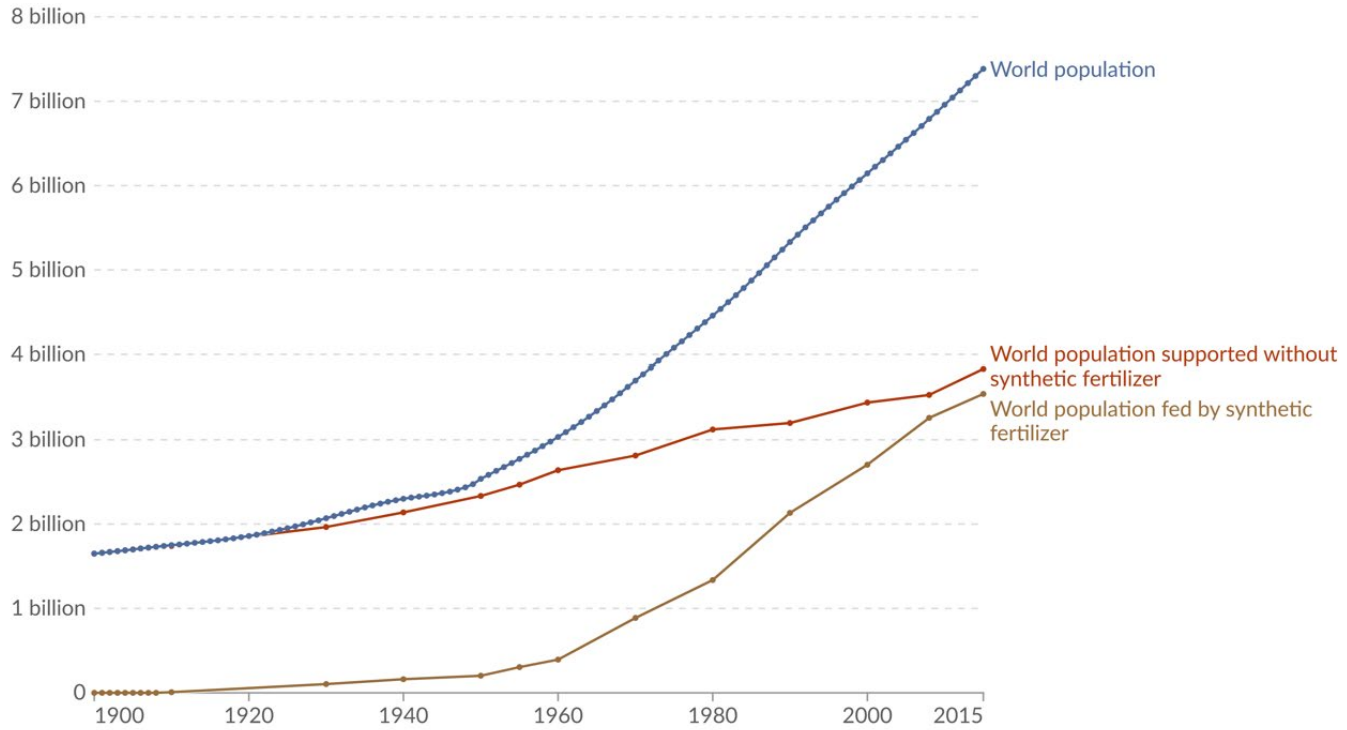
Can we simply reduce nitrogen fertilizer use?



Eckard (2009)

Reducing nitrogen fertiliser use?

- The production and use of nitrogen fertiliser
  - = 33% of global GHG
  - Sustains 48% of the world's population
    - Without Haber-Bosh global population may have been < 4B



Erisman et al. (2008); Smil (2002); Stewart (2005)

Mitigation options for agriculture

- Overall agricultural potential = 45%

  (Rosa & Gabrielli 2023)

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Potential towards net zero by 2030

- Pigs and poultry
  - >90% => Manure management and green energy
- Perennial horticulture & wine
  - >90% => Renewable energy, N inhibitors, N rates, on-farm N, biochar
- Grains, cropping, sugar, cotton
  - 50% => N inhibitors, N rates, on-farm N
- Rice
  - 60% => Later flooding, N inhibitors, N rates, on-farm N
- Dairy and feedlots
  - 50% => Feed inhibitors, N inhibitors, N rates, green energy
- Extensive grazing
  - 10-20% => Breeding, legumes

- Options more limited in extensive or subsistence agricultural systems
- Few options are profitable

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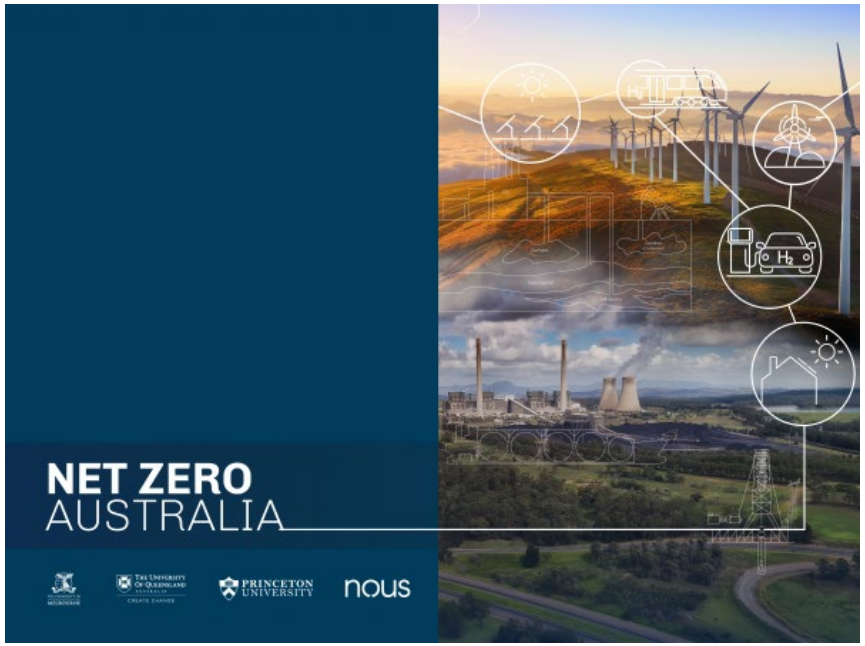
Key conclusion from Net Zero Australia plan

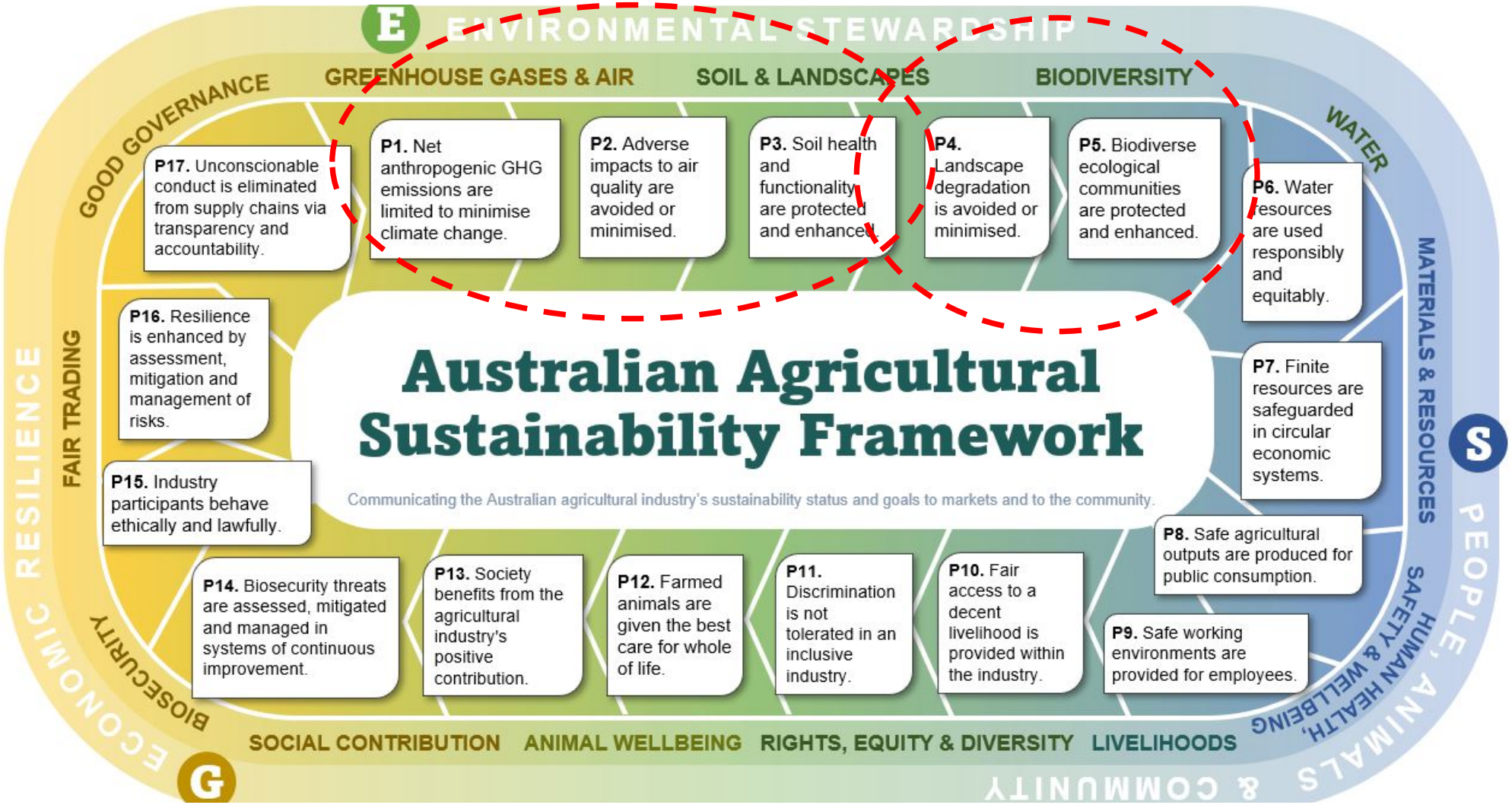
*Australian Agriculture is unlikely to achieve its own net zero target by 2050 if they **inset** ALL sequestration available*

Let alone the notion of providing offsets to the large emitters



https://www.netzeroaustralia.net.au/final-modelling-results/

The Australian Agricultural Sustainability Framework



Is the future a balance between ESG criteria?

Answer

- Can we feed the world with **NET** zero emissions?
  - Temporarily - in some industries
    - The law of diminishing returns - sequestration has a natural limit

- Can we feed the world with **ABSOLUTE** zero emissions?
  - Not with current technology and costs
    - *Purpose of the ZNEAg CRC*
  - A shared value-chain insetting business model is needed
    - *New ZNEAg CRC project*

Key Messages

- Mitigation options are emerging to reduce agricultural emissions
  - Incentives or cost-sharing needed
  - Potential conflict with food security goals
- Australian agriculture is unlikely to achieve its own value chain GHG targets
  - Unless we **inset** all sequestration available
- Poses key questions:
  - Should agricultural offsets be sold to the large emitters?
    - Are we selling ourselves short of our own targets?
  - Should food production be sacrificed for carbon offsets?
    - Current policy settings incentivise the conversion of agricultural land for carbon offsets
  - Will future markets except a balance between biodiversity and GHG?
    - Is this the future for our extensive grazing industry?
- Are emissions from food production the most legitimate form of emission?

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