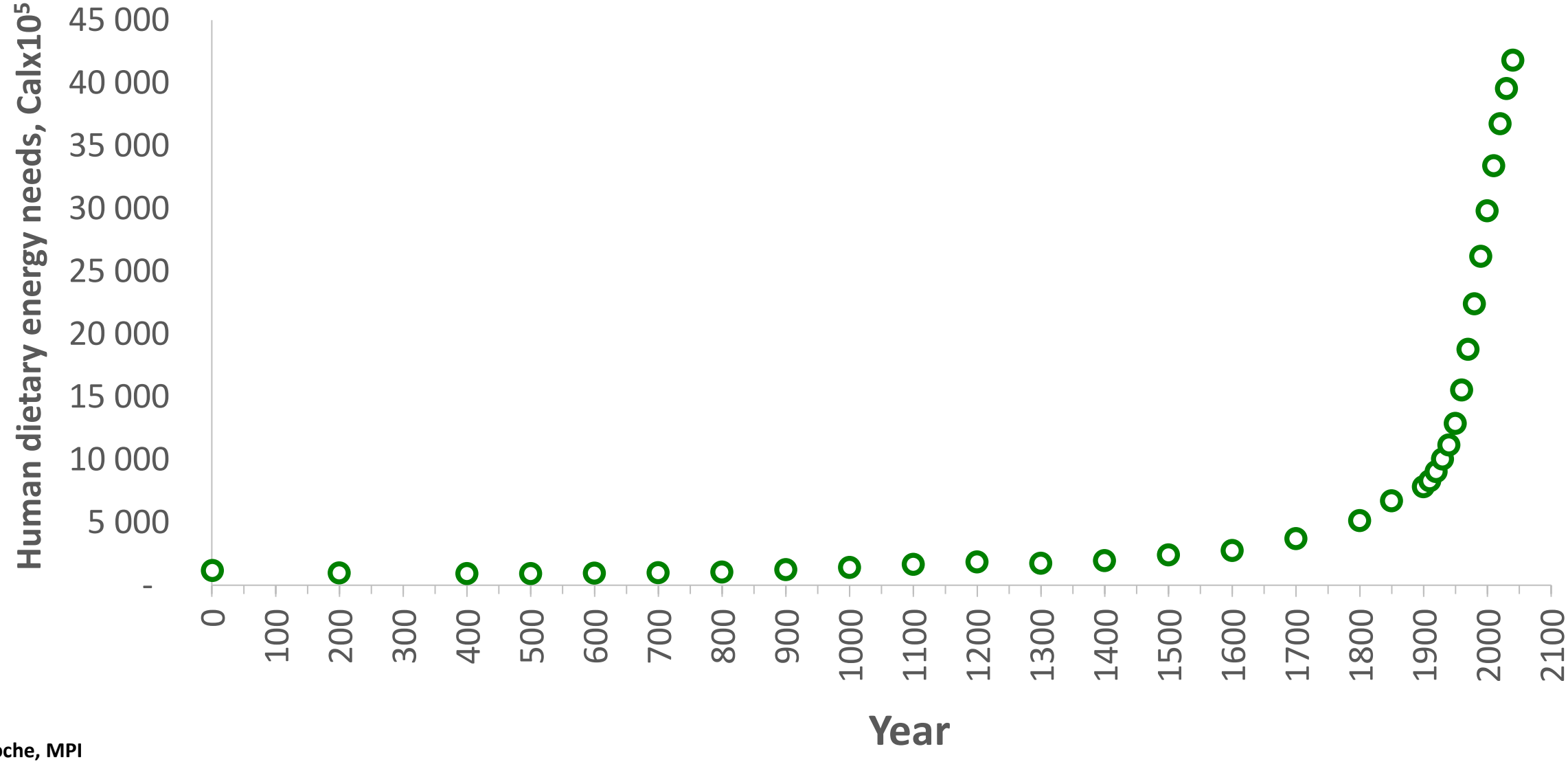
atf animal task force
A European Public-Private Partnership

12th ATF Seminar
17 November 2022

Reduction and mitigation measures in New Zealand's livestock sector

Dr. John Roche
Chief Science Adviser &
Director On-Farm Support,
Ministry for Primary Industries,
New Zealand

Humanity has a massive challenge



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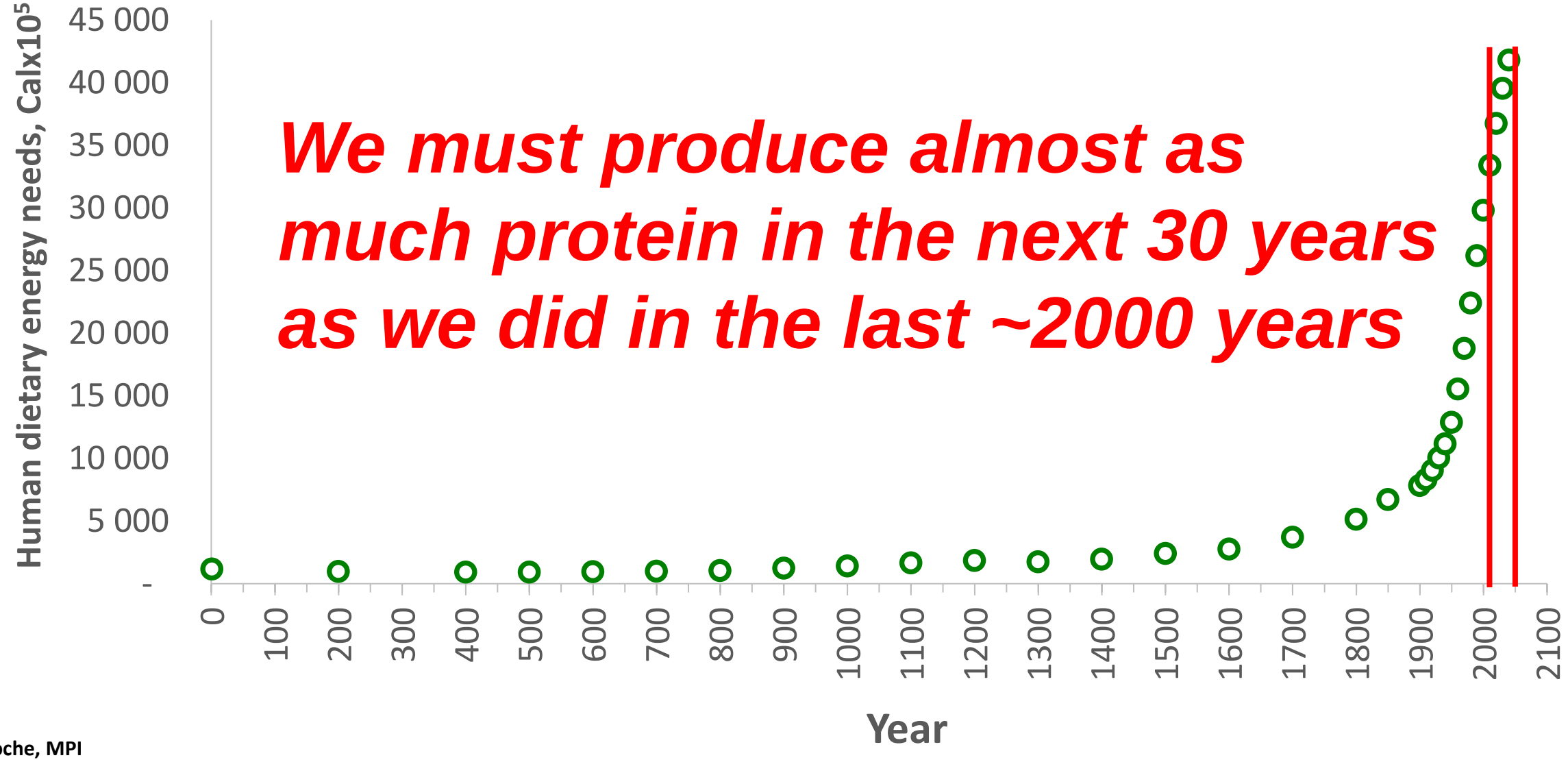
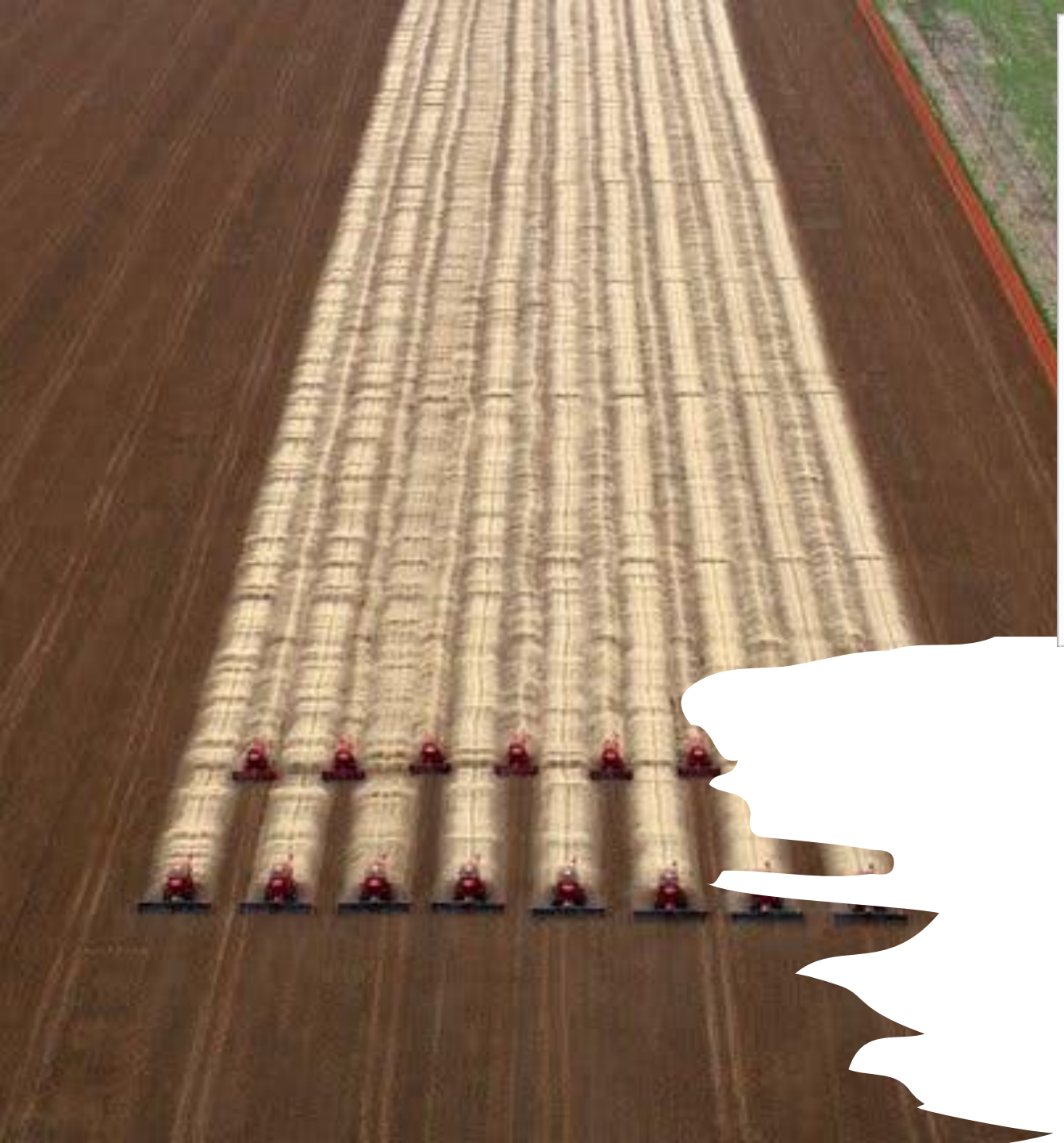
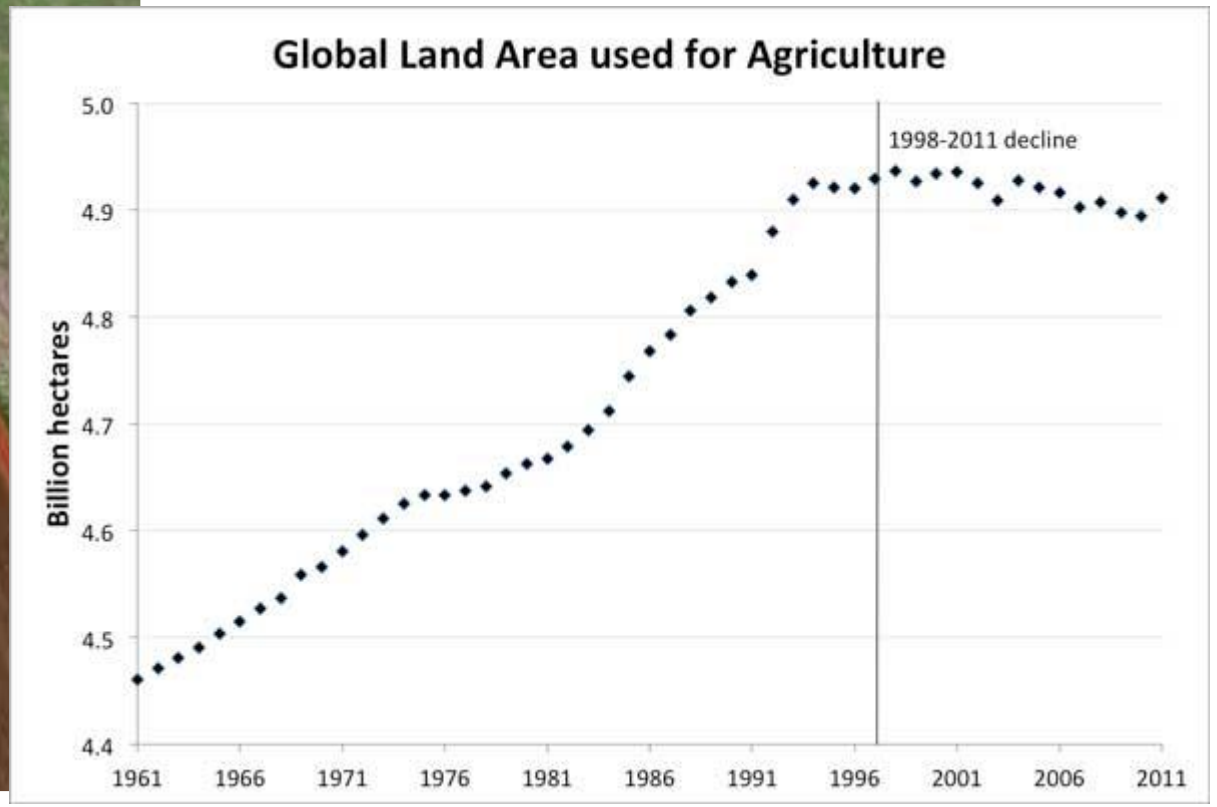






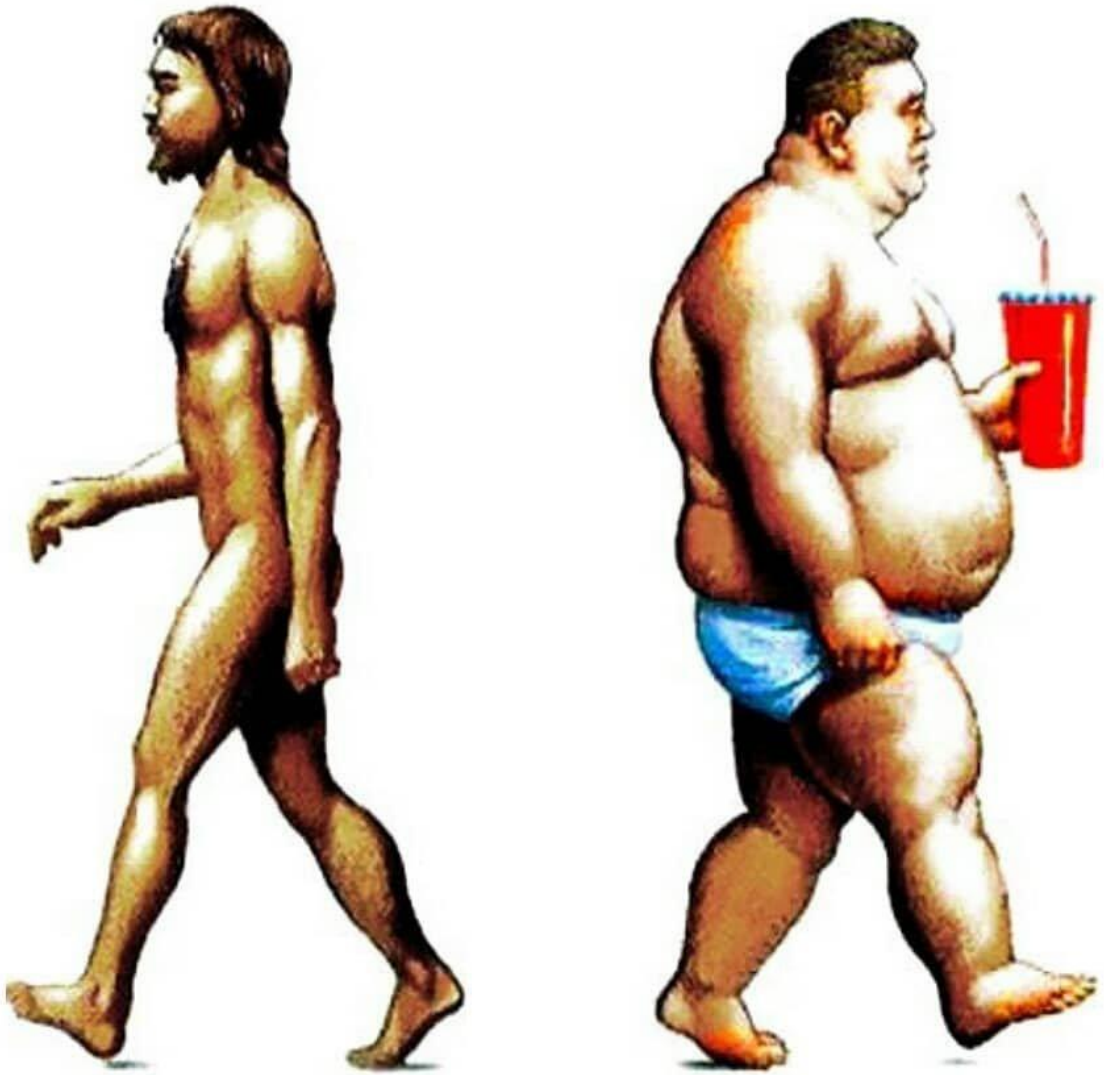
And we cannot use more land!

World Hunger Continues Dramatic Rise

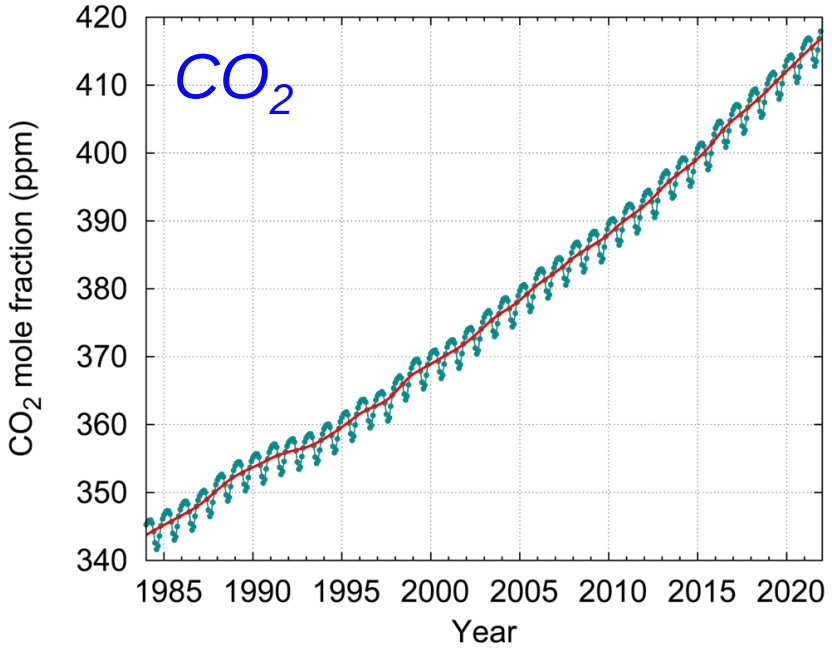
Number of undernourished people worldwide from 2005 to 2021*

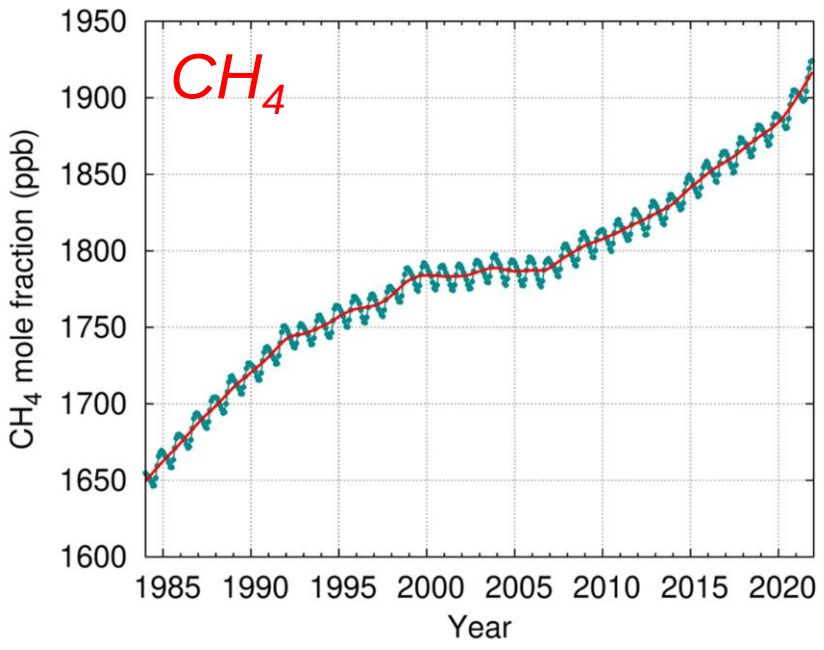
* 2020: Middle estimate. 2021: Middle estimate, projection
Source: UN Food and Agriculture Organization

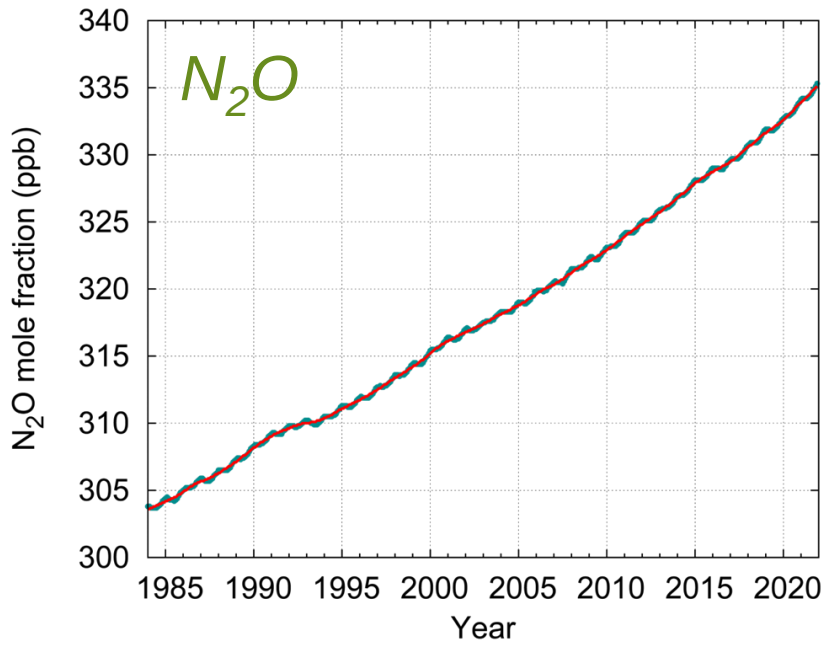
Hidden Hunger - malnutrition

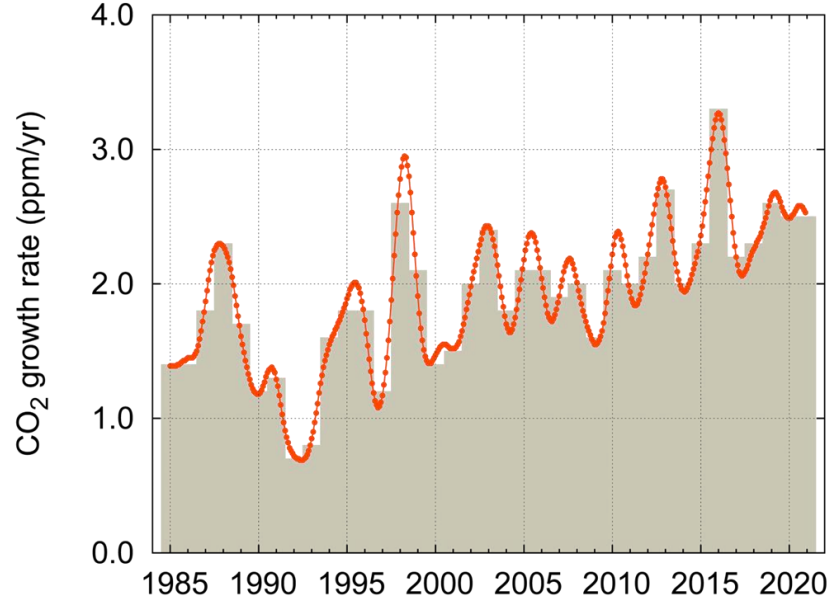


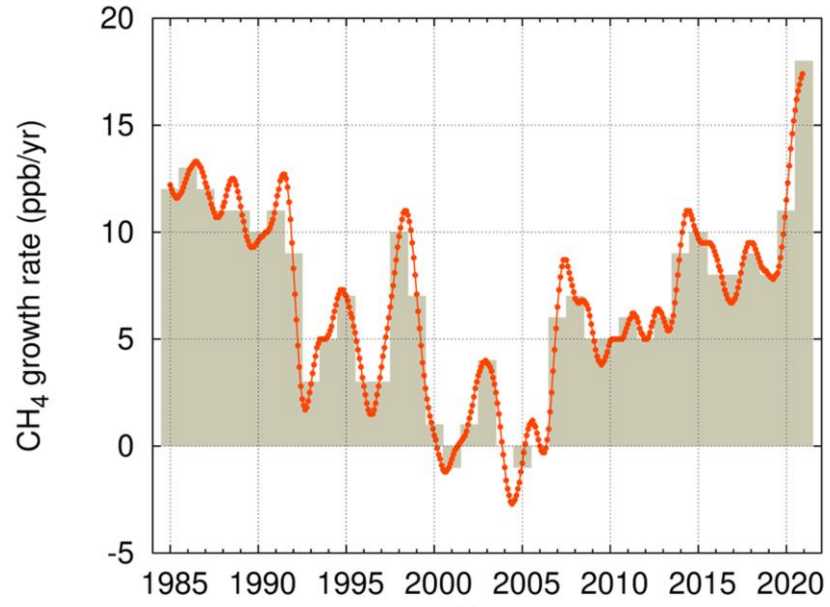
Current trends in atmospheric GHGs

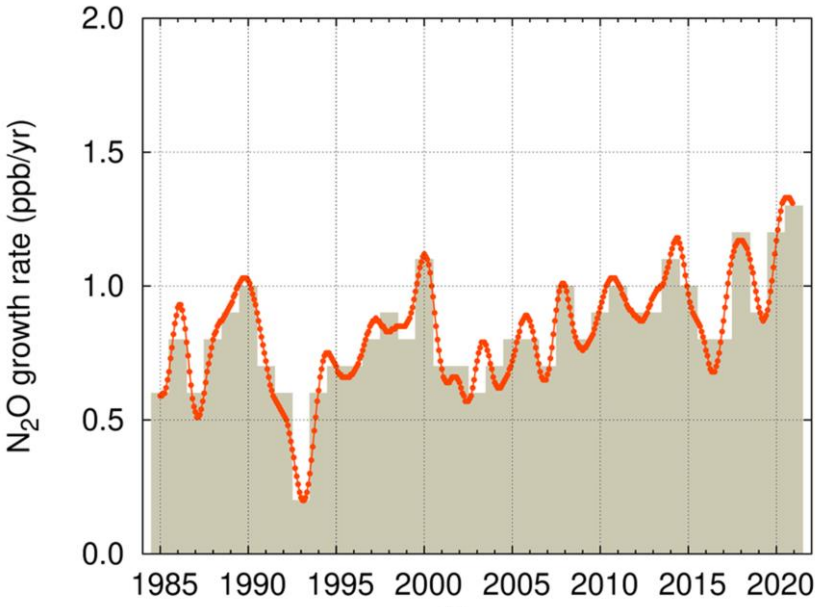




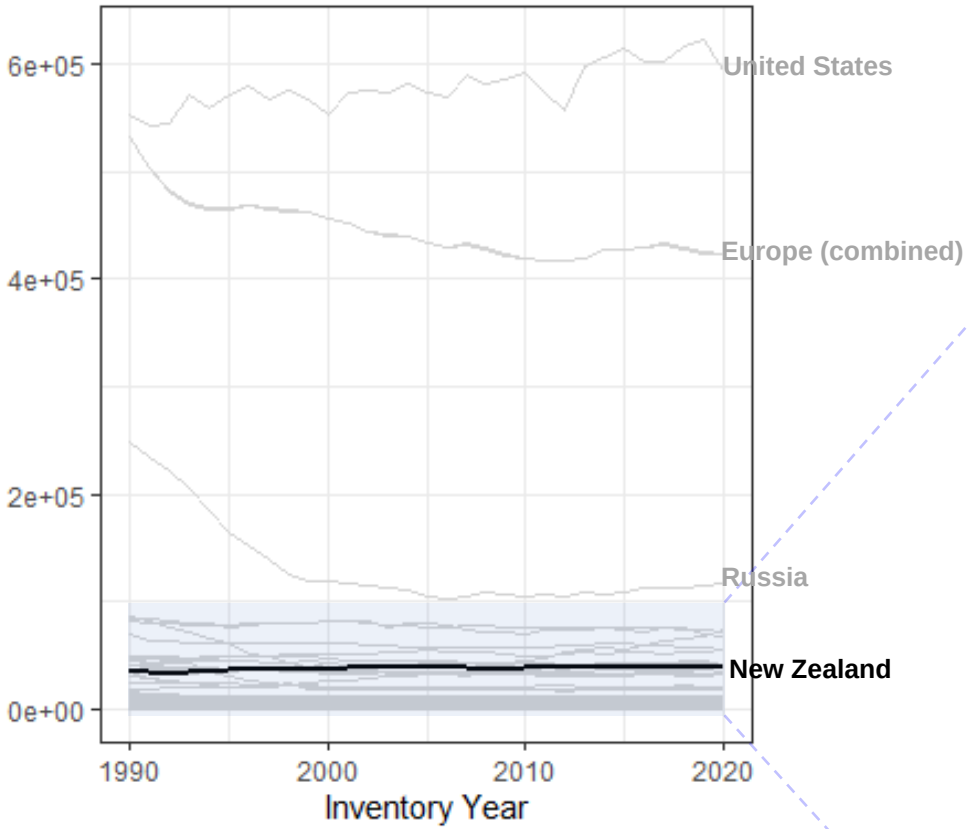








New Zealand is quite unique

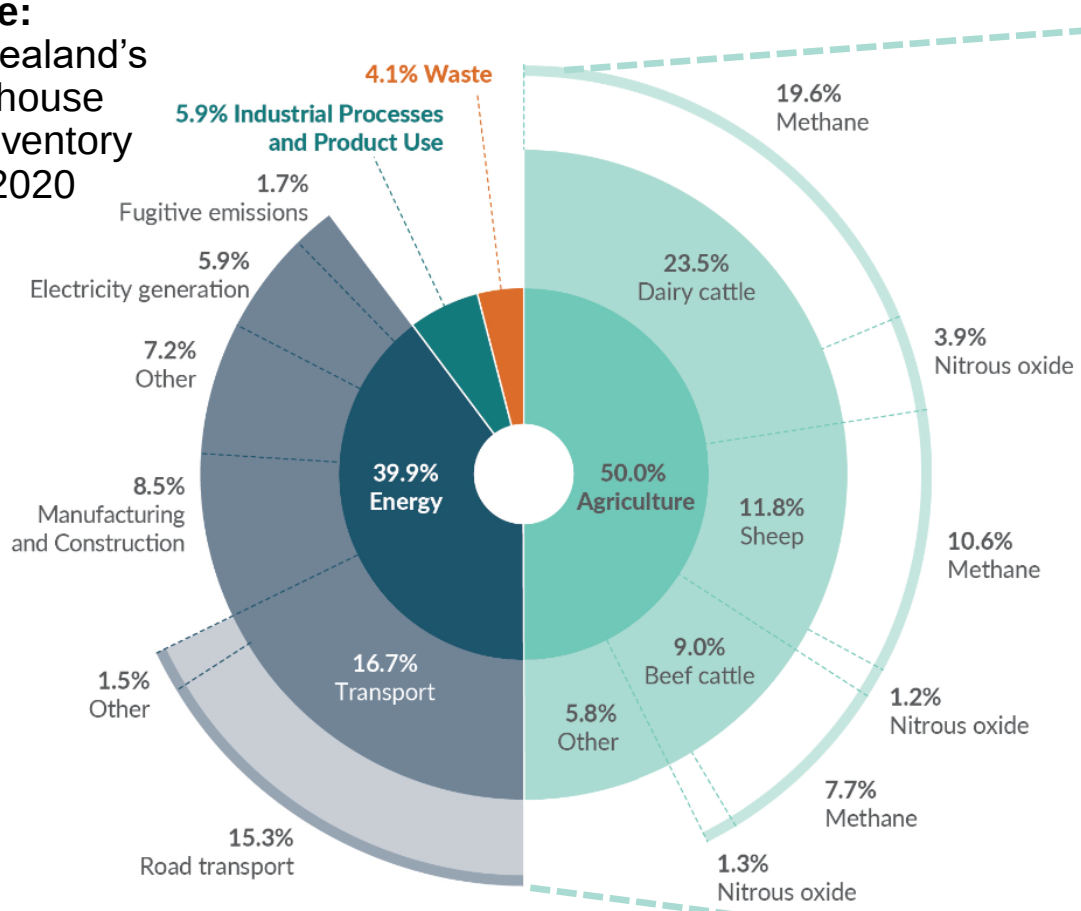


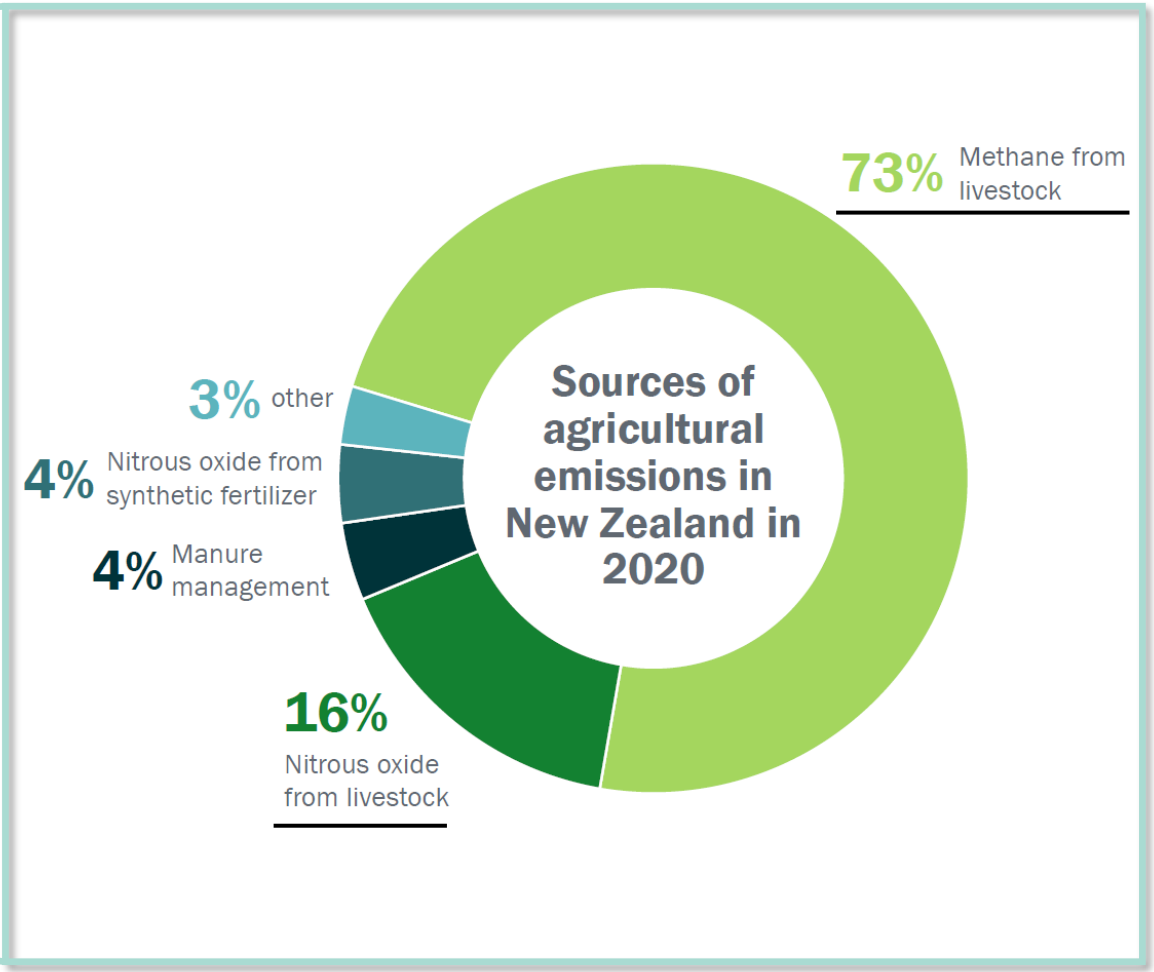
Annex I agricultural emissions (CO_2-eq kt)

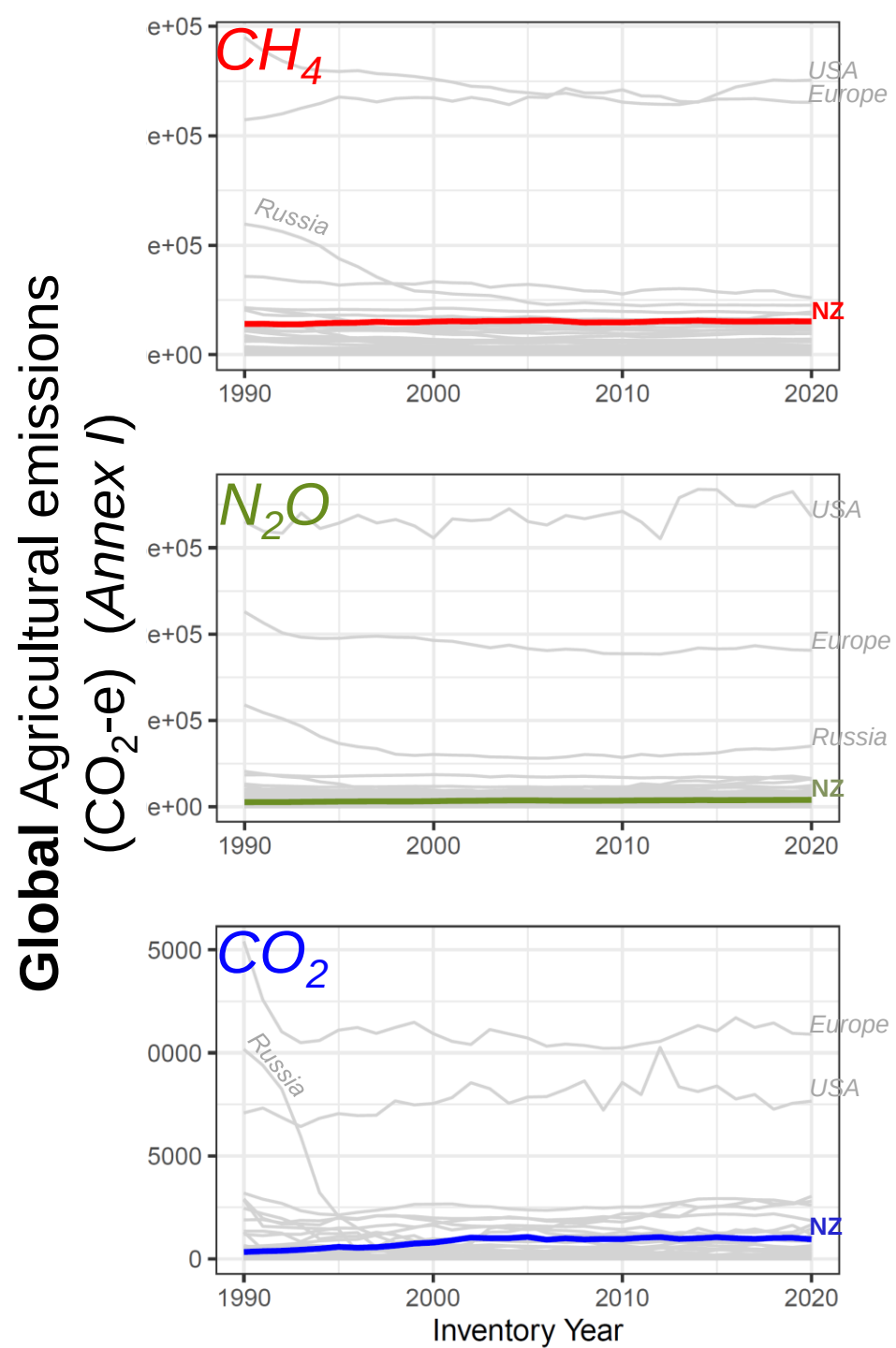
©John Roche, MPI

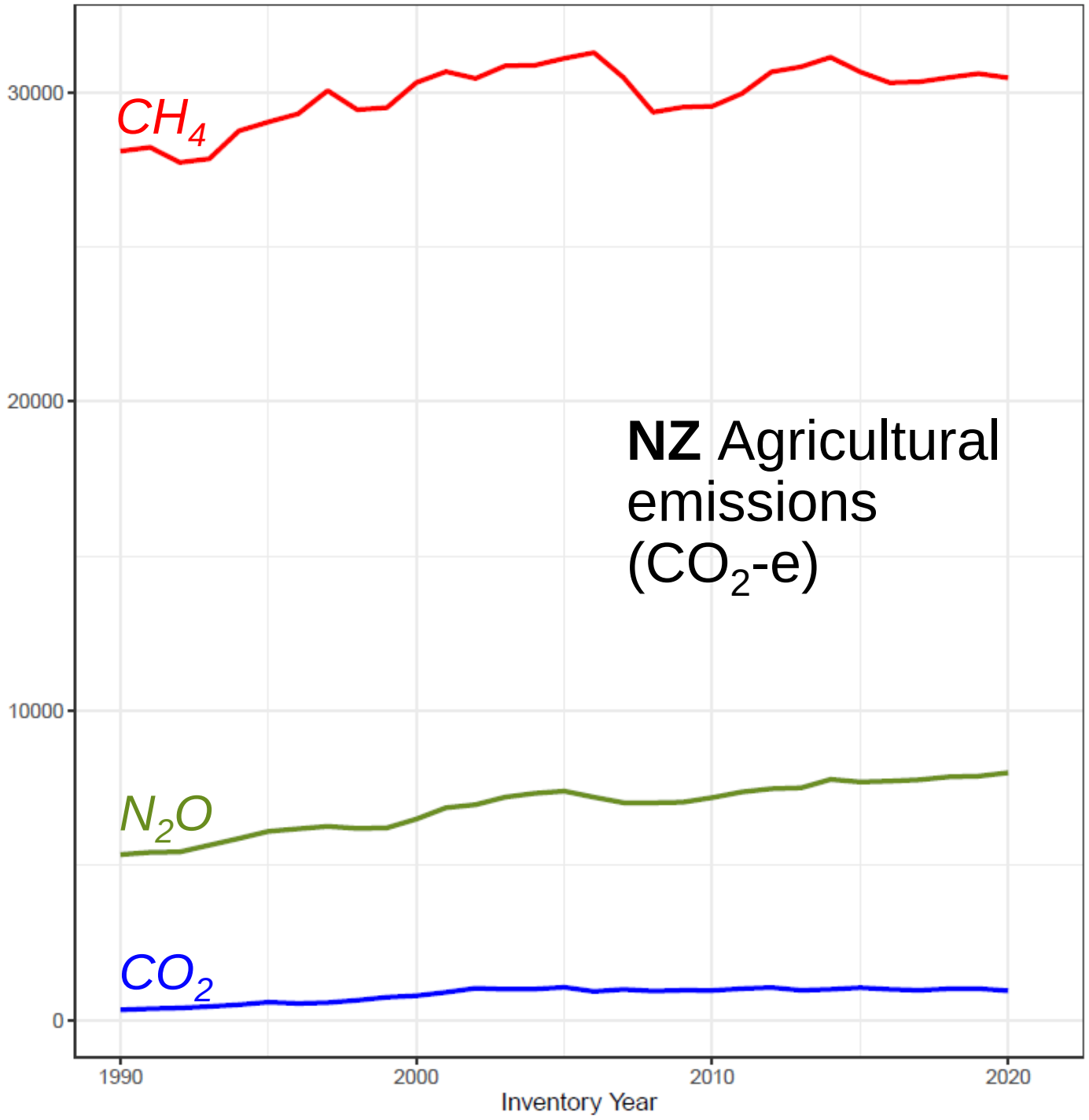
50 % of New Zealand's emissions are related to the agricultural sector (2020 data – CO_2-e)

Source:
New Zealand's Greenhouse Gas Inventory 1990-2020 (MfE)






Global Agricultural emissions
(CO_2-e) (*Annex I*)
CH_4
USA
Europe
Russia
NZ
e+05
e+00
N_2O
CO_2
5000
0000
0
1990
2000
2010
2020
Inventory Year


CH_4
N_2O
CO_2
30000
20000
10000
0
NZ Agricultural emissions (CO_2-e)
1990
2000
2010
2020
Inventory Year

Environmental Impact Assessment Review 98 (2023) 106946

Contents lists available at ScienceDirect

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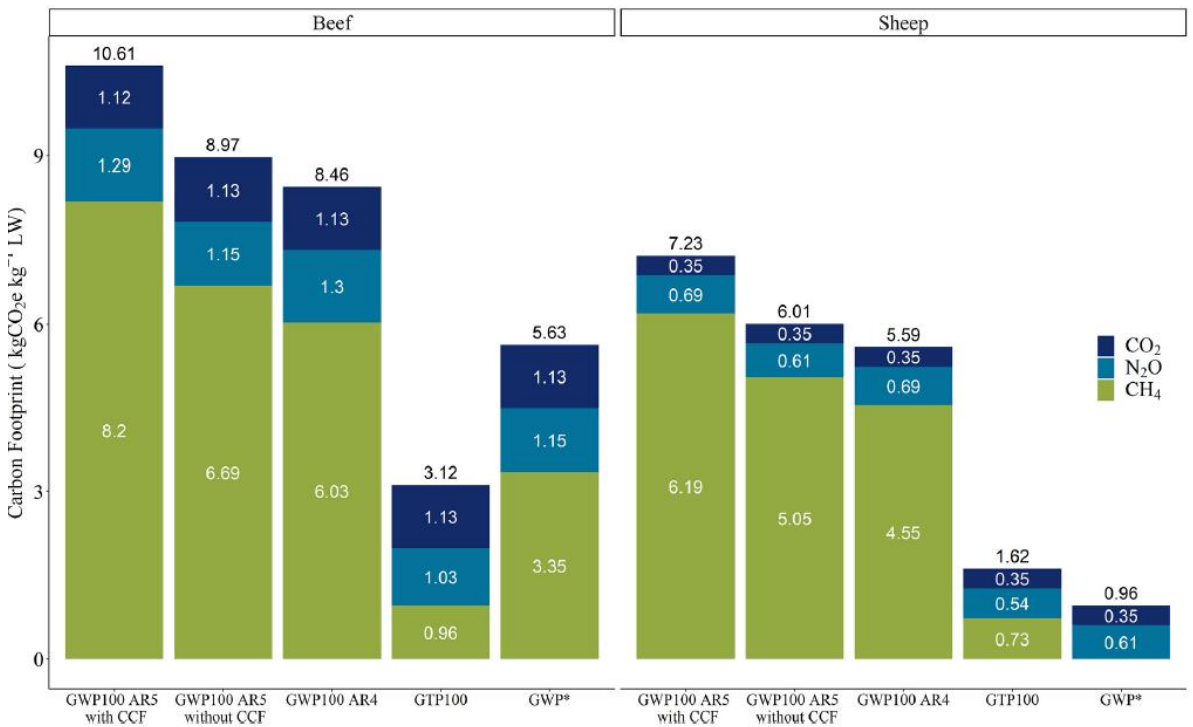
Andre M. Mazzetto [a,*], Shelley Falconer [b], Stewart Ledgard [b]



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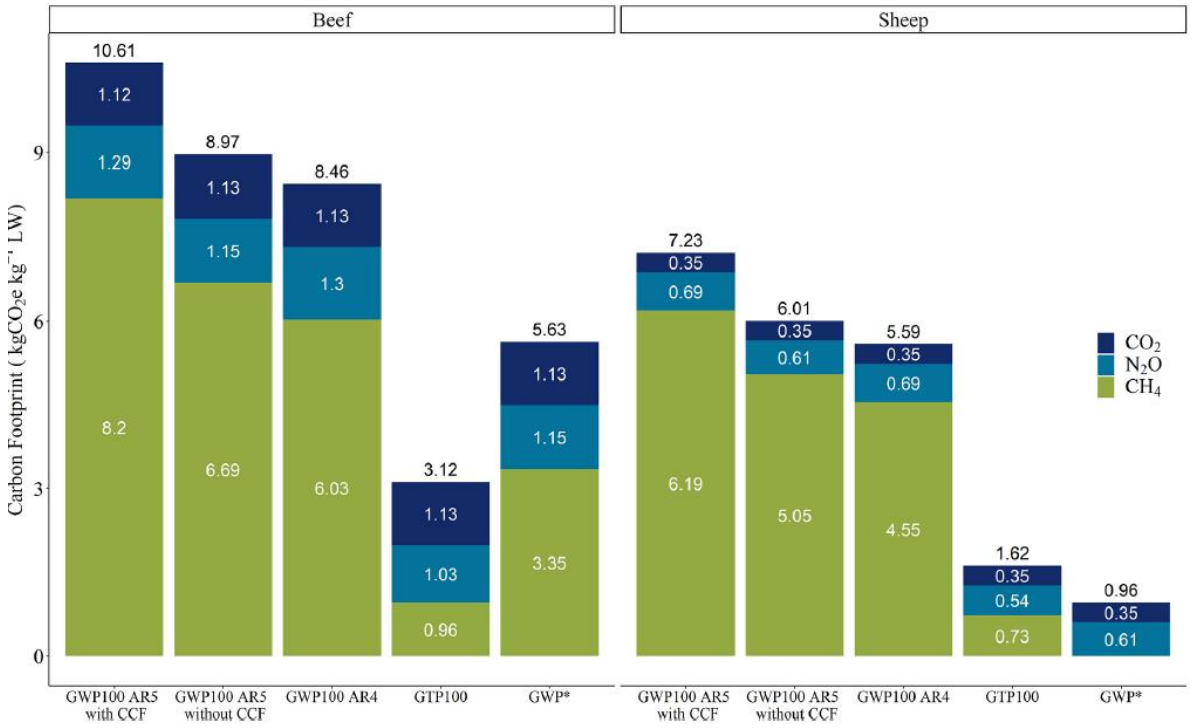


Key results

- New Zealand ruminant products have a very low GHG footprint relative to international competitors;
- The method of 'foot-printing' has a big effect on 'impact';
- There is a significant effect (-29%) of sequestration on net farm emissions.

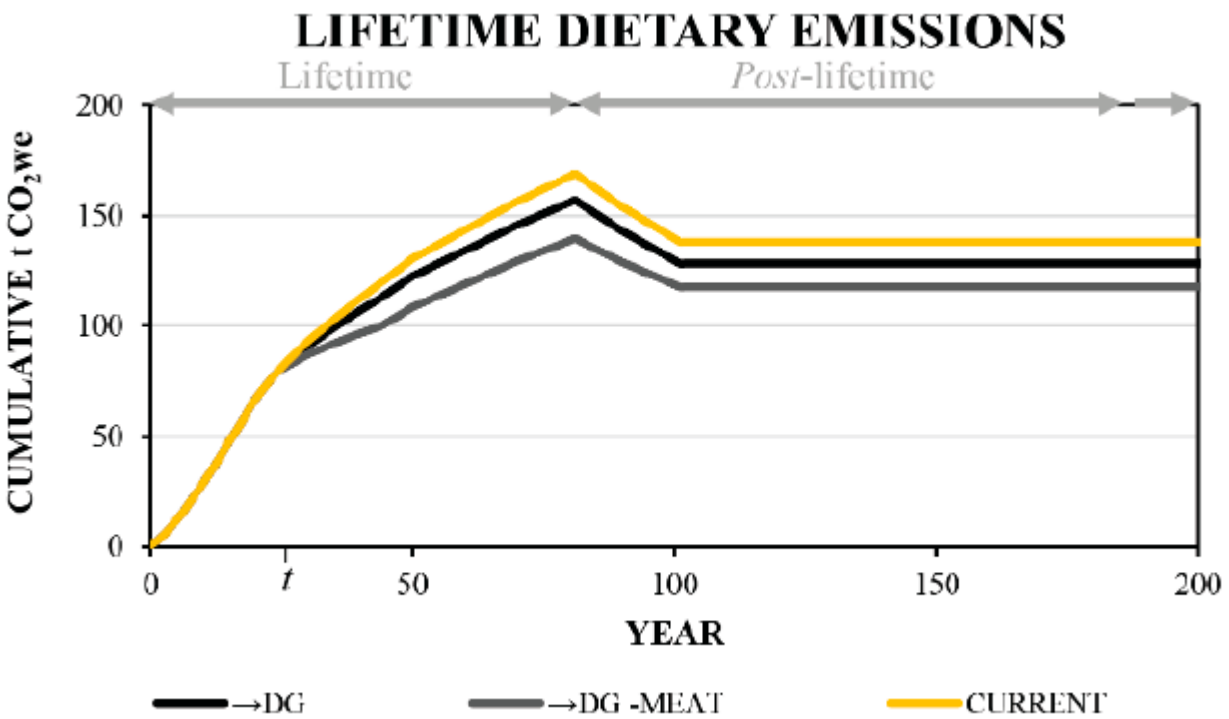
sustainability

MDPI

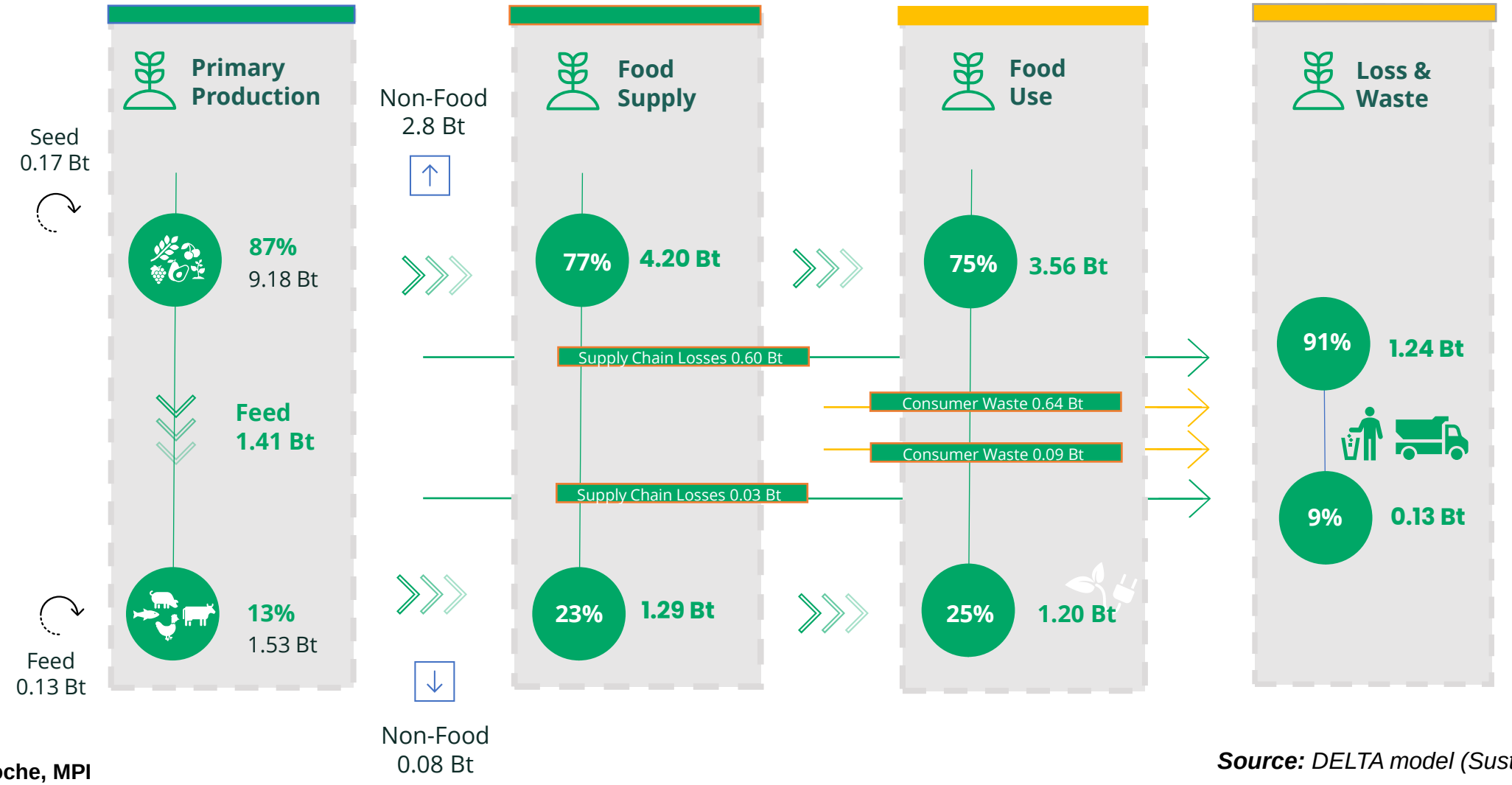
Article

Lifetime Climate Impacts of Diet Transitions: A Novel Climate Change Accounting Perspective

Jonathan E. Barnsley [1], Chanjief Chandrakumar [1], Carlos Gonzalez-Fischer [2], Paul E. Eme [1], Bridget E. P. Bourke [1], Nick W. Smith [3], Lakshmi A. Dave [3], Warren C. McNabb [3], Harry Clark [2], David J. Frame [4], John Lynch [5] and John R. Roche [1,6,*]

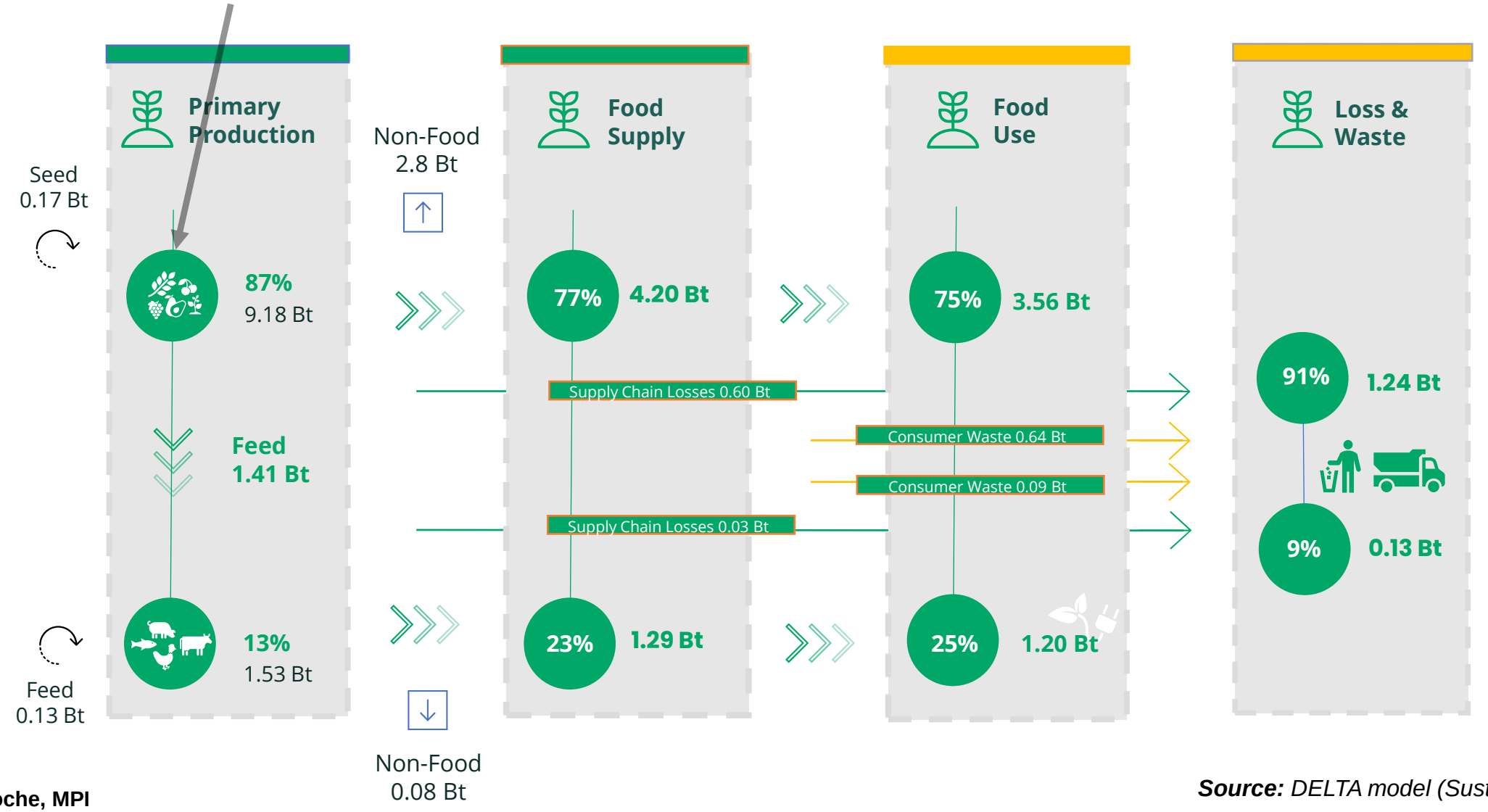


On calorie equivalent



Source: *DELTA model (Sustainable food initiative)*

87% food commodity mass leaving farm gate is plant-based



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87% food commodity mass leaving farm gate is plant-based

75% food commodity mass at consumption is plant-based

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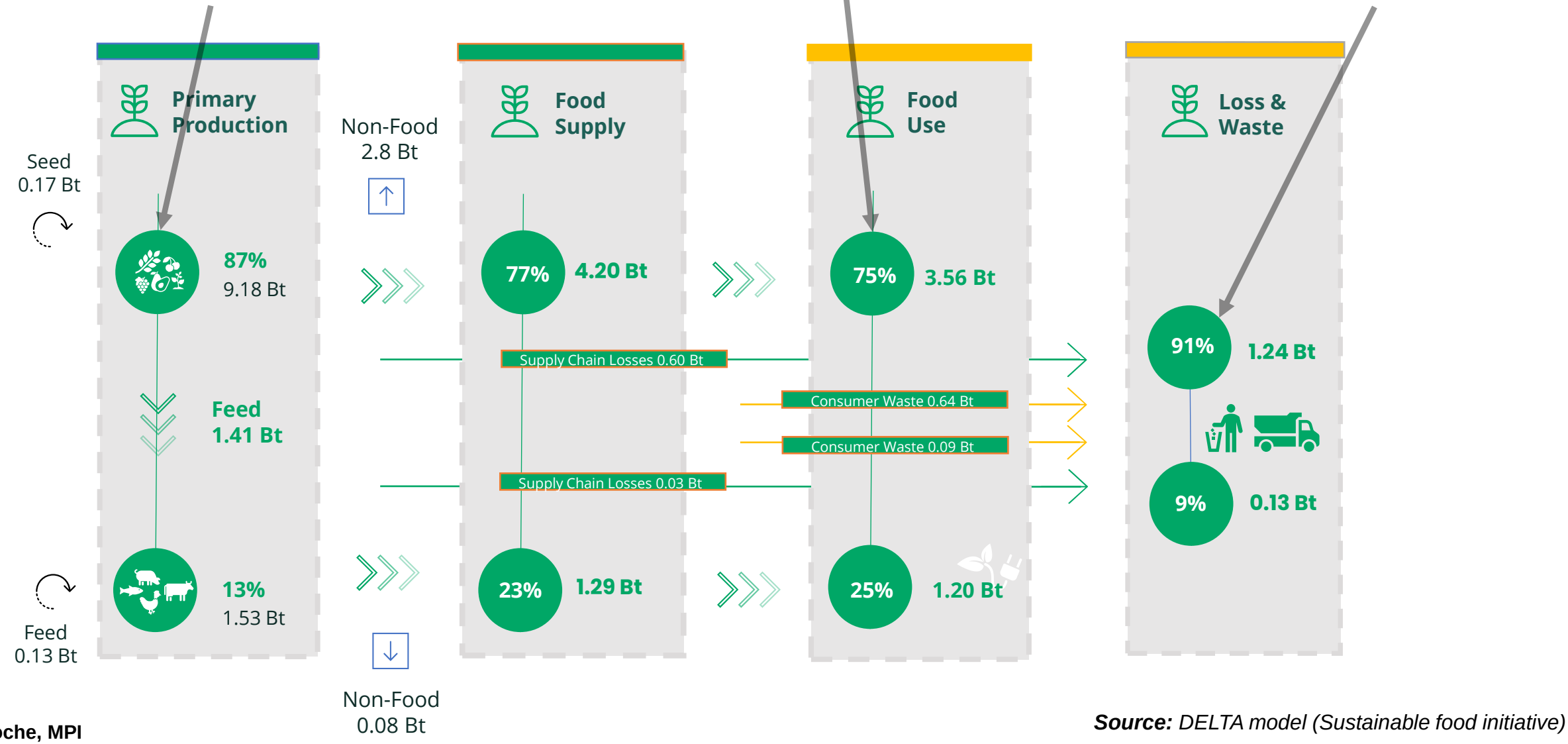
87% food commodity mass leaving farm gate is plant-based

75% food commodity mass at consumption is plant-based

91% of loss/waste is plant-based



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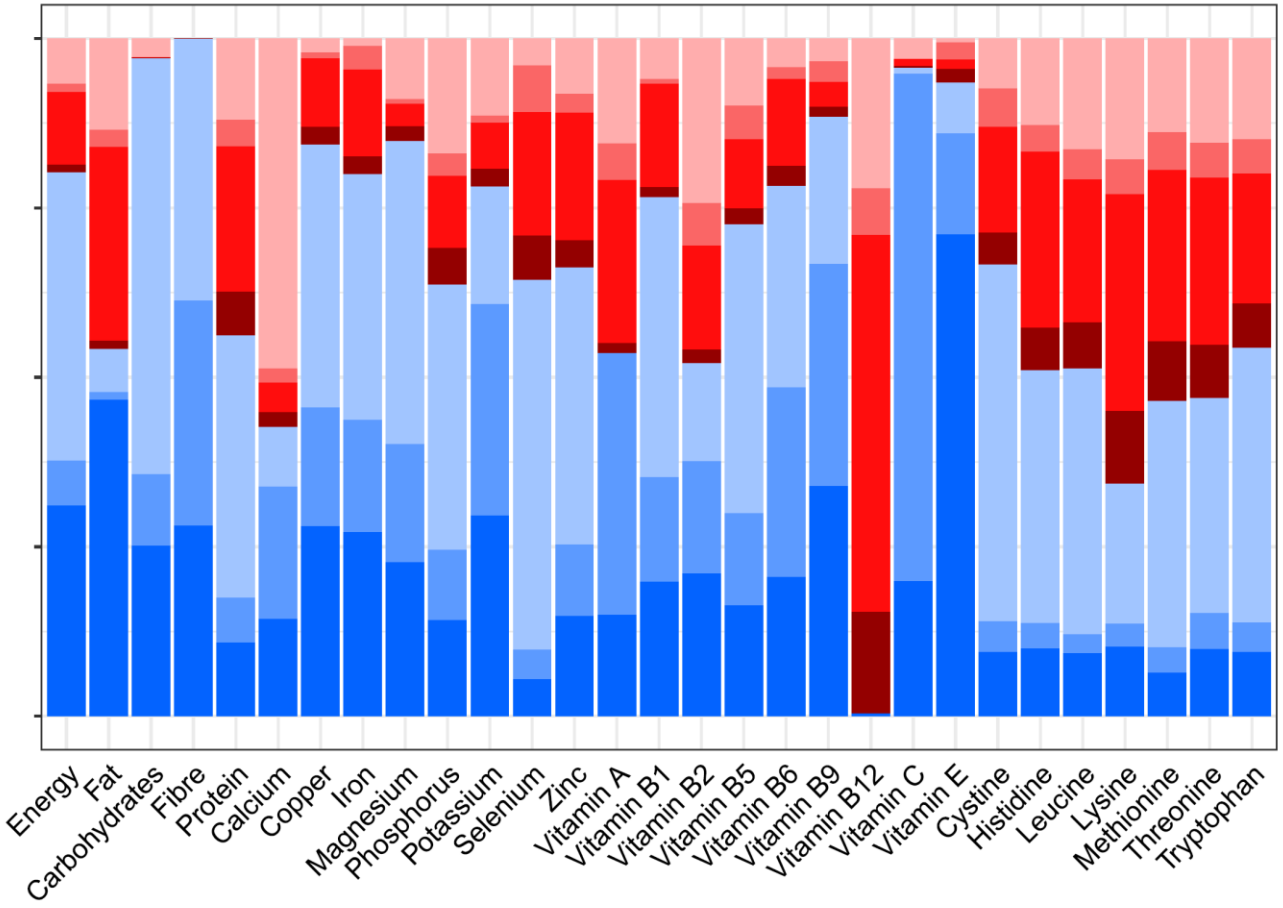
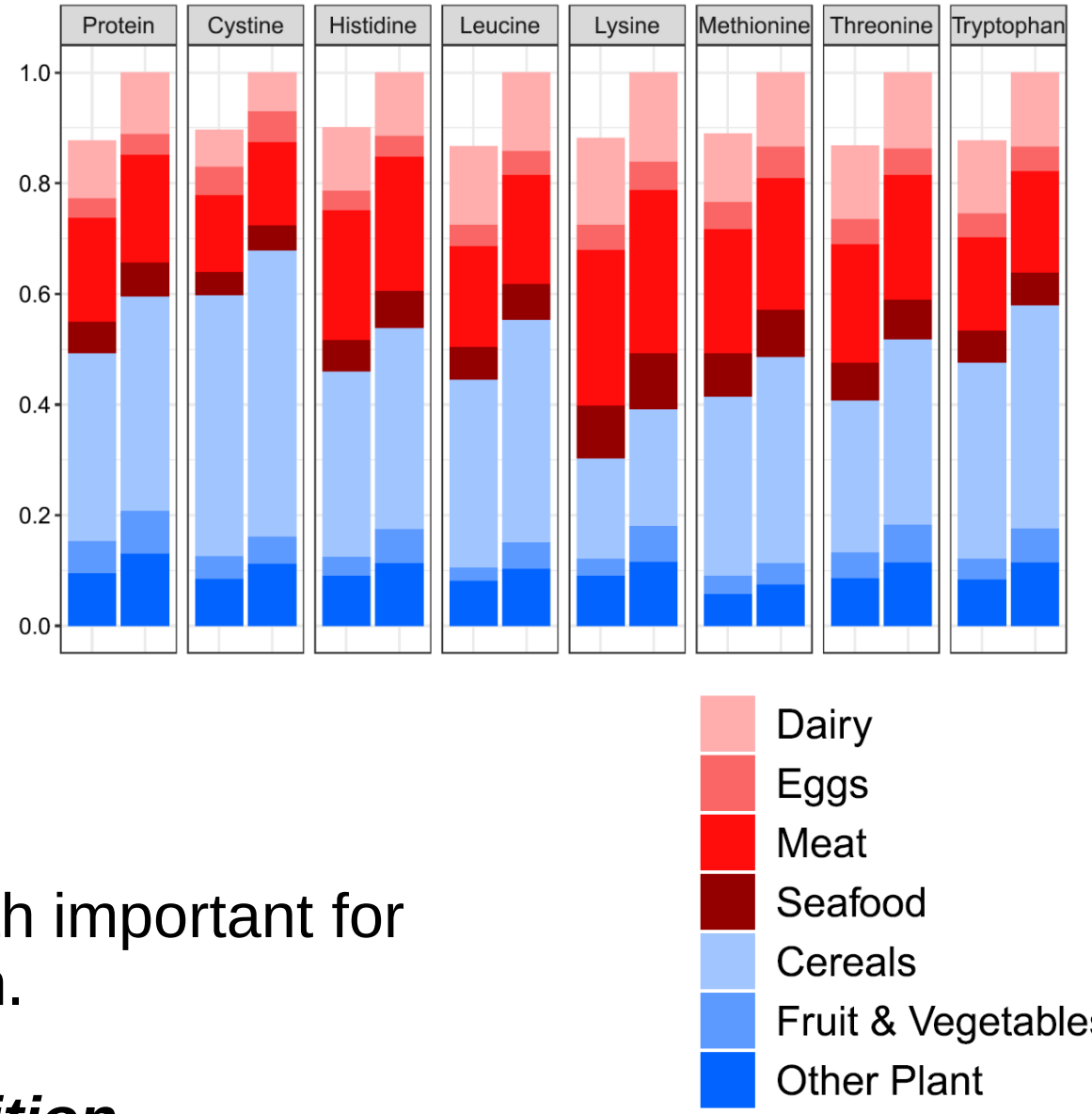
Global proportion of nutrients



Global Proportion of protein



Plant- and animal-sourced foods are both important for sustainable global nutrition.

Complimentary not ***Competition***

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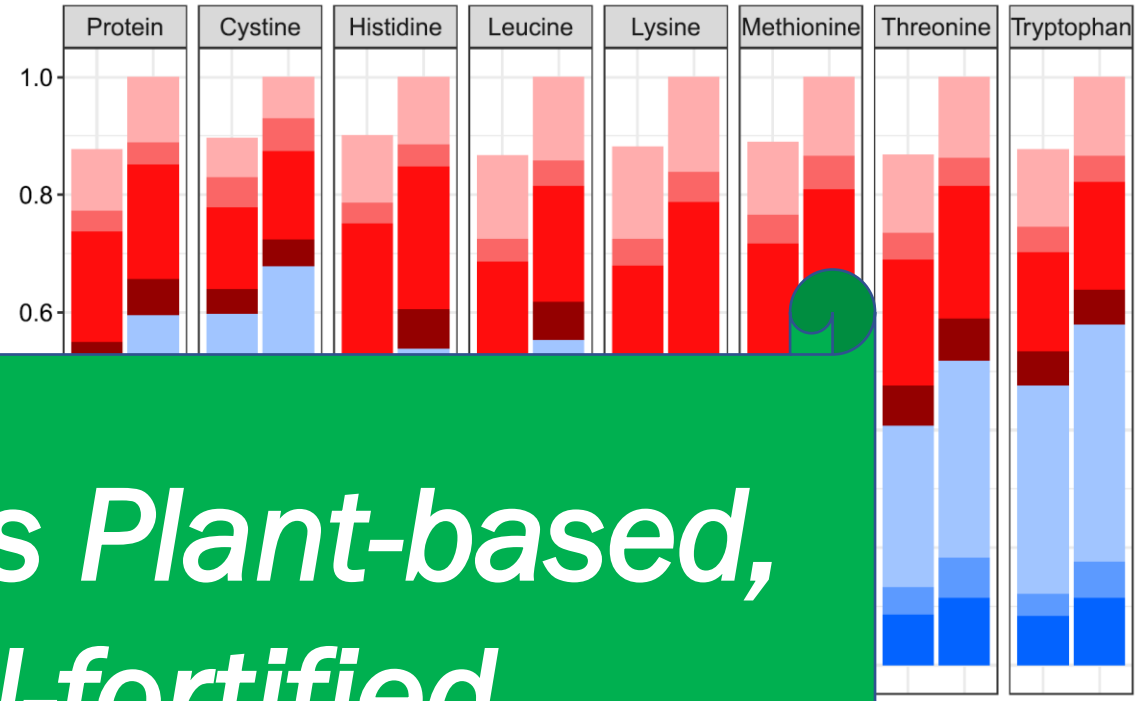
Global proportion of nutrients

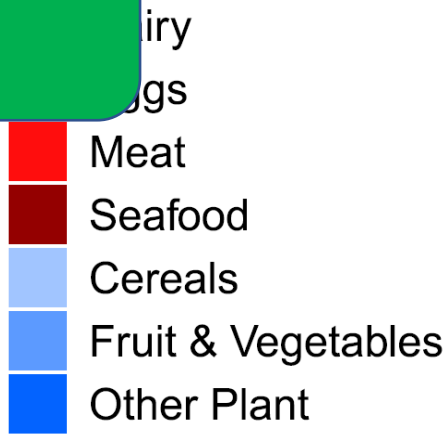
Global Proportion of protein



The world diet is Plant-based, but Animal-fortified

Plant- and animal-sourced foods are both important for sustainable global nutrition.

Complimentary not ***Competition***



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sustainability

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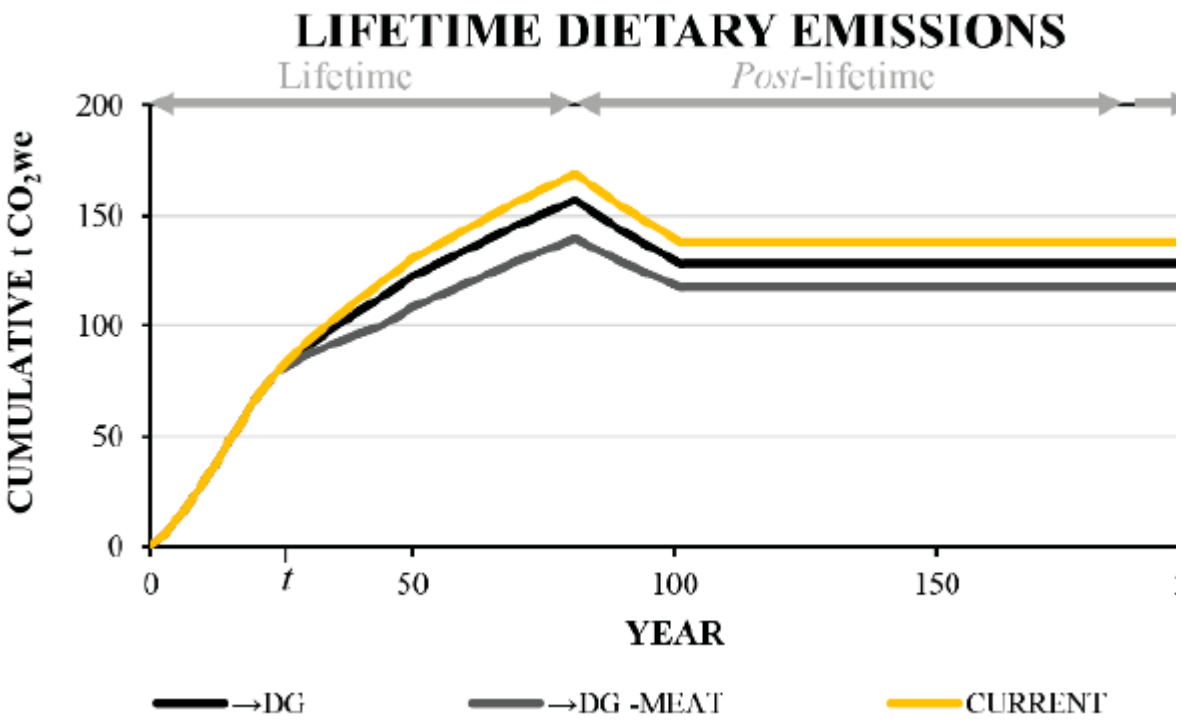

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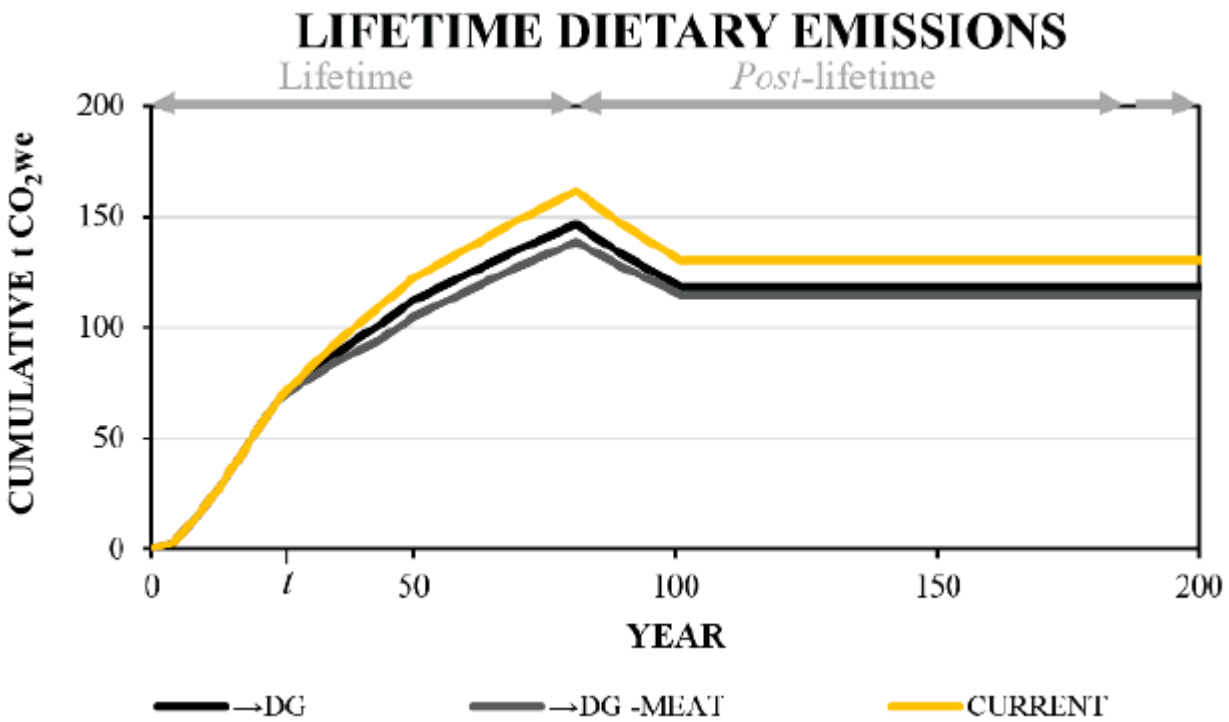


On protein equivalent

New Zealand's emissions reduction targets

Domestic

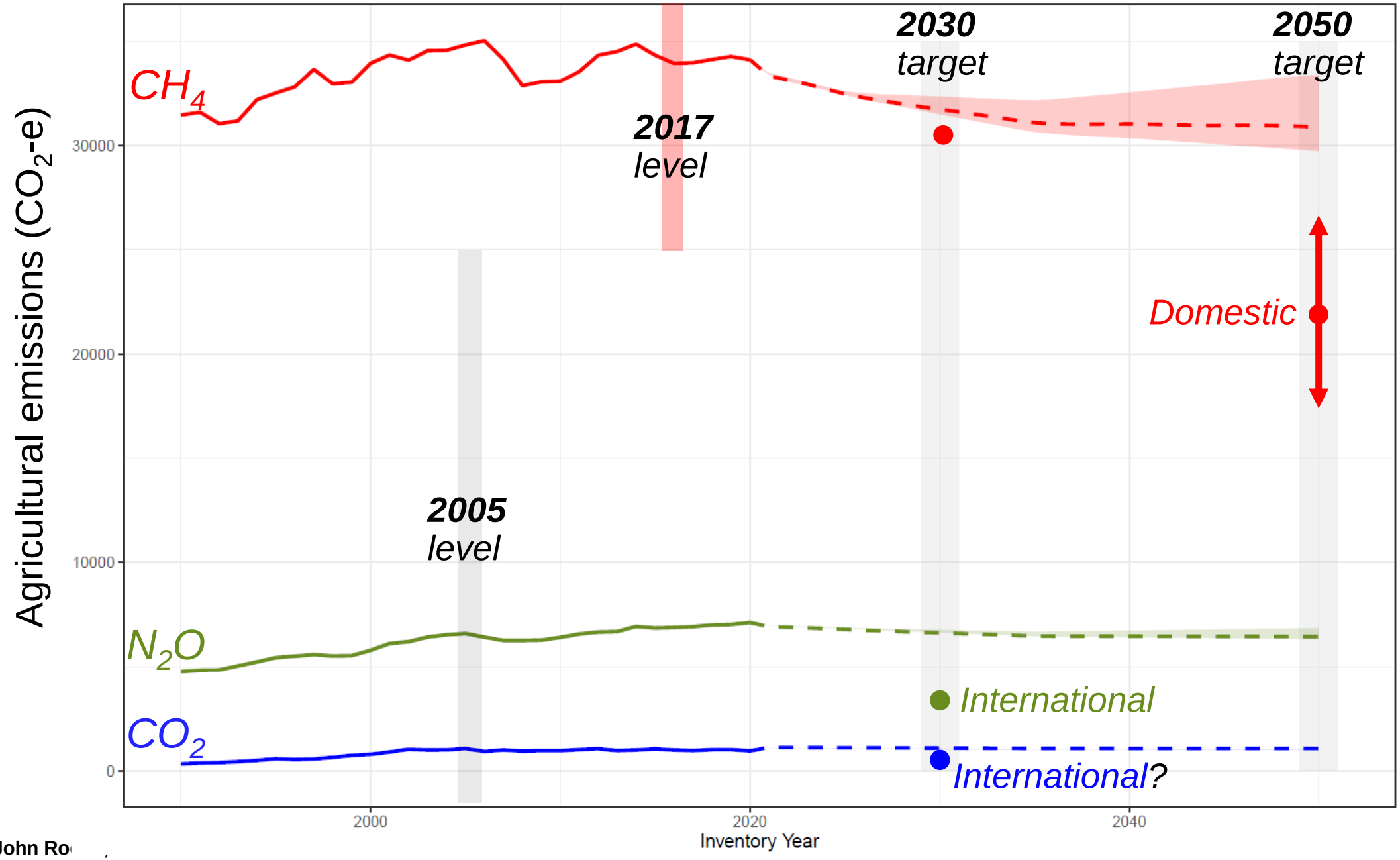
Climate Change Response (Zero Carbon) Amendment Act 2020

- Split-gas approach

- Long lived gases (carbon dioxide and nitrous oxide)
  - **net zero by 2050**

- Short lived gases (biogenic methane) to:
  - **10% below 2017 level by 2030;** and
  - **24-47% below 2017 levels by 2050**

New Zealand's emissions reduction targets



Fit for a Better World

This roadmap is designed to achieve, within a decade, ambitious targets for a more productive, sustainable and inclusive economy

Our primary sectors can lead across the three pillars of New Zealand's economic recovery to achieve these ambitious targets:

Productivity:

Add **$44 billion** in export earnings over the next decade via a focus on creating value and building off the strong position of our core sectors.

Sustainability:

Play our part in New Zealand's journey to a low emissions economy, by reducing biogenic methane to **24–47 percent below** 2017 levels by 2050, including to 10 percent below 2017 levels by 2030, and by restoring New Zealand's freshwater to a healthy state within a generation.

Inclusiveness:

Employ **10 percent more** Kiwis from **all** walks of life in the primary sector by 2030 and 10,000 more New Zealanders in the primary sector workforce over the next four years.

Budget 2022 recognised the urgent need to get tools into the hands of farmers faster

- Lack of mitigation options is a significant barrier to being able to respond effectively to pricing – particularly for the beef, sheep, and deer sectors
- Budget 2022 allocated $338m (and approximately $120m in outyears) to create a strong system that gets solutions in the hands of farmers faster
- Funded activities correspond to focus area 2 of the agriculture chapter of the Emissions Reduction Plan
- Key action within this is the establishment of the Centre for Climate Action on Agricultural Emissions

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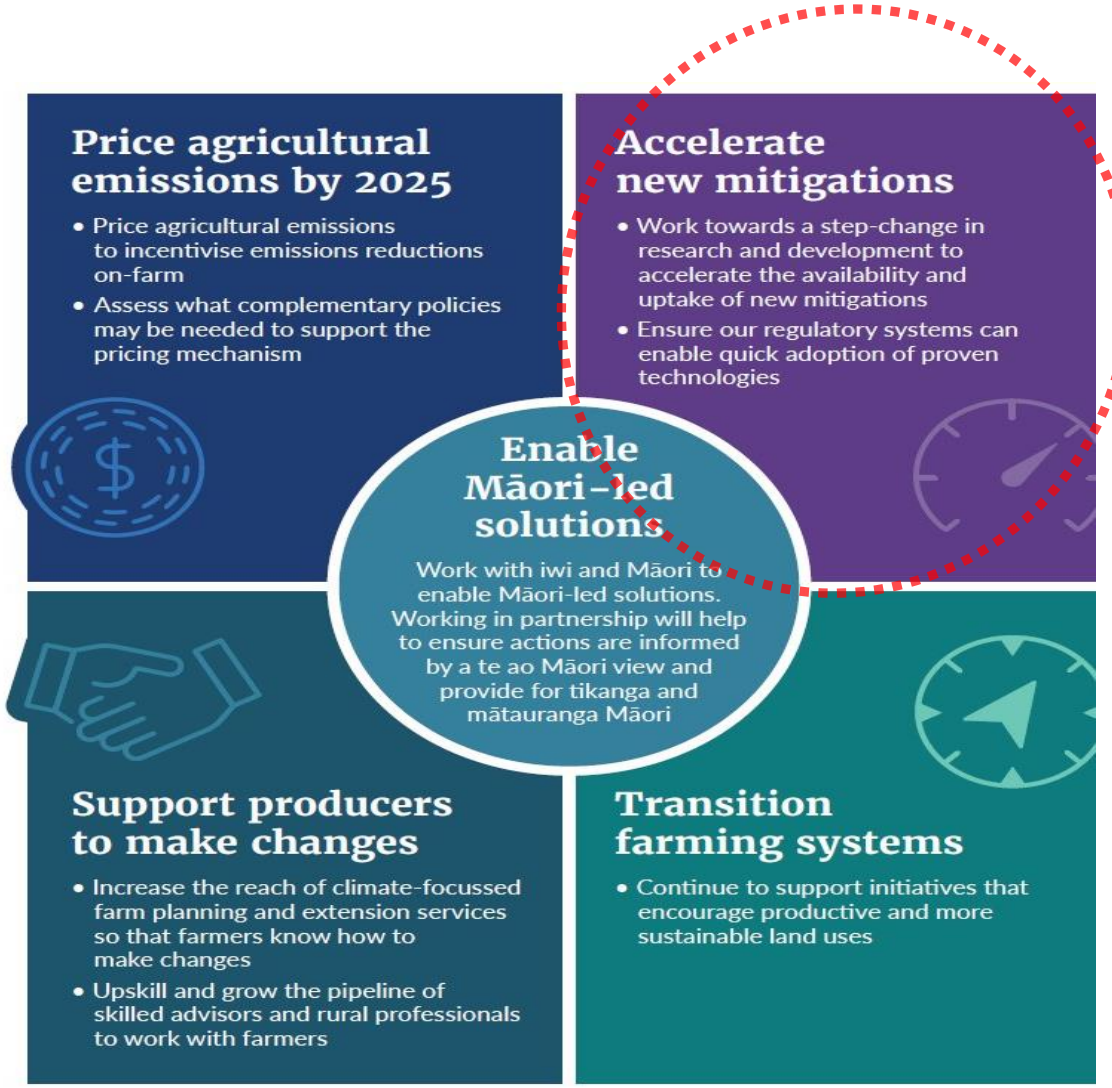

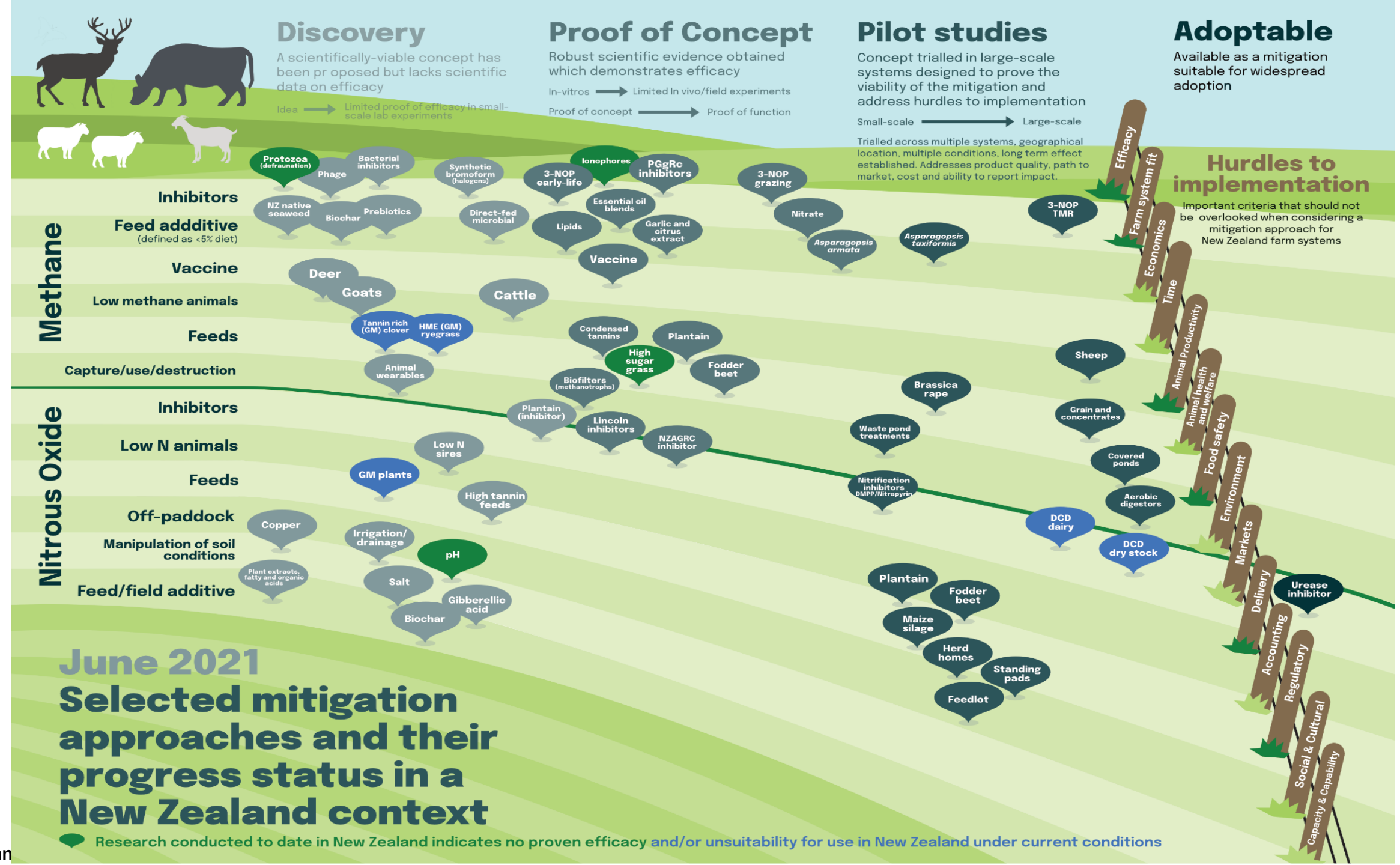
Discovery
A scientifically-viable concept has been pr oposed but lacks scientific data on efficacy
Idea → Limited proof of efficacy in small-scale lab experiments
Proof of Concept
Robust scientific evidence obtained which demonstrates efficacy
In-vitros → Limited In vivo/field experiments
Proof of concept → Proof of function
Pilot studies
Concept trialled in large-scale systems designed to prove the viability of the mitigation and address hurdles to implementation
Small-scale → Large-scale
Trialled across multiple systems, geographical location, multiple conditions, long term effect established. Addresses product quality, path to market, cost and ability to report impact.
Adoptable
Available as a mitigation suitable for widespread adoption
Hurdles to implementation
Important criteria that should not be overlooked when considering a mitigation approach for New Zealand farm systems
Efficacy
Farm system fit
Economics
Time
Animal Productivity
Animal health and welfare
Food safety
Environment
Markets
Delivery
Accounting
Regulatory
Social & Cultural
Capacity & Capability
Methane
Inhibitors
Feed addditive (defined as <5% diet)
Vaccine
Low methane animals
Feeds
Capture/use/destruction
Nitrous Oxide
Inhibitors
Low N animals
Feeds
Off-paddock
Manipulation of soil conditions
Feed/field additive
Protozoa (defraunation)
Phage
Bacterial inhibitors
NZ native seaweed
Biochar
Prebiotics
Synthetic bromoform (halogens)
Direct-fed microbial
Ionophores
PGgRc inhibitors
3-NOP early-life
Essential oil blends
Lipids
Garlic and citrus extract
Vaccine
3-NOP grazing
Nitrate
Asparagopsis armata
Asparagopsis taxiformis
3-NOP TMR
Deer
Goats
Cattle
Tannin rich (GM) clover
HME (GM) ryegrass
Animal wearables
Condensed tannins
Plantain
High sugar grass
Fodder beet
Biofilters (methanotrophs)
Plantain (inhibitor)
Lincoln inhibitors
NZAGRC inhibitor
Brassica rape
Waste pond treatments
Nitrification inhibitors DMPP/Nitrapyrin
Sheep
Grain and concentrates
Covered ponds
Aerobic digestors
DCD dairy
DCD dry stock
Low N sires
GM plants
High tannin feeds
Copper
Plant extracts, fatty and organic acids
Irrigation/ drainage
pH
Salt
Gibberellic acid
Biochar
Plantain
Fodder beet
Maize silage
Herd homes
Standing pads
Feedlot
Urease inhibitor
June 2021
Selected mitigation approaches and their progress status in a New Zealand context
Research conducted to date in New Zealand indicates no proven efficacy and/or unsuitability for use in New Zealand under current conditions

Mitigation options for agriculture in New Zealand

Technology	When available	Maximum efficacy
Low-emitting sheep (methane)	2-3 years	10 %?
Low-emitting cattle (methane)	> 5 years	10 %?
Low N excreting cattle	Now in theory	?
Methane vaccine	> 10 years	30 %?
Methane inhibitors	2-5 years	30+ %
Nitrification inhibitors	3-5 years	50+ %
Low emission feeds (e.g., forage rape, fodder beet, plantain)	Available now	?
Novel low emitting feeds/additives (e.g., seaweed, DFMs)	?	?
Animal devices (e.g., methane capture/destruction)	?	?
Manure management approaches	Now	Depends
Herd management (e.g., off paddock housing)	Now	Depends

Questions?