Ministry for Primary Industries
Manatū Ahu Matua

ON FARM SUPPORT TEAM

Sustainable food systems – the place for a balanced diet in mitigating greenhouse gases

John Roche,
Chief Science Adviser, &
Director, On-Farm support
Ministry for Primary Industries

Kaitohutohu Mātanga Pūtaiao Matua, me
Te Pou Whakahaere, Mahi Ahuwhehua
Manatū Ahu Matua

NZAGRC, 28th February 2023

Sustainable food systems

achieving food and nutrition security today contributes to food and nutrition security for future generations

- FAO

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Climate Change and Food Systems

Sonja J. Vermeulen,[1,2] Bruce M. Campbell,[2,3] and John S.I. Ingram[4,5]

[1]Department of Plant and Environmental Sciences, University of Copenhagen, Frederiksberg C, DK-1958, Denmark

[2]Consortium of International Agricultural Research Centers Research Program on Change, Agriculture and Food Security, Frederiksberg C, DK-1958, Denmark; email: s.vermeulen@cgiar.org, b.campbell@cgiar.org

[3]International Center for Tropical Agriculture (CIAT), Cali, Colombia

[4]Environmental Change Institute, University of Oxford, Oxford OX1 3QY, United Kingdom; email: john.ingram@eci.ox.ac.uk

[5]Natural Environment Research Council, Swindon SN2 1EU, United Kingdom

Table 1 Estimates of the relative contributions of different stages of the food chain to global greenhouse gas emissions

Stage of food chain[a]		Emissions ($MtCO_2e$)[b]
Preproduction	Fertilizer manufacture	282–575
	Energy use in animal feed production	60
	Pesticide production	3–140
Production	Direct emissions from agriculture	5,120–6,116
	Indirect emissions from agriculture	2,198–6,567
Postproduction[c]	Primary and secondary processing	192
	Storage, packaging, and transport	396
	Refrigeration	490
	Retail activities	224
	Catering and domestic food management	160
	Waste disposal	72

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Stage of food chain[a]		Emissions ($MtCO_2e$)[b]
Preproduction ~1-1.5%	Fertilizer manufacture	282–575
	Energy use in animal feed production	60
	Pesticide production	3–140
Production 15-25%	Direct emissions from agriculture	5,120–6,116
	Indirect emissions from agriculture	2,198–6,567
Postproduction[c] ~3%	Primary and secondary processing	192
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Globally,

- **food system is responsible for 20-30% of anthropogenic GHG emissions;**
- **agriculture sector accounts for about 15-25% of anthropogenic GHG emissions;**
- **IPCC estimates that 50% of total agricultural emissions are non-CO_2 GHGs (i.e., methane [CH_4] and nitrous oxide [N_2O])**

Corporate Pledges to meet warming neutrality

Nestlé

20% emissions reduction by 2025, 50% by 2030, and
Net Zero emissions by 2040 [at the latest]

JBS FOODS

net-zero greenhouse gas emissions by 2040

DANONE
ONE PLANET. ONE HEALTH

reduce absolute methane emissions from its fresh milk supply chain by 30% by 2030

Cargill

reduce supply chain emissions by 30% by 2030

KraftHeinz

emissions reduction of 50% by 2030 across all Scope 1, 2 & 3

net zero greenhouse gas (“GHG”) emissions across its operational footprint (Scope 1 and Scope 2) and entire global supply chain (Scope 3) by 2050

Avoiding meat and dairy is 'single biggest way' to reduce your impact on Earth

The Guardian

Biggest analysis to date reveals huge footprint of livestock - it provides just 18% of calories but takes up 83% of farmland

Damian Carrington
Environment editor
@dpcarrington

Thu 31 May 2018 19.00 BST

The Guardian

Avoiding meat and dairy is 'single biggest way' to reduce your impact on Earth

Biggest analysis to date reveals huge footprint of livestock - it provides just 18% of calories but takes up 83% of farmland

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- Without meat and dairy consumption, global farmland use could be reduced by more than 75% – an area equivalent to the U.S., China, the European Union and Australia combined – and still feed the world.
- "*A vegan diet is probably the single biggest way to reduce your impact on planet Earth*"

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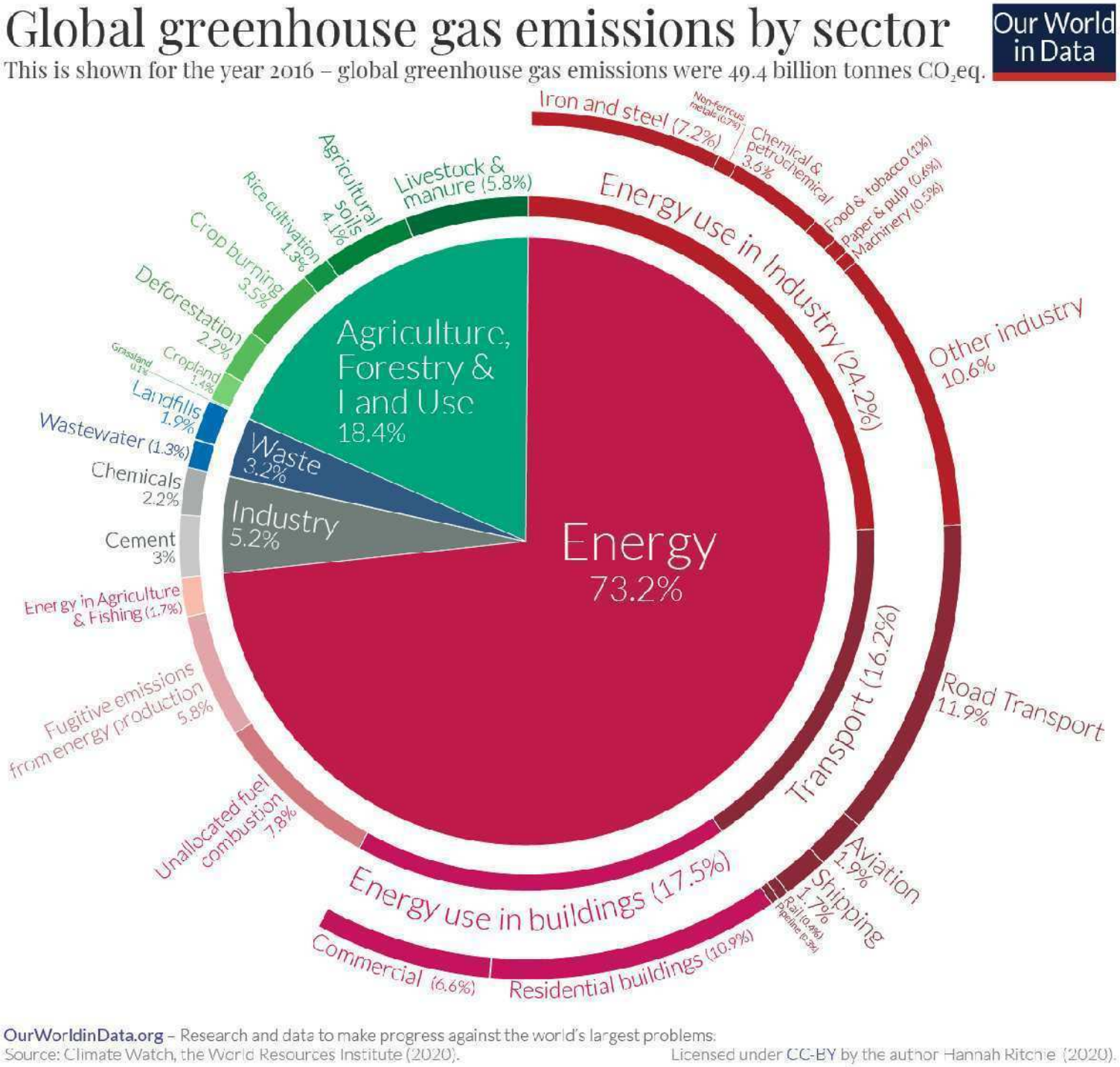
Share of GHG

	%
• Energy	73.2
• Agriculture	18.4
• Industry	5.2
• Waste	3.2



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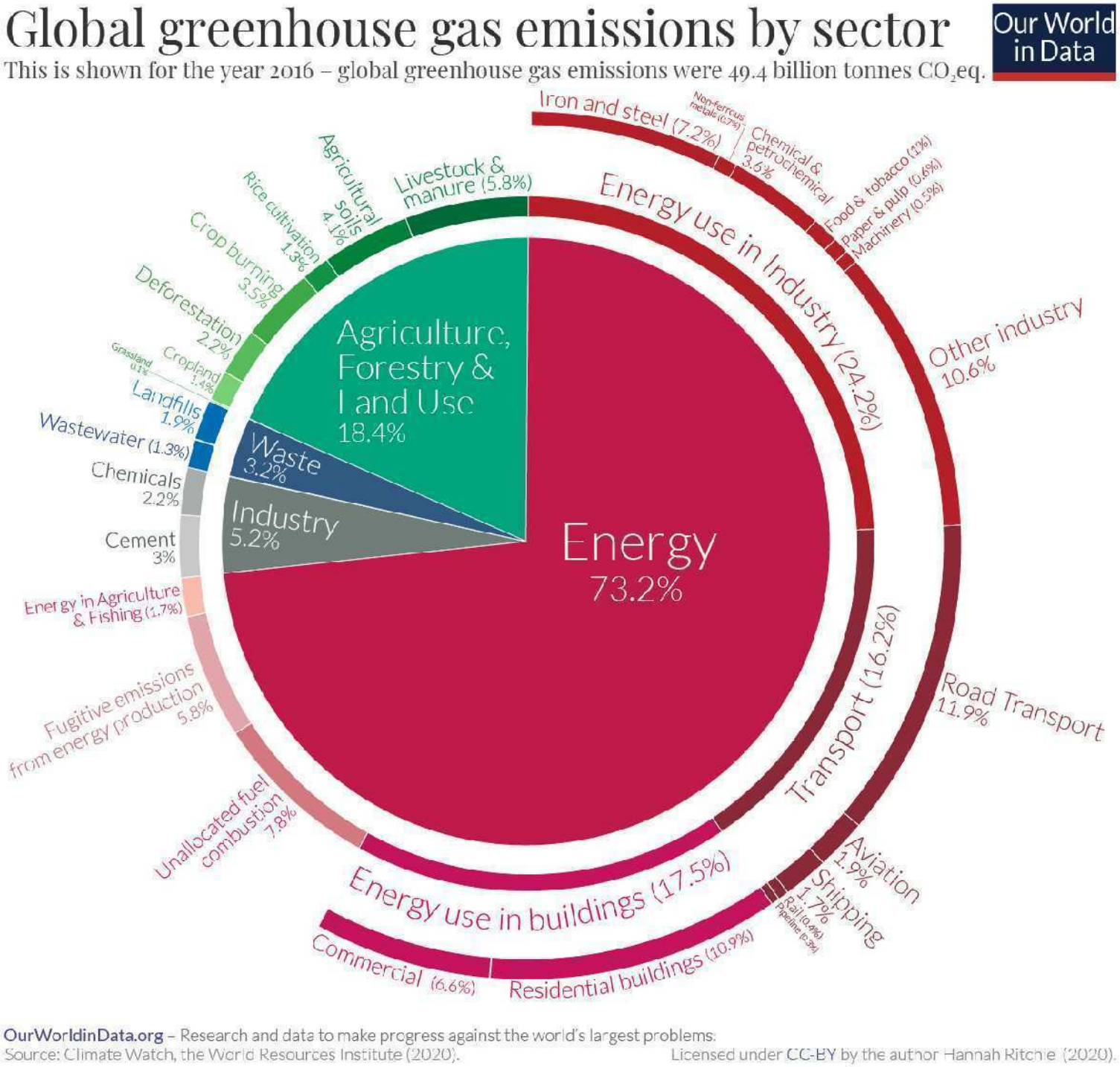
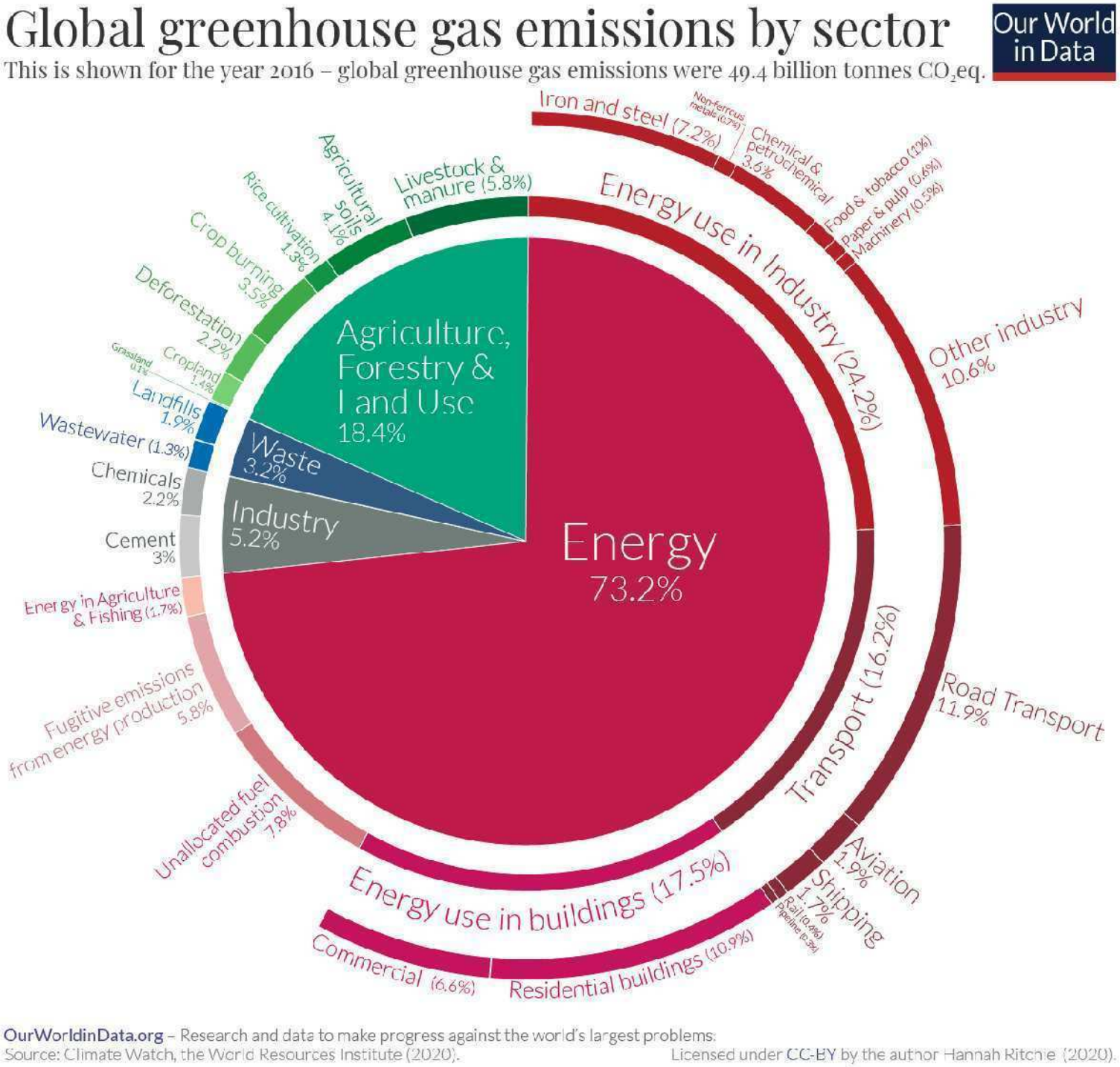


Share of GHG

	%
Agriculture	18.4
• Grassland	0.1
• Cropland	1.4
• Deforestation	2.2
• Crop burning	3.5
• Rice cultivation	1.3
• Agric soils	4.1
• Livestock	5.8

(incl manure)



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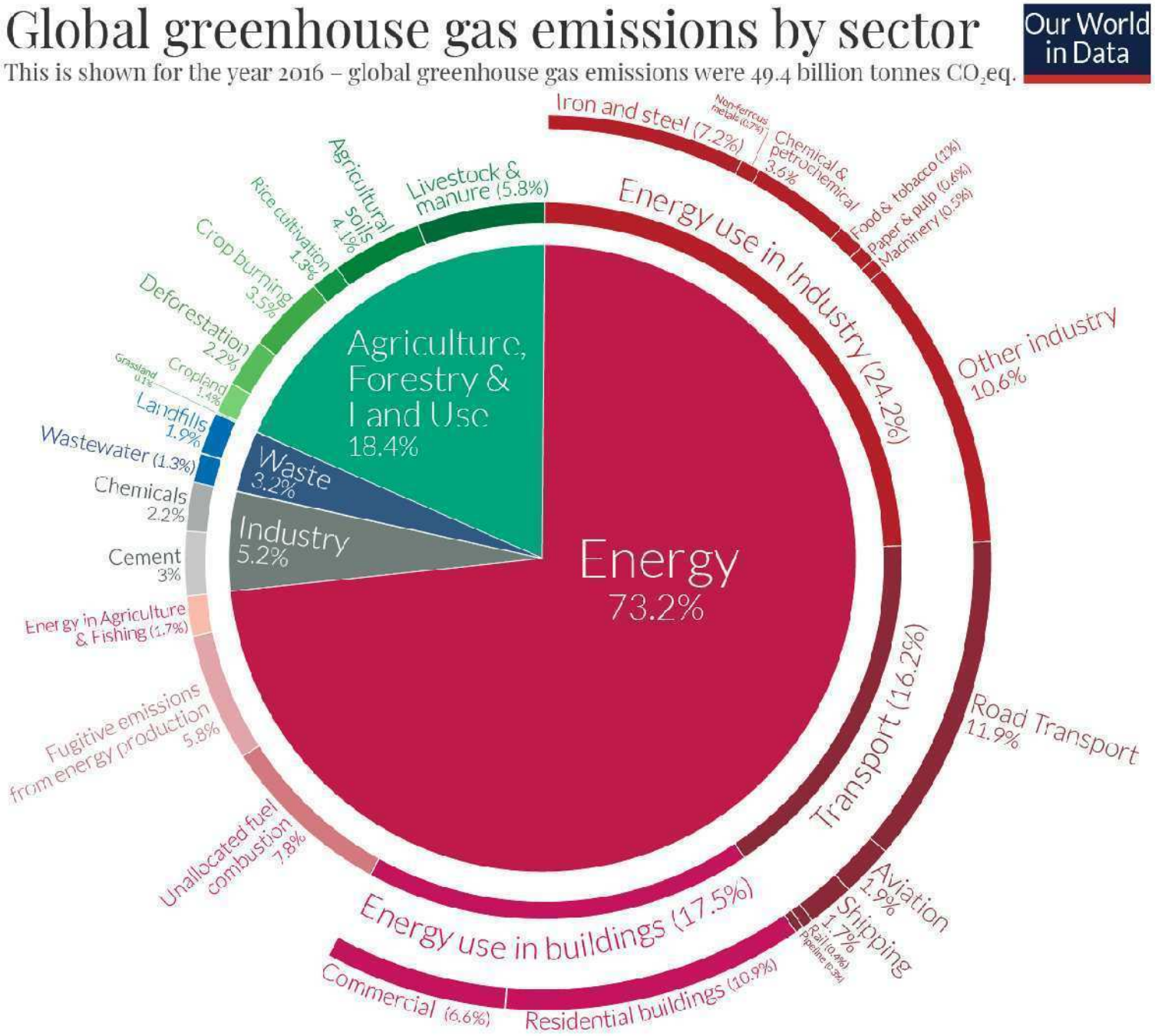
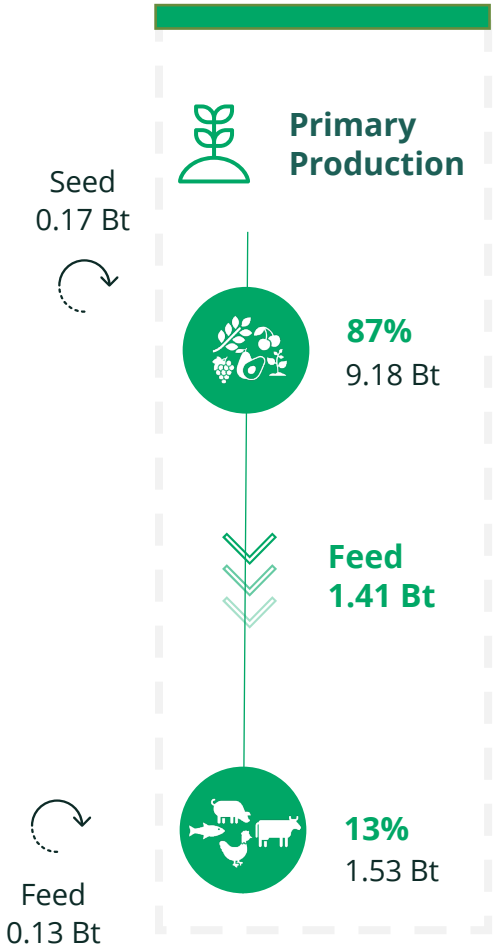
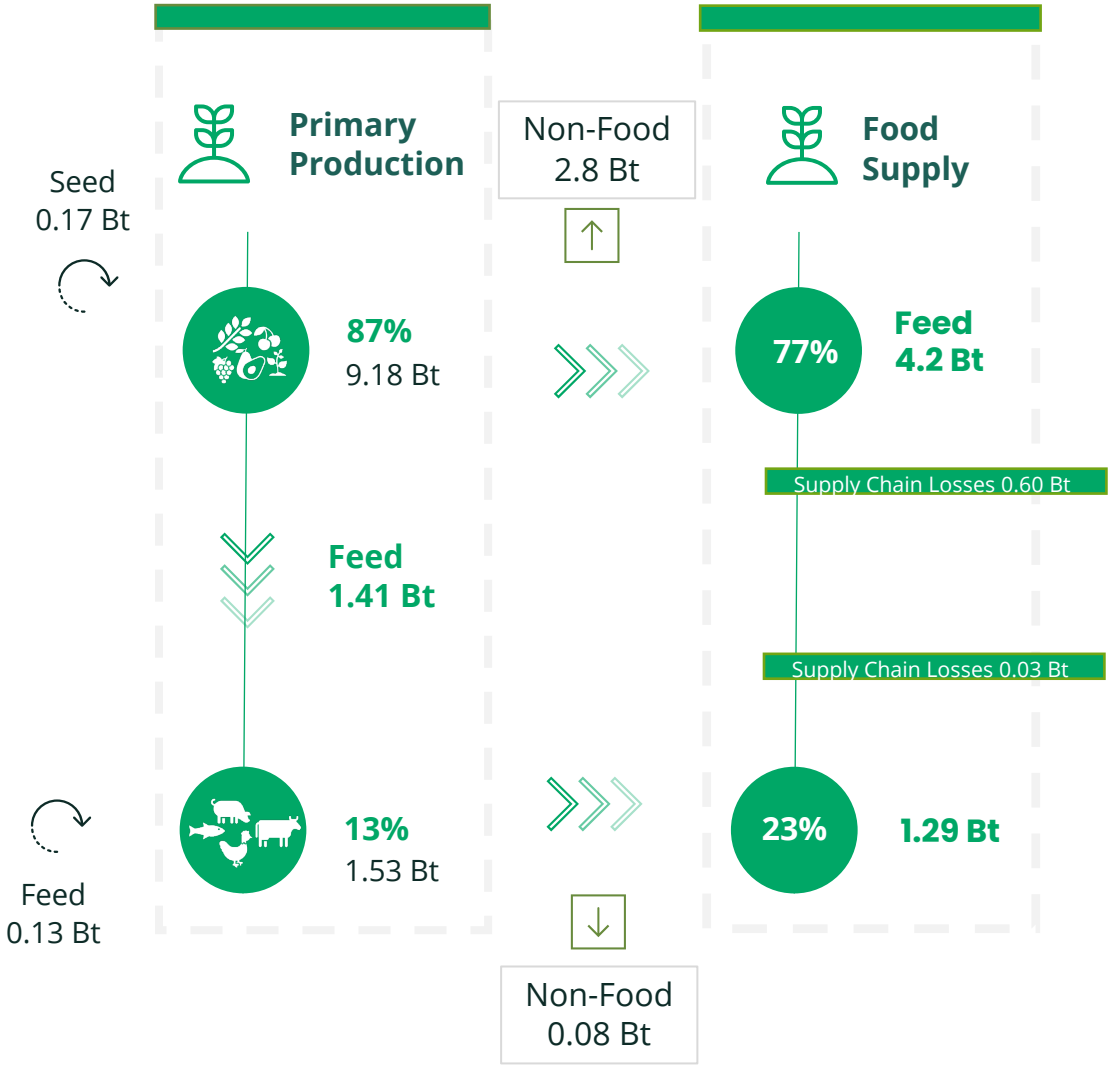


Nutrition

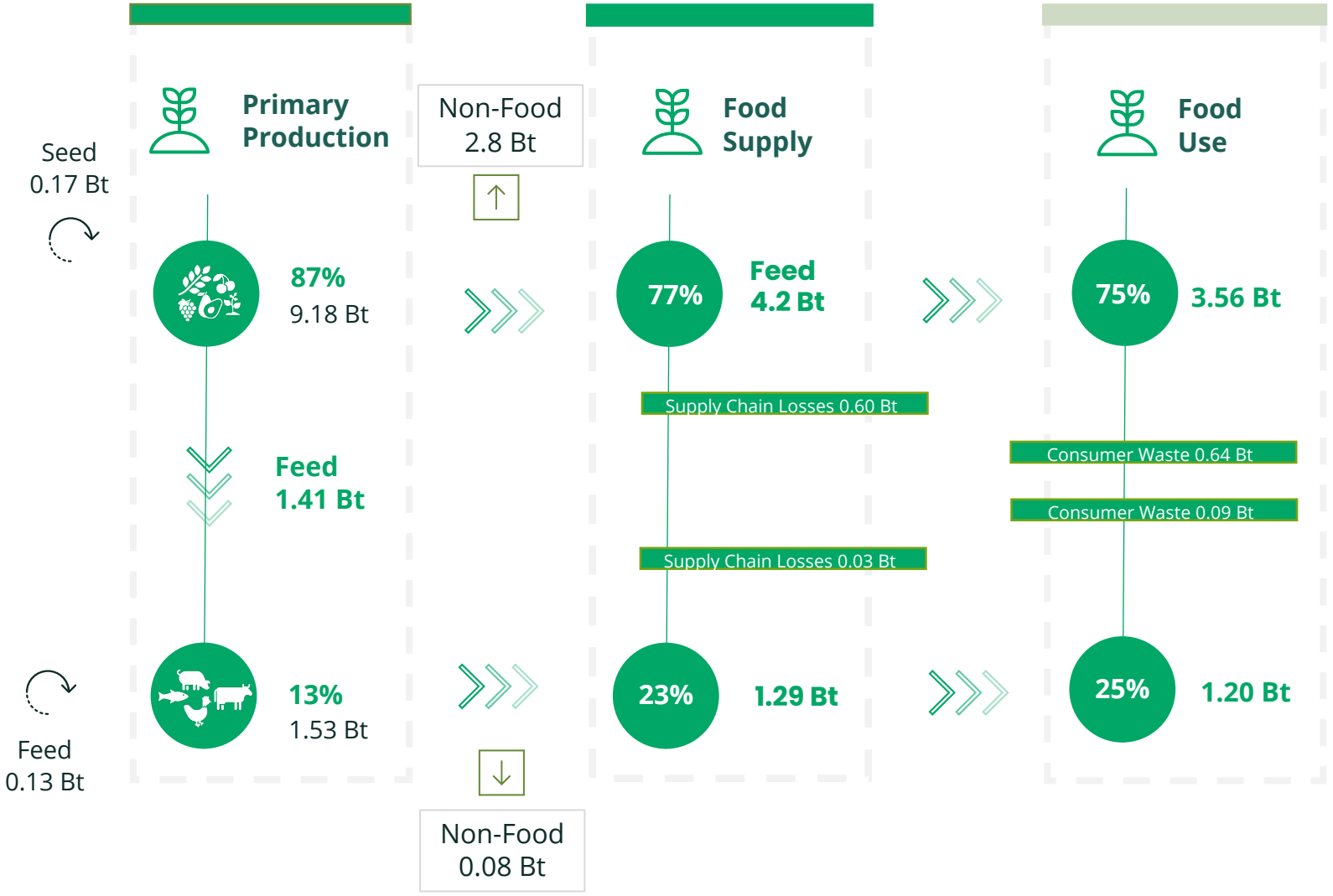
Mass flows


Primary Production
Seed
0.17 Bt
87%
9.18 Bt
Feed
1.41 Bt
13%
1.53 Bt
Feed
0.13 Bt

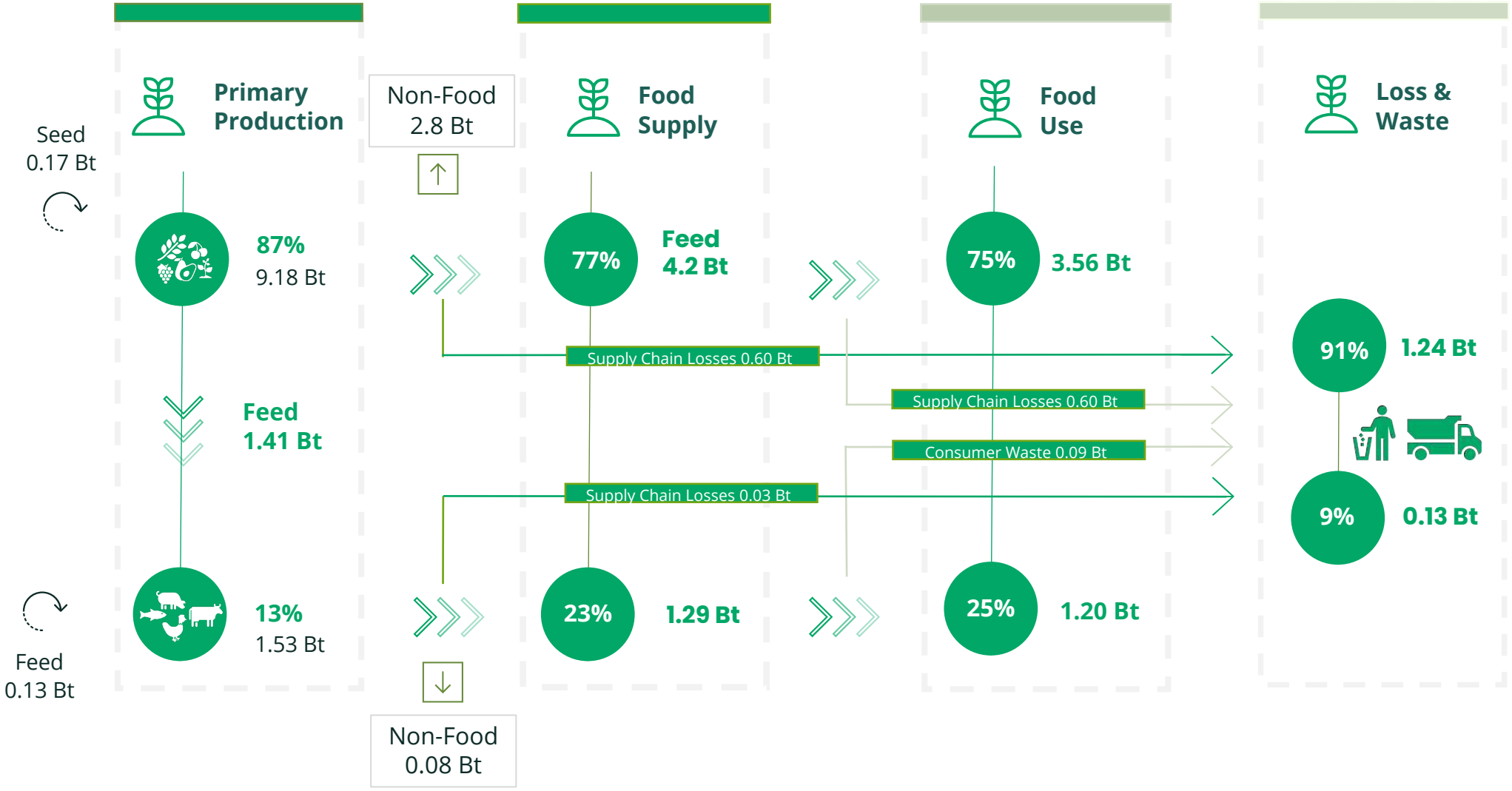
Mass flows


Primary Production
Non-Food 2.8 Bt
Food Supply
Seed 0.17 Bt
87% 9.18 Bt
77%
Feed 4.2 Bt
Supply Chain Losses 0.60 Bt
Feed 1.41 Bt
Supply Chain Losses 0.03 Bt
13% 1.53 Bt
23%
1.29 Bt
Feed 0.13 Bt
Non-Food 0.08 Bt

Mass flows


Primary Production
Non-Food 2.8 Bt
Food Supply
Food Use
Seed 0.17 Bt
87% 9.18 Bt
77%
Feed 4.2 Bt
75% 3.56 Bt
Supply Chain Losses 0.60 Bt
Consumer Waste 0.64 Bt
Feed 1.41 Bt
Consumer Waste 0.09 Bt
Supply Chain Losses 0.03 Bt
13% 1.53 Bt
23% 1.29 Bt
25% 1.20 Bt
Feed 0.13 Bt
Non-Food 0.08 Bt

Mass flows


Primary Production
Non-Food 2.8 Bt
Food Supply
Food Use
Loss & Waste
Seed 0.17 Bt
87% 9.18 Bt
Feed 1.41 Bt
13% 1.53 Bt
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77% Feed 4.2 Bt
75% 3.56 Bt
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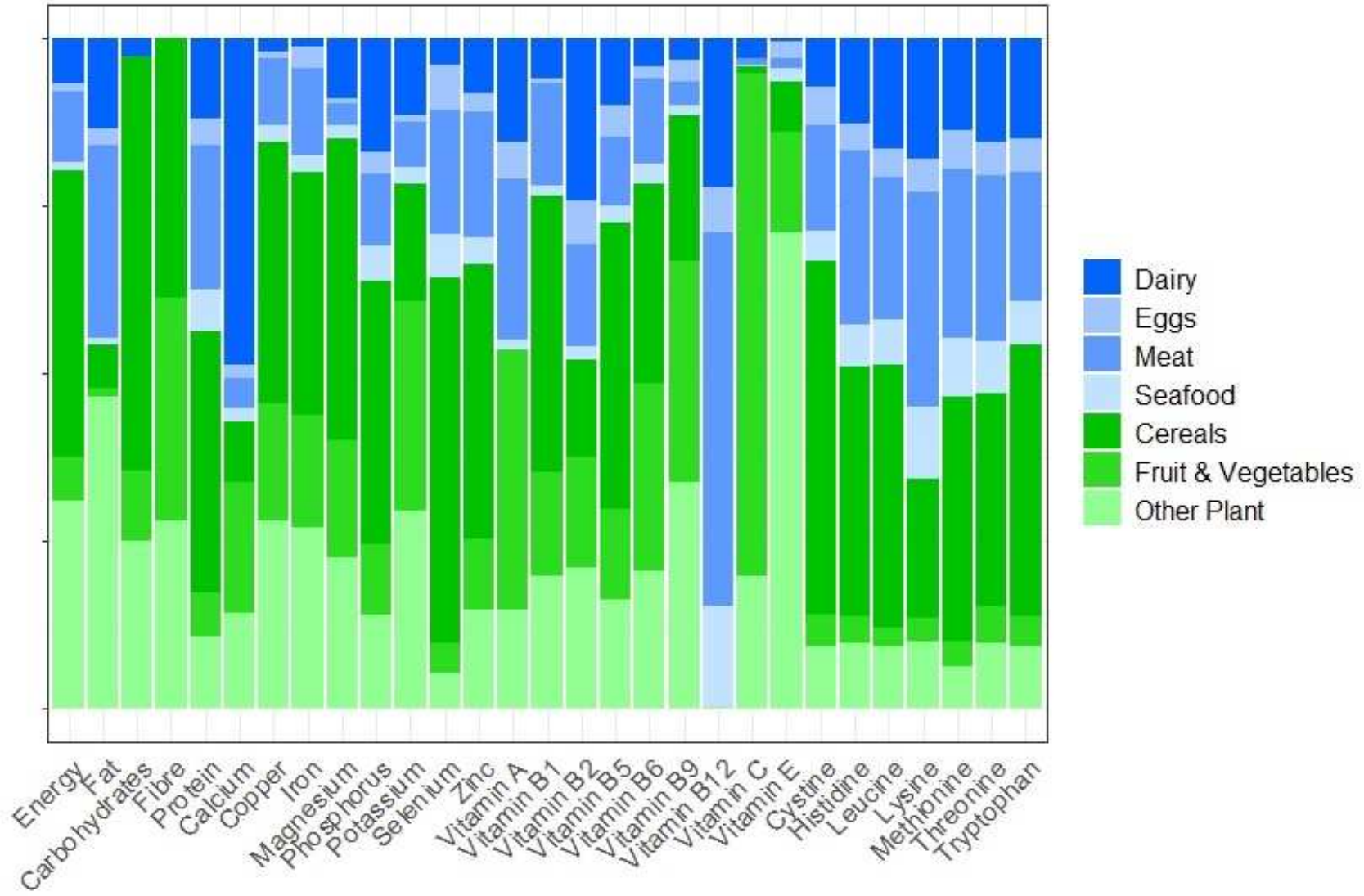
23% 1.29 Bt
25% 1.20 Bt
91% 1.24 Bt
9% 0.13 Bt
Non-Food 0.08 Bt

Nutrient sources



Smith et al. 2021 *Animal Production Science*


But, what about atmospheric warming?

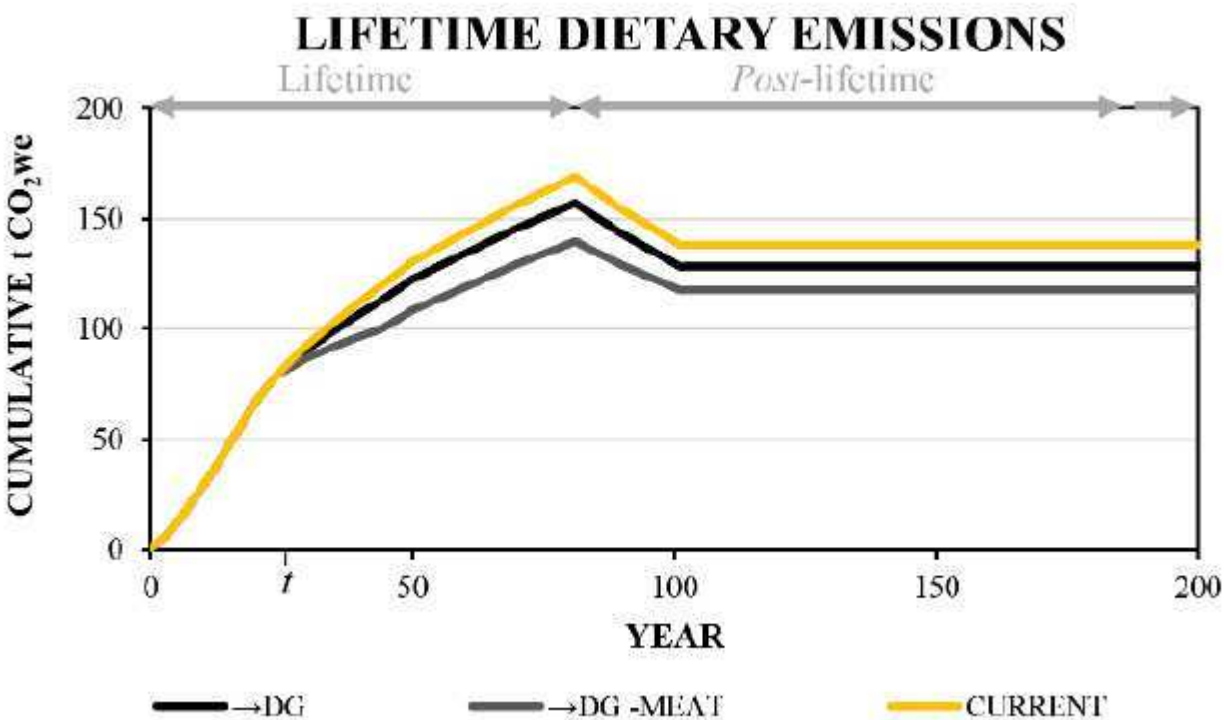
sustainability

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 equivalency

sustainability

MDPI

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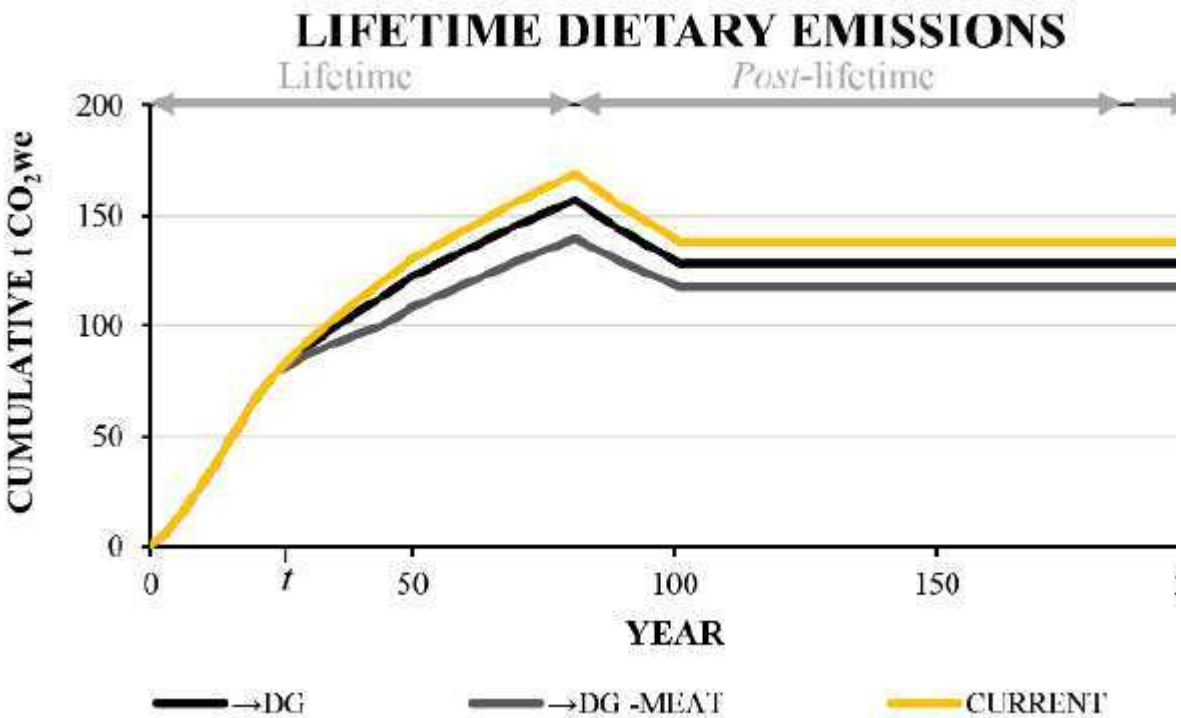
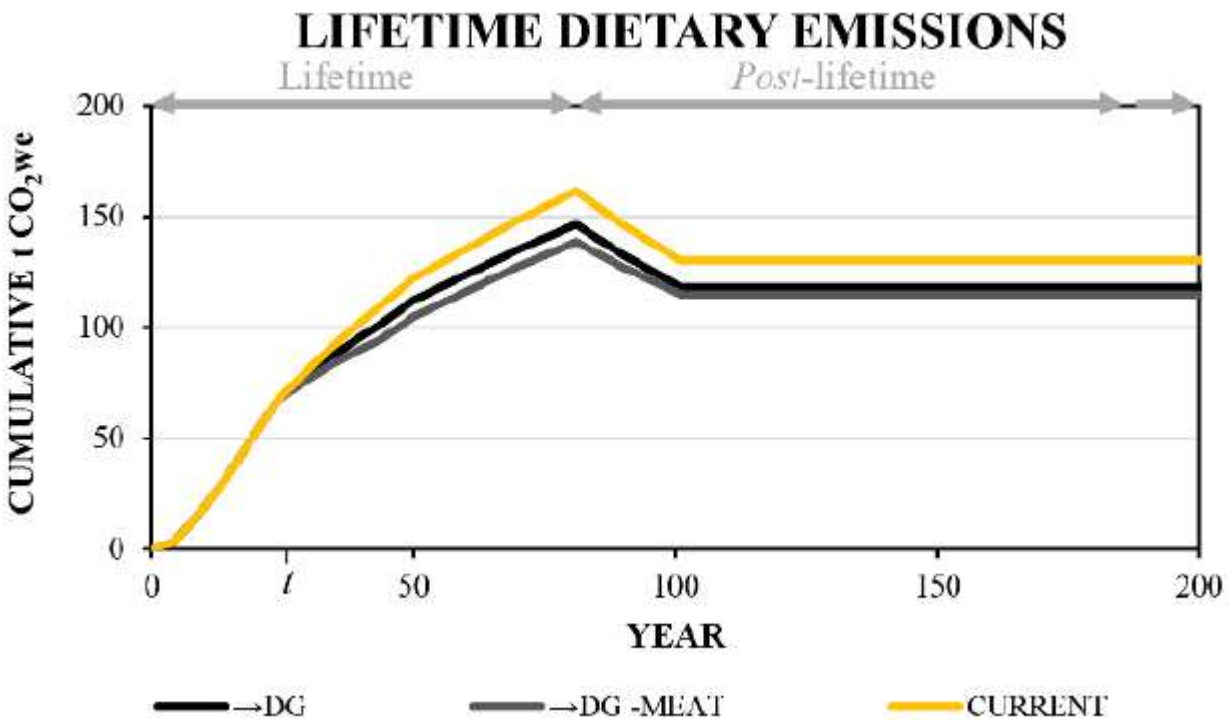


On calorie equivalency



On protein equivalency

What about affordability?

Affordability of nutrition

What's the cheapest way to get a nutrient adequate diet?

In the USA:

- Least cost nutrient adequate diet cost US$1.98 per day

- Least cost plant-only diet cost US$3.61 per day

Chungchunlam et al. 2020 *Nature Food*

Affordability of nutrition

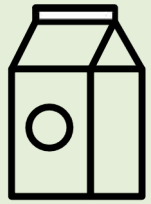
What's the cheapest way to get a nutrient adequate diet?

In the USA:

- Least cost nutrient adequate diet cost US$1.98 per day

- Least cost plant-only diet cost US$3.61 per day

- Large increases in the price of animal-sourced foods required before they were priced out:



8x

11.5x

6.5x

3 - 5.5x

Chungchunlam et al. 2020 *Nature Food*

Summary

- The food system is a considerable contributor to global GHGs;
- The global diet is plant-based, but animal fortified;
- Animal-sourced foods are an important natural source of EAAs and micro-nutrients;
- ‘Empty-calorie’ foods contribute significantly to personal ‘warming footprint’;
- Changing to vegetarianism in NZ has only a very small effect on atmospheric warming when dietary role of animal-based foods is properly considered;

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Thought for the Day

@down2earth_john