Redefining the conversation around ruminant impacts on the environment

IGFA Climate Change Workshop, September 24th 2019

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'They're telling us the herd needs to be reduced by 50%': Ireland's farmers and the climate crisis

Beef farmers in Ireland are facing low prices and pressure to reduce emissions – Is the model broken?

Aug 28th 2019, 7:31 AM 22,874 Views 95 Comments Share 35 Tweet Email 2

SEAN GORMLEY IS a suckler and sheep farmer with about 75 hectares of farmland not far from in south Roscommon, not far from Athlone.

The number of cows in Ireland is the subject of great debate.

Image: Eamonn Farrell/RollingNews.ie

On a bright afternoon earlier this month he took *TheJournal.ie* through his fields, spread out across the countryside. Gormley is a 5th generation farmer – his family has been on the lands for well over 100 years.

He has a herd of 50 cattle and about 200 sheep and Gormley works long, hard hours to ensure his herd is well looked after, especially during calving and lamb season in the spring.

3,037 views | Sep 4, 2019, 10:00am

Could Climate Change Make Cows The Next Stranded Asset?

Mike Scott Contributor ⓘ
Markets

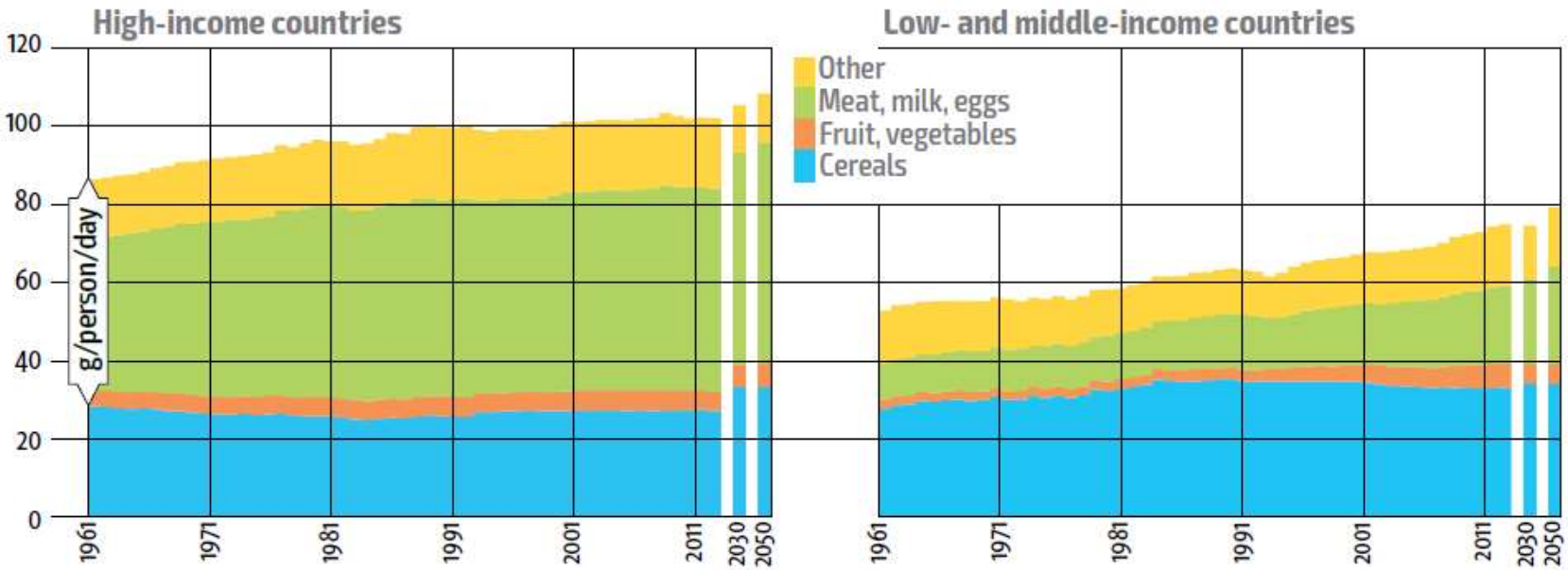
Pressure is growing on meat, fish and dairy producers to reduce deforestation, greenhouse gas emissions and antiobiotic use, from retailers, investors and consumers.

Growth in global urban and rural populations to 2050

Source: UN, 2015.

The global population will become increasingly urbanised

Per capita protein intake by source, 1961 - 2050



FAO (2017)

Contribution of animal protein will stabilise in developed countries and increase in developing countries

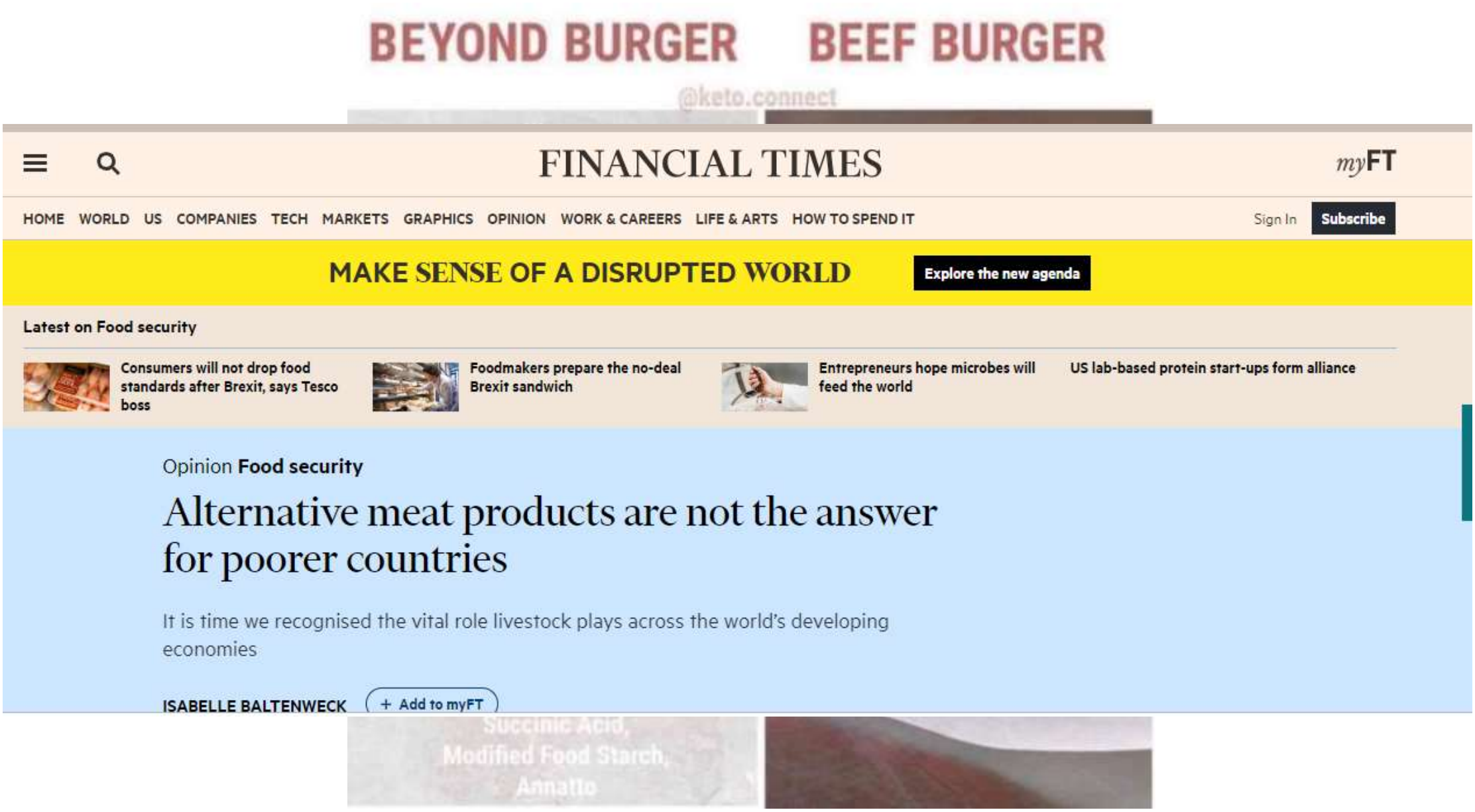
Table 1. Daily recommended dietary nutrients supplied by consuming one serving of beef

Nutrient	Purpose	Content of a 3-oz Serving*	% Daily Value**
Protein (g)	helps preserve, build and repair muscle	25.4	51%
Vitamin B_{12} (mcg)	helps maintain brain function and gives energy	2.4	41%
Zinc (mg)	helps maintain a healthy immune system	5.9	39%
Selenium (mcg)	helps protect cells from damage	26.6	38%
Niacin (mg)	supports energy production and metabolism	4.9	25%
Vitamin B_6 (mg)	helps maintain brain function and gives energy	0.48	24%
Phosphorus (mg)	helps build bone and teeth	201	20%
Riboflavin (mg)	helps convert food into fuel	0.24	14%
Iron (mg)	helps your body use oxygen	2.5	14%
Choline (mg)	supports nervous system development	73.1	13%
Calories* **	provide energy	173	9%
Carbohydrates (g)	provide energy	0	0%

**Nutrient content of a 3 oz serving of beef is based on the Reference Amount Customarily Consumed (RACC) of beef established by USDA. USDA National Nutrient Database for Standard Reference, NDB# 13364.*

***DV refers to Daily Value, the amount of a nutrient needed for a healthy adult on a 2,000-calorie diet. The %DV is the percent of a nutrient's DV supplied by a particular food.*

****Percent of calories is based on a 2000-calorie daily diet.*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US lab-based protein start-ups form alliance
Opinion Food security
Alternative meat products are not the answer for poorer countries
It is time we recognised the vital role livestock plays across the world's developing economies
ISABELLE BALTENWECK
+ Add to myFT
Succinic Acid,
Modified Food Starch,
Annatto


TEAGLE
Teagle
CENTERLINER

6 BILLION TONNES DRY MATTER

non-edible to humans

edible to humans

46% GRASS & LEAVES

19% CROP RESIDUES — straws and stover, sugar cane tops, banana stems

8% FODDER CROPS — grain and legume silage, fodder beets

5% OIL SEED CAKES

5% BY-PRODUCTS

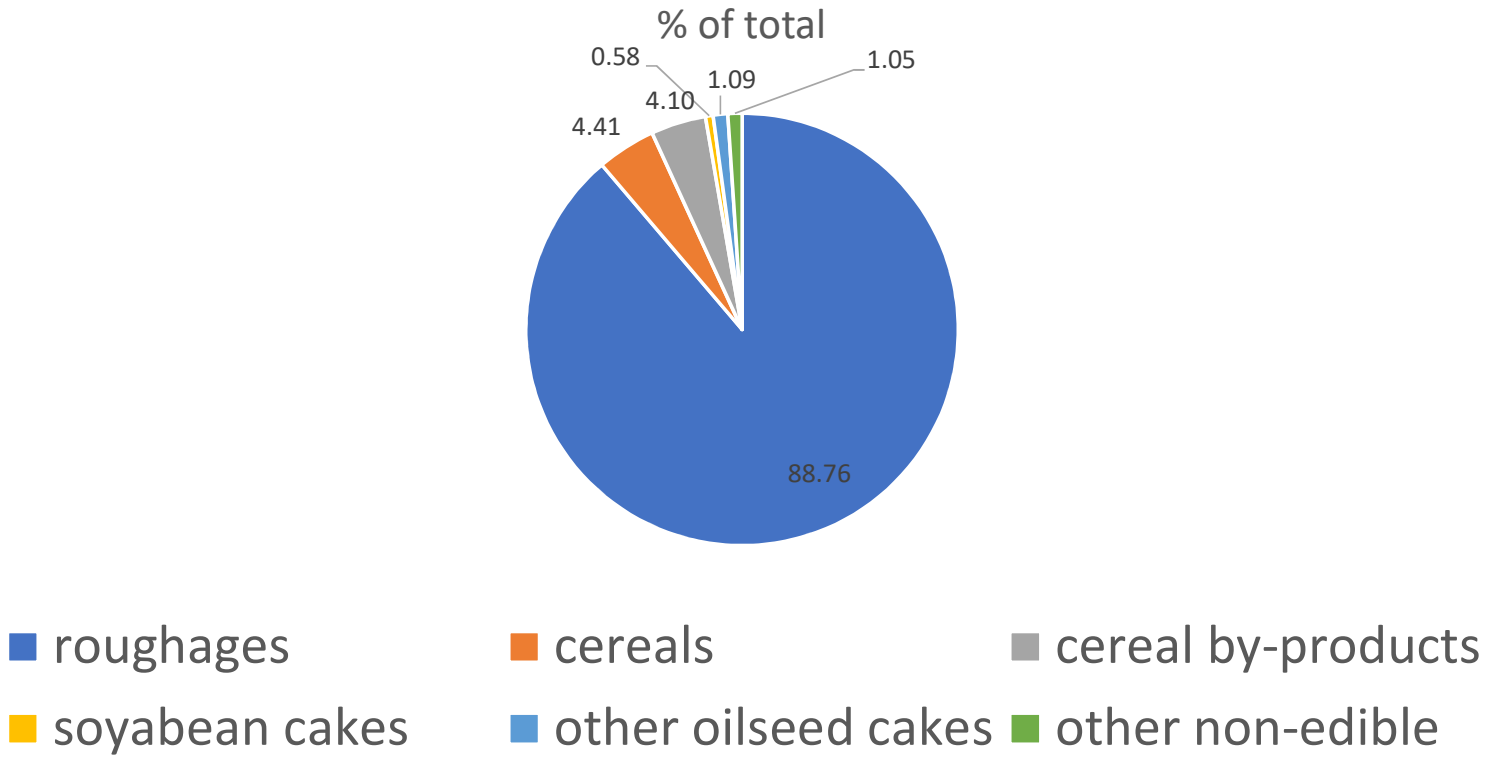
brans, corn gluten meal and feed, molasses,beetroop pulp and spent breweries, distilleries, biofuel grains

3% OTHER NON-EDIBLE — second grade cereals, swill, fish meal, synthetic amino acids, lime

13% GRAINS

1% OTHER EDIBLE
cassava pellets, beans and soy beans, rapeseed and soy oil

Contribution of various feedstuffs to global ruminant feed intake



Mottet et al., 2017

Do cows need cereal grains?

Whelan et al. 2017

Ingredient inclusion rate of concentrates	BP35	BP95
Barley	45.0	0.0
Soybean meal	12.0	0.0
Distillers dried grain	11.6	31.0
Palm kernel expeller	11.6	31.0
Soybean hulls	11.6	31.0
Molasses	5.0	5.0
Calcined magnesite	0.8	0.8
Salt	0.7	0.7
Palm oil	0.6	0.6
Lime flour	0.5	0.2
Monocalcium diphosphate	0.3	0.0
Vitamin and mineral premix[2]	0.5	0.5

Table 2. The effect of supplementary concentrate type on DMI and milk production parameters[1]

Item	BP35	BP55	BP75	BP95	SEM	*P*-value
DMI (kg/d)						
Pasture	15.86	15.64	15.82	15.62	1.26	0.99
Concentrate	5.35	5.33	5.42	5.31	1.01	0.89
Total	21.21	20.97	21.14	20.93	1.26	0.99
Milk production (kg/d)						
Milk	30.61	31.90	30.18	30.63	1.76	0.76
Fat	1.04	1.08	1.06	1.10	0.07	0.82
Protein	0.98	1.03	0.96	0.98	0.05	0.57


LEVEL 3
Hogan Stand
Livestock
42m
Global surface
LA
Nally
Dineen Hill 16
Davin Stand
Cusack Stand
Crops
336
335
334
333
332
331
330
329
328
327
326
325
324
323
322
321
320
319
318
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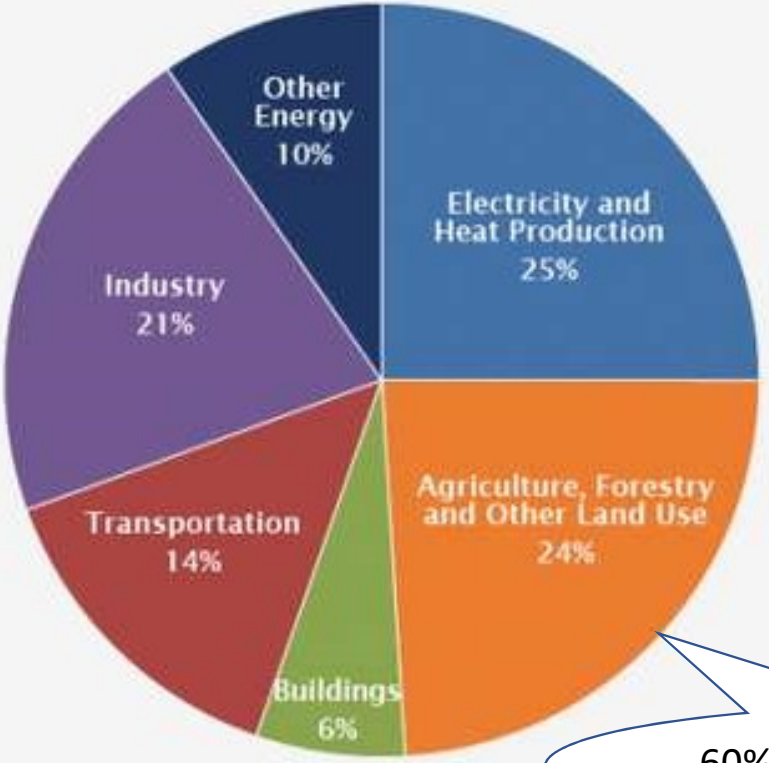
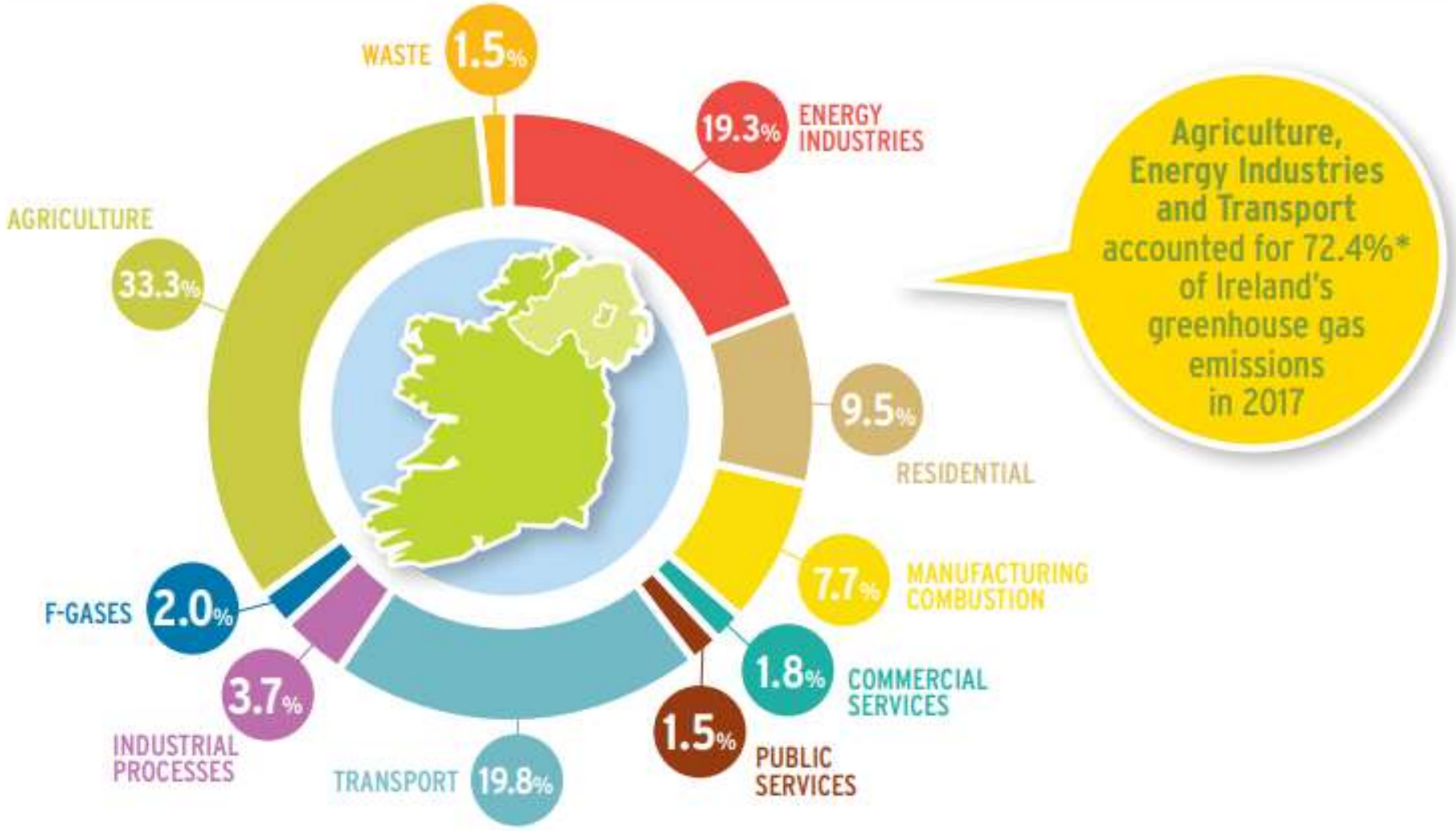
Global Greenhouse Gas Emissions by Economic Sector

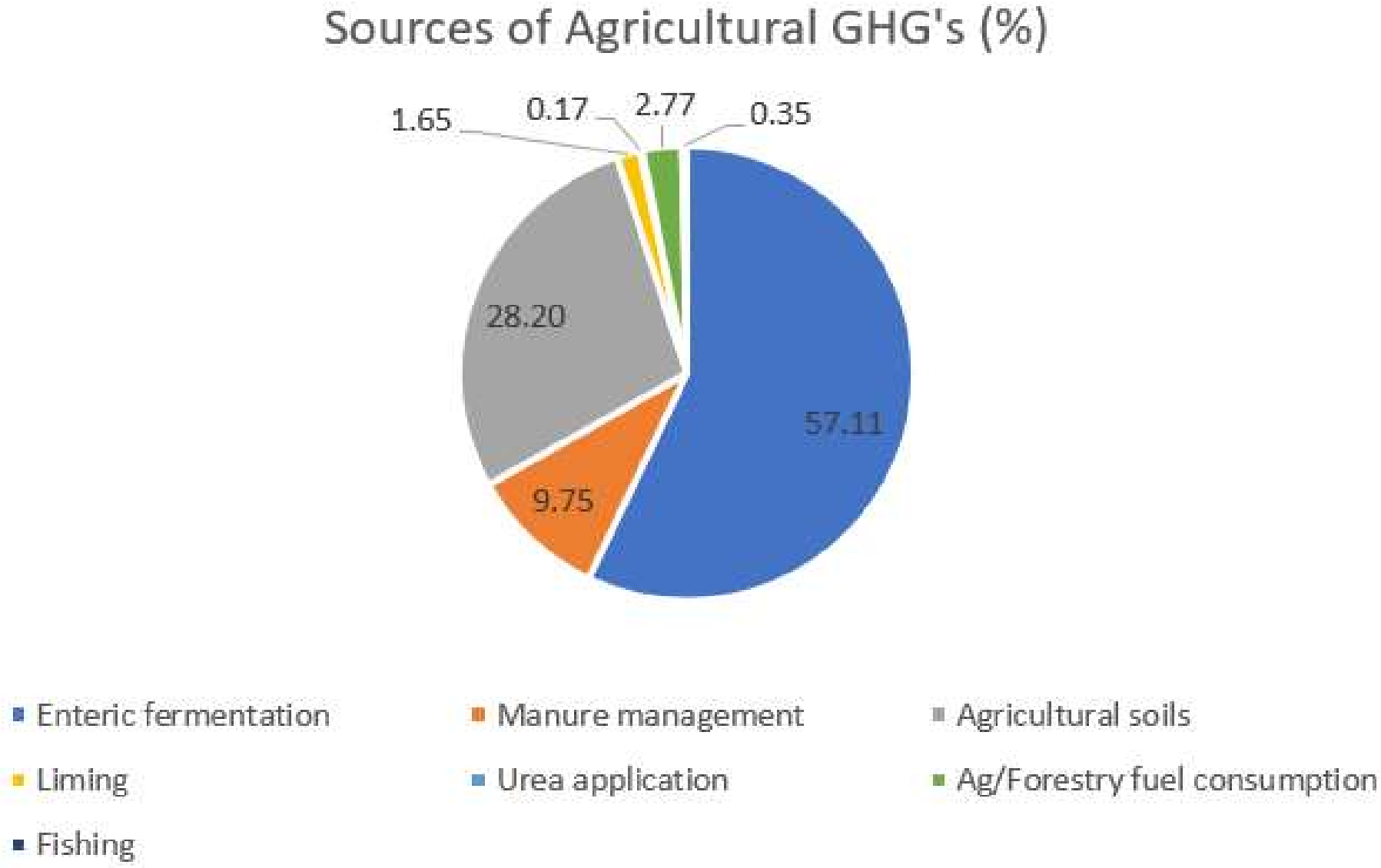


Source: IPCC (2014); Exit based on global emissions from 2010. Details about the sources included in these estimates can be found in the *Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Exit

60% from livestock

SOURCES OF GREENHOUSE GASES




Sources of Agricultural GHG's (%)
1.65
0.17
2.77
0.35
28.20
57.11
9.75
Enteric fermentation
Manure management
Agricultural soils
Liming
Urea application
Ag/Forestry fuel consumption
Fishing

CO_2
Carbon Dioxide

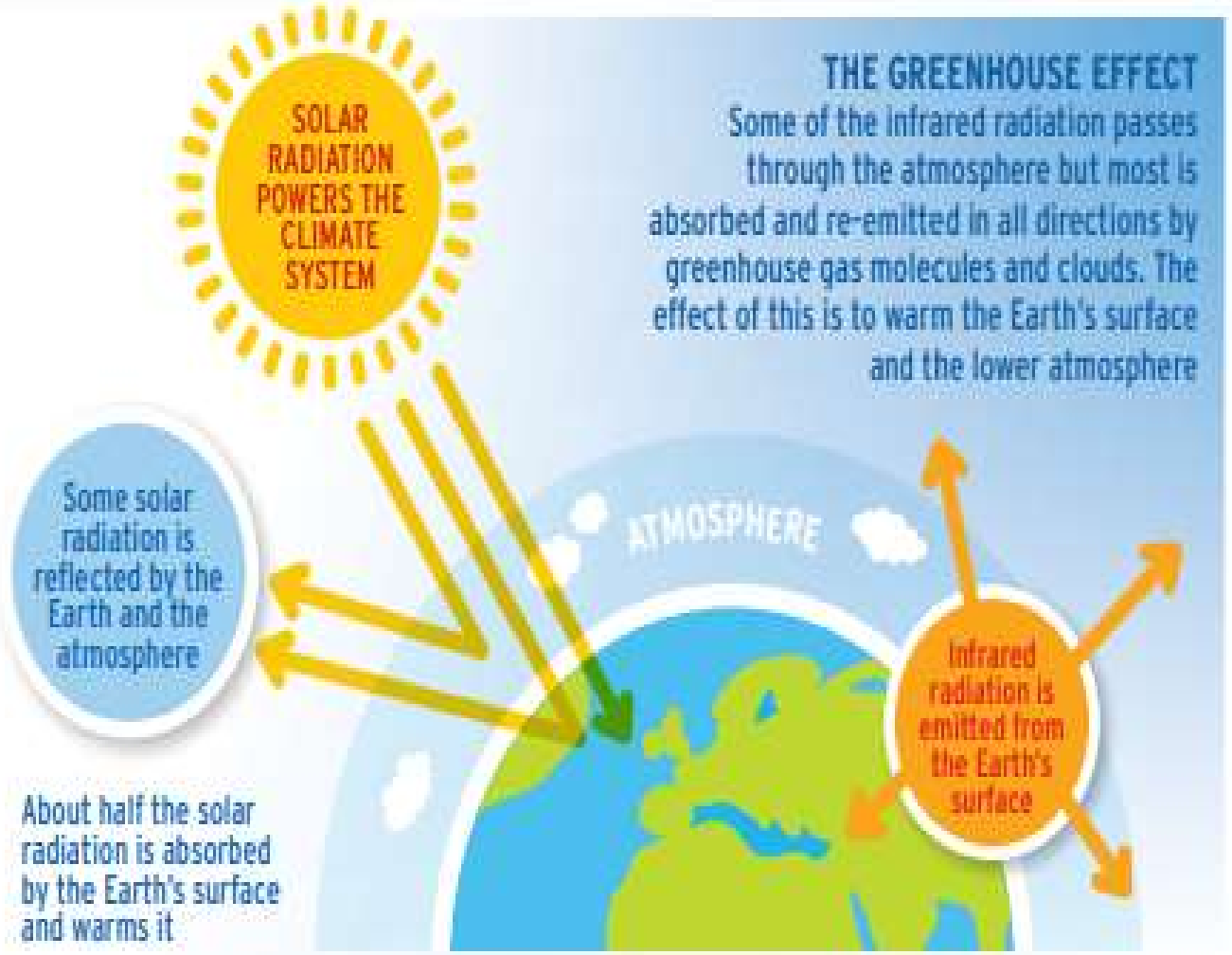
CH_4
Methane

N_2O
Nitrous Oxide

HFC, PFC, SF_6 and NF_3
Fluorinated Gases

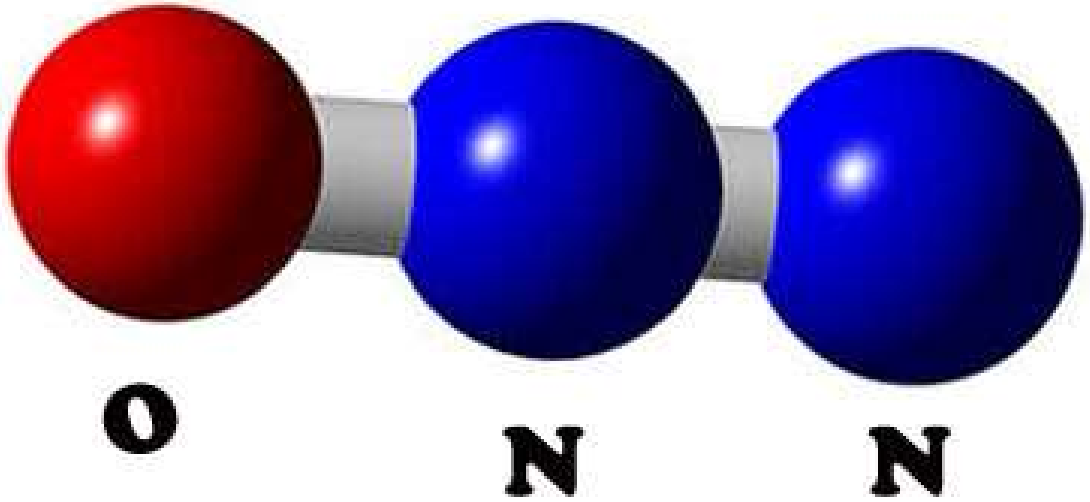
=

Increased concentrations of heat-trapping greenhouse gases has increased the amount of energy being trapped in the climate system

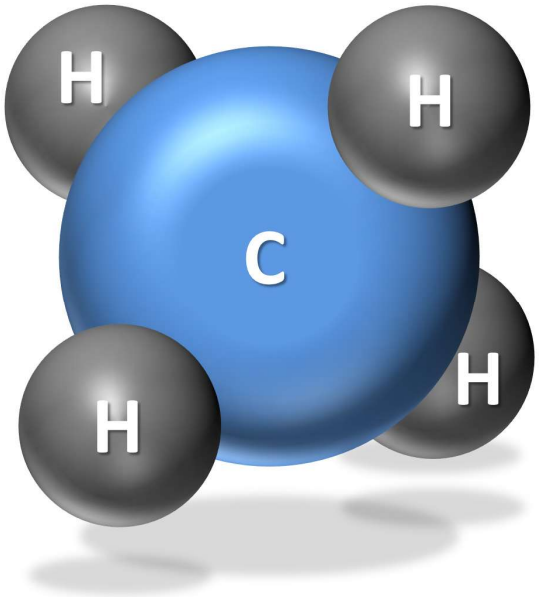


This causes global warming and gives rise to Earth system changes known as climate change

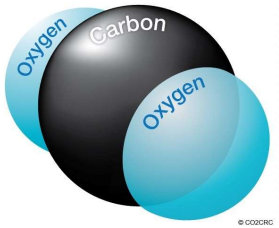
GWP 298



GWP 28

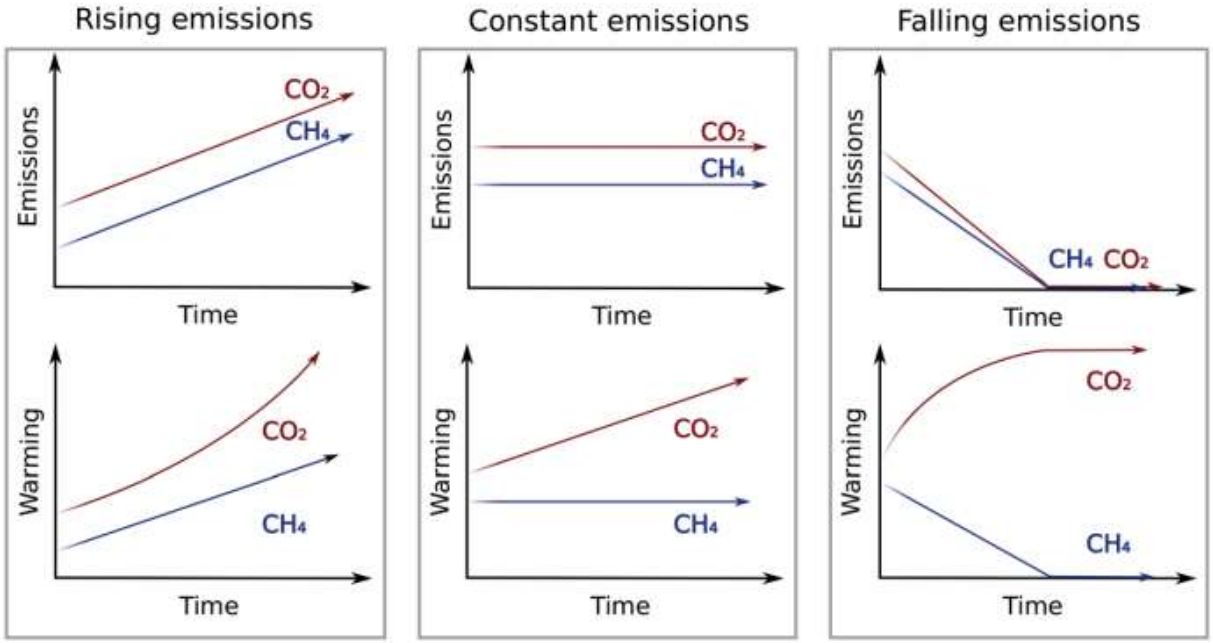


GWP 1



Differential expressions of GWP (UNFCCC)

Species	**Chemical formula**	**Lifetime (years)**	**Global warming potential (time horizon)**		
			20 years	100 years	500 years
Carbon dioxide	CO2	Variable	1	1	1
Methane Nitrous oxide	CH4 N20	12±3 120	56 280	28 298	6.5 170

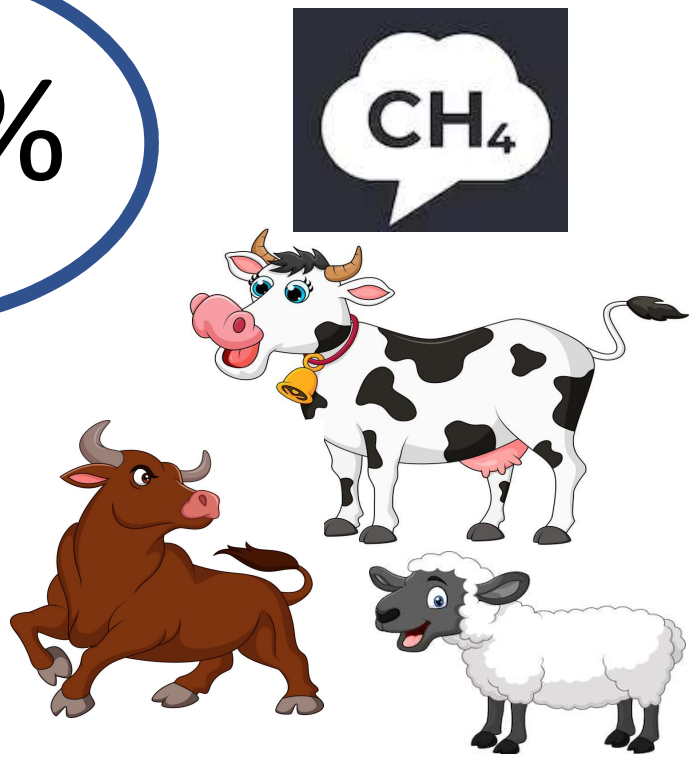


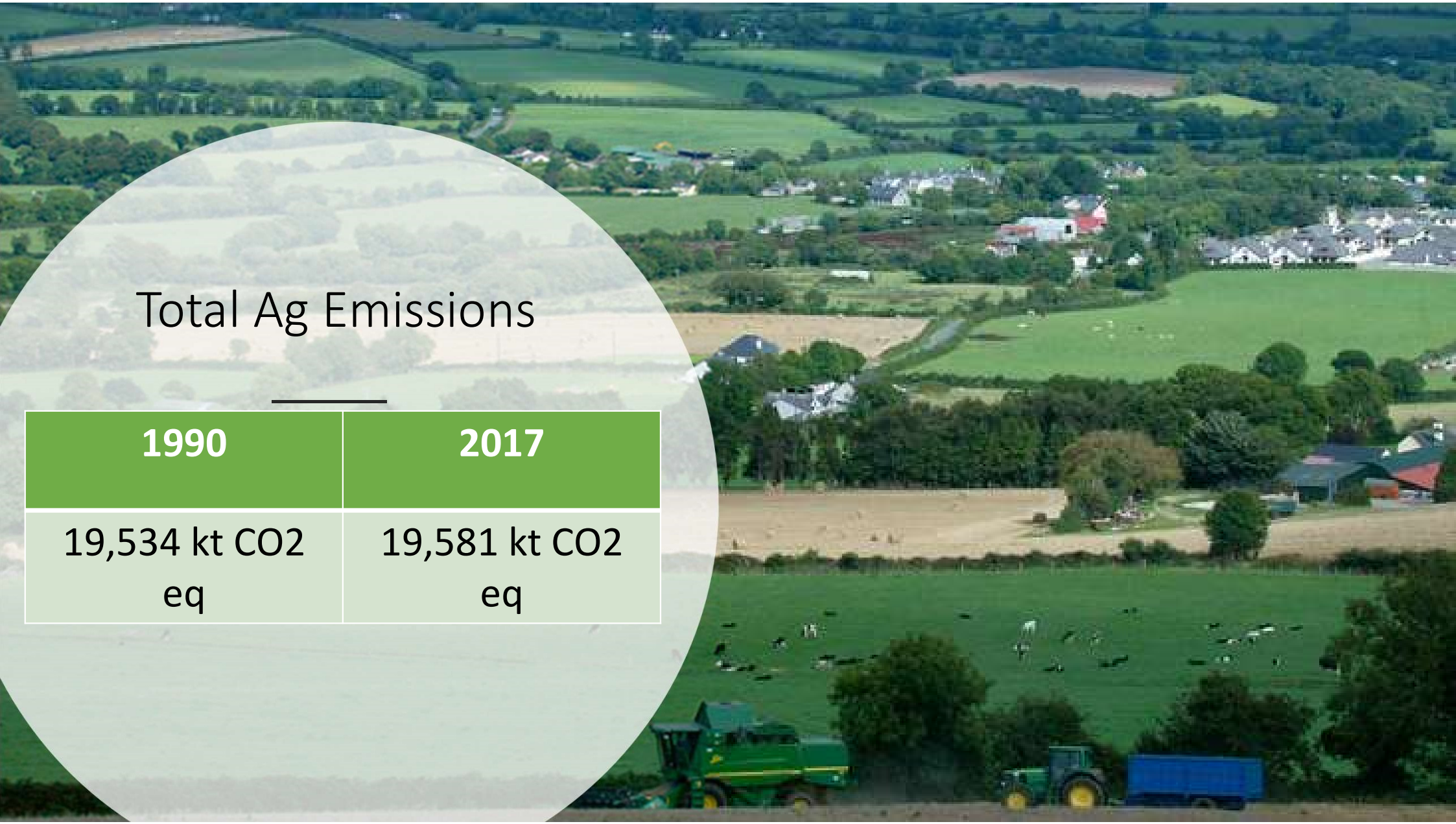
Allen et al. 2018

1990
11,357 Kt CO2 eq

+1.7%

2017
11,542 Kt CO2 eq





Total Ag Emissions

1990	2017
19,534 kt CO2 eq	19,581 kt CO2 eq

1990
5,035 Kt CO2 eq

+136%

2017
11,864 Kt CO2 eq

GLOBAL METHANE BUDGET

Global Carbon Project

TOTAL EMISSIONS

558
(540-568)

CH_4 ATMOSPHERIC GROWTH RATE
10
(9.4-10.6)

TOTAL SINKS

548
(529-555)

105
(77-133)

188
(115-243)

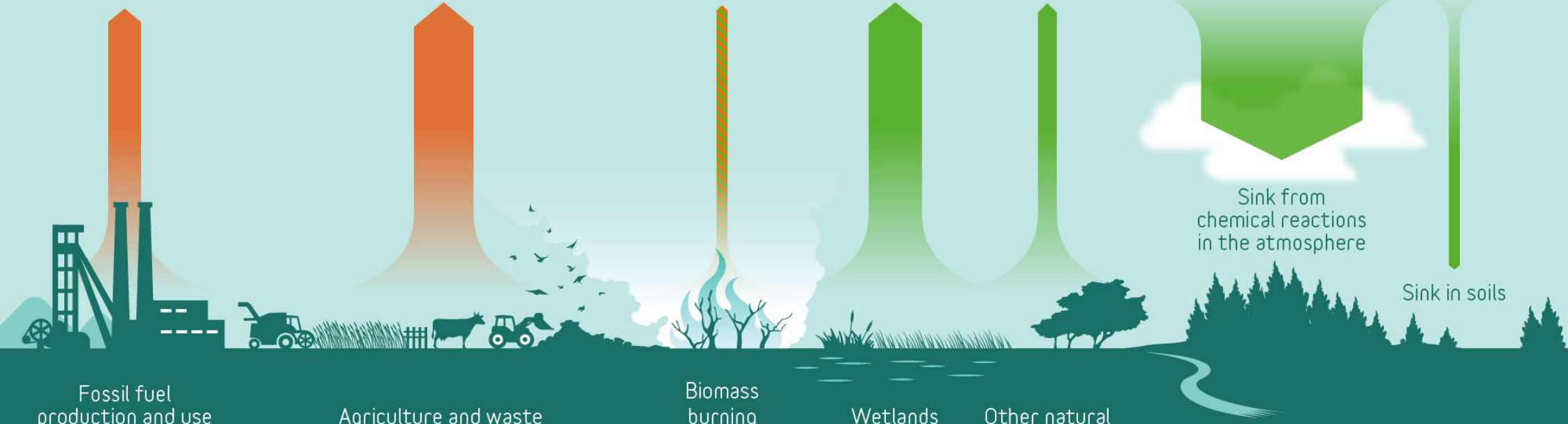
34
(15-53)

167
(127-202)

64
(21-132)

515
(510-583)

33
(28-38)



Sink from chemical reactions in the atmosphere

Sink in soils

Fossil fuel production and use

Agriculture and waste

Biomass burning

Wetlands

Other natural emissions

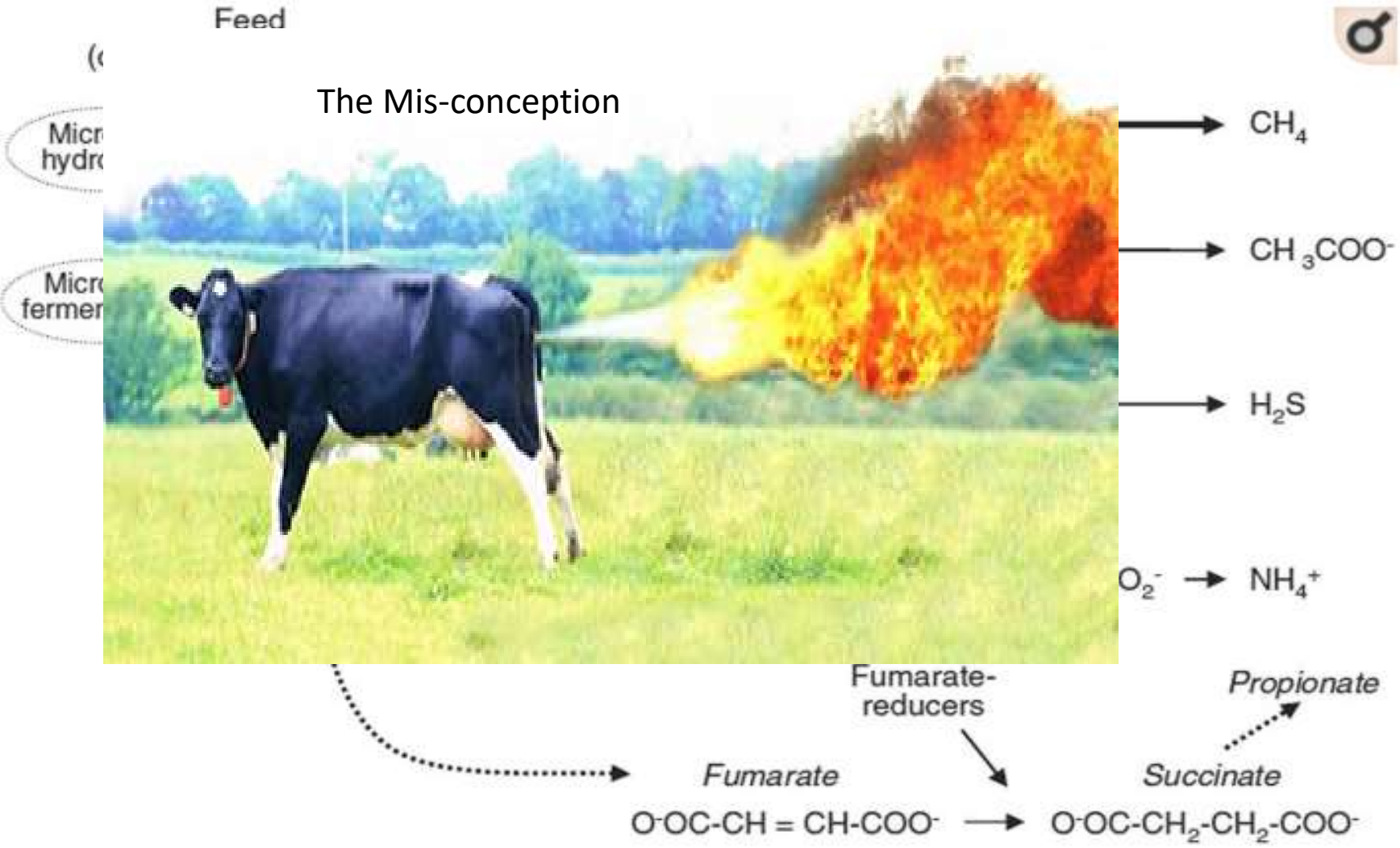
Geological, lakes, termites, oceans, permafrost

EMISSIONS BY SOURCE

In million-tons of CH_4 per year (Tg CH_4 / yr), average 2003-2012

FONDATION

Enteric methane production



PRESS RELEASE

New study: Fracking prompts global spike in atmospheric methane

14 August 2019

As methane concentrations increase in the Earth's atmosphere, chemical fingerprints point to a probable source: shale oil and gas, according to new Cornell University research published today in Biogeosciences, a journal of the European Geosciences Union.

The research suggests that this methane has less carbon-13 relative to carbon-12 (denoting the weight of the carbon atom at the centre of the methane molecule) than does methane from conventional natural gas and other fossil fuels such as coal.

This carbon-13 signature means that since the use of high-volume hydraulic fracturing – commonly called fracking –

Contact

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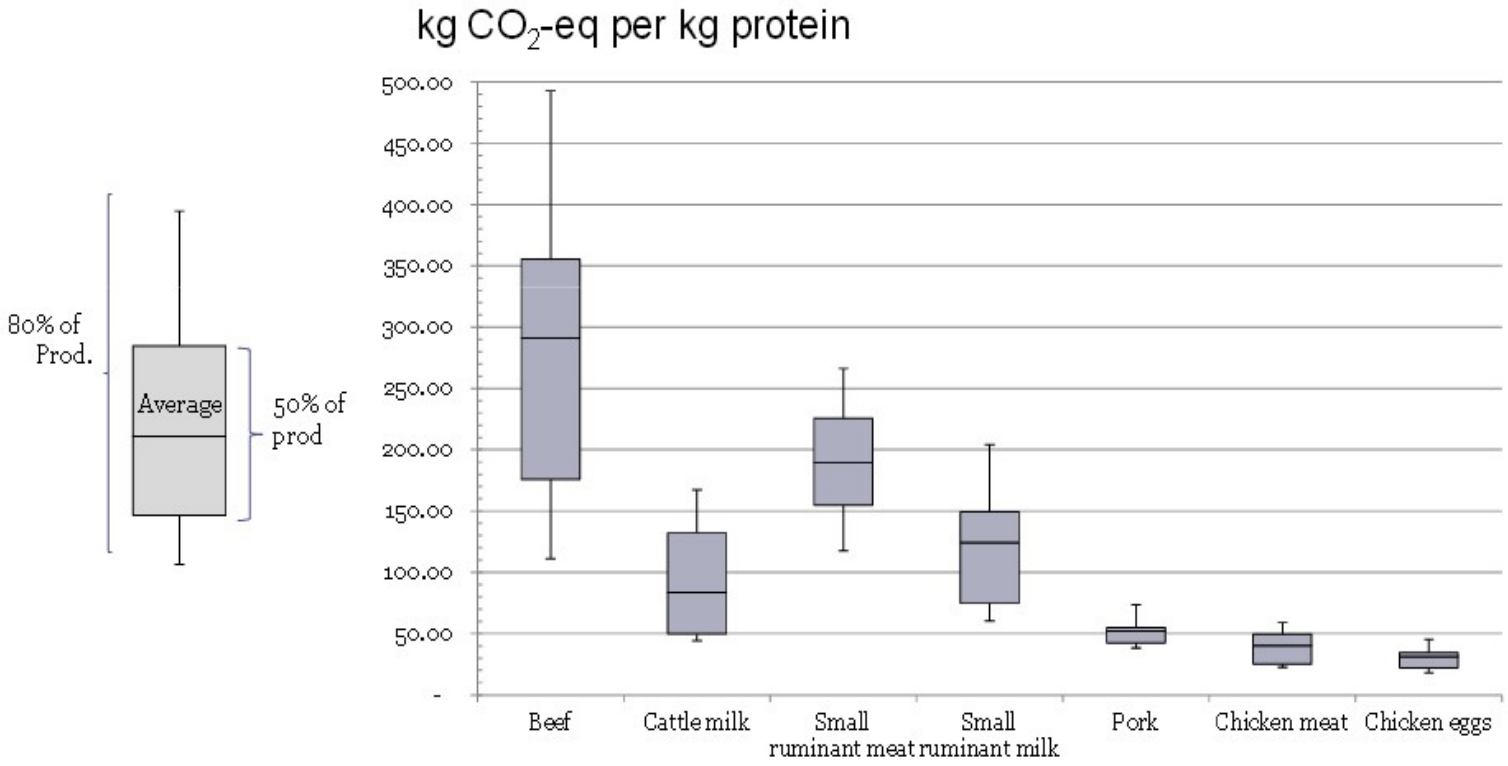
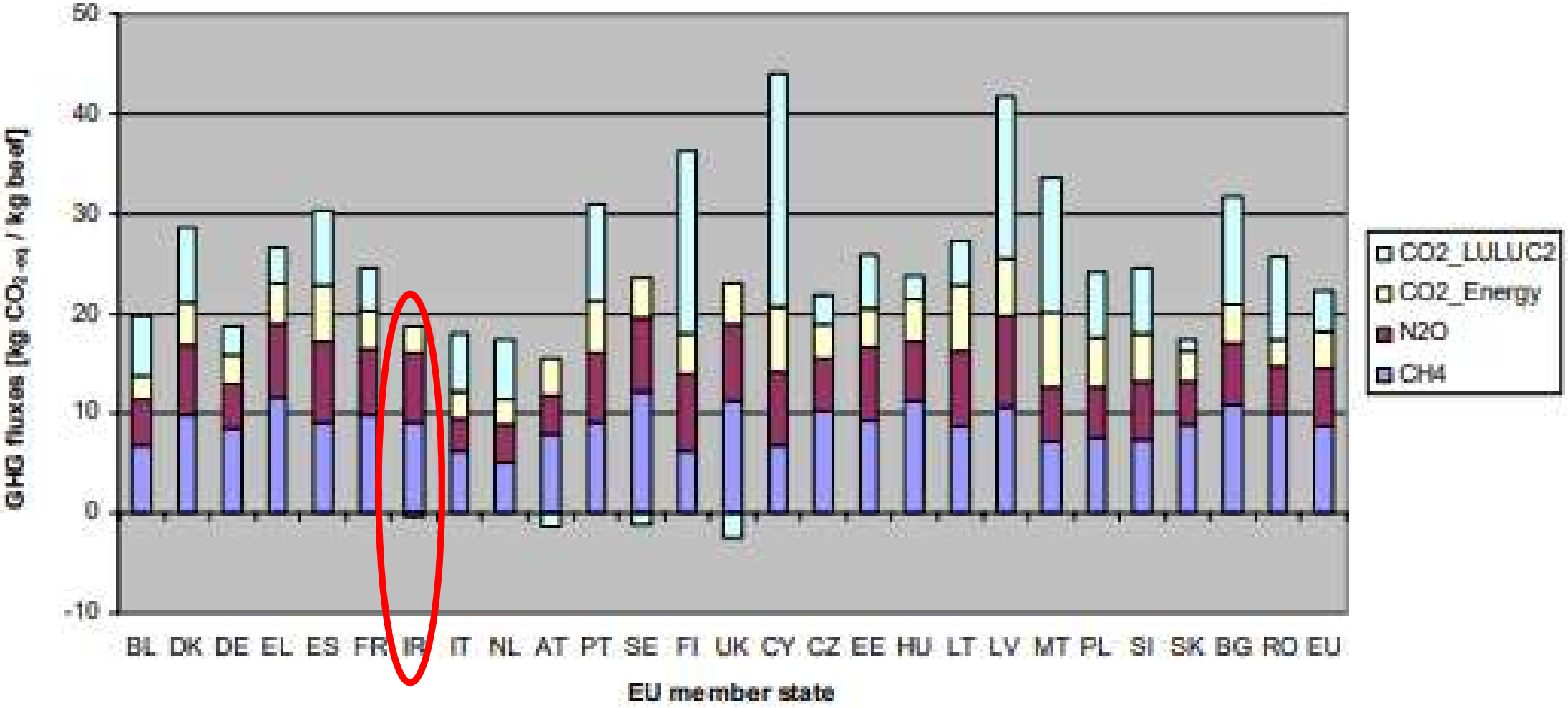
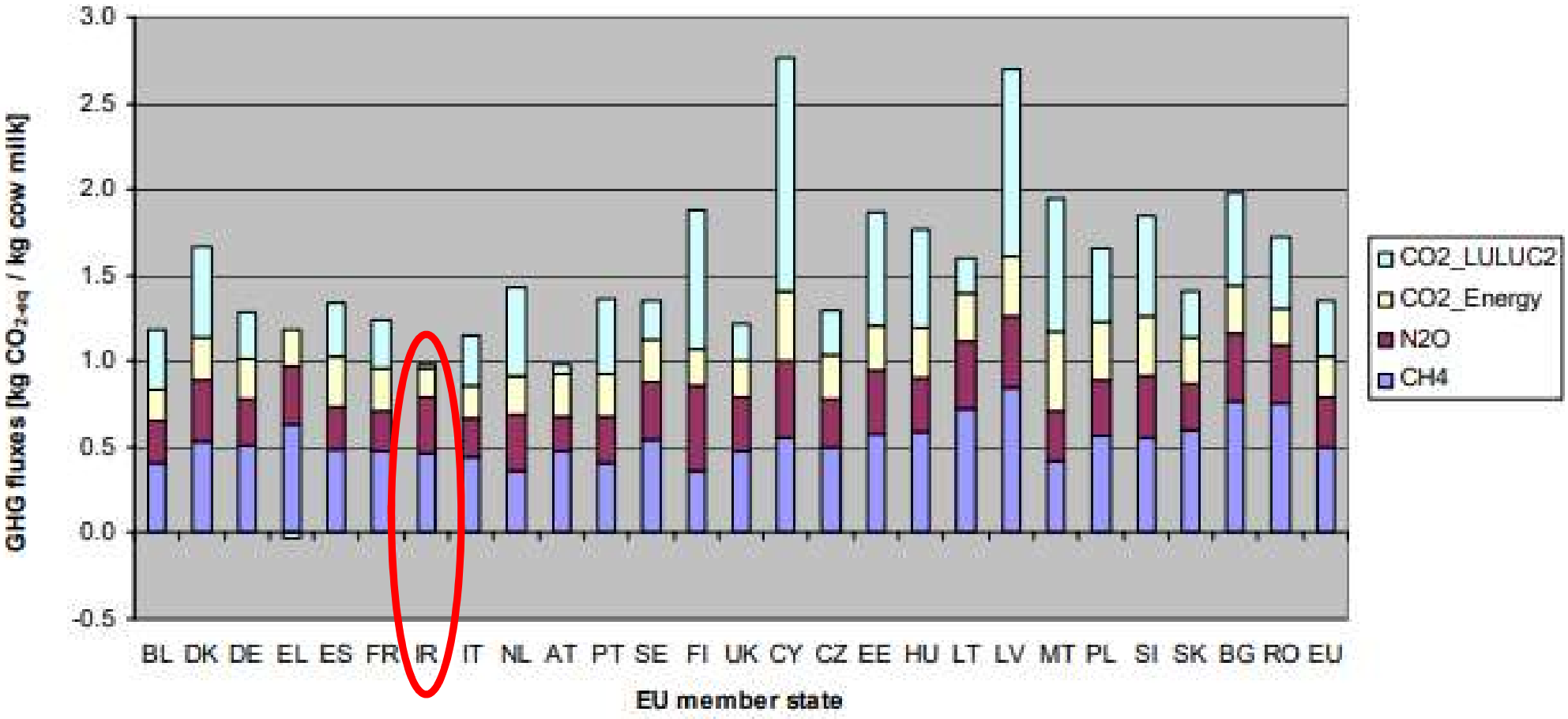
Estimated global emission intensities (Ei)



FAO 2013



Leip et al., (2010)



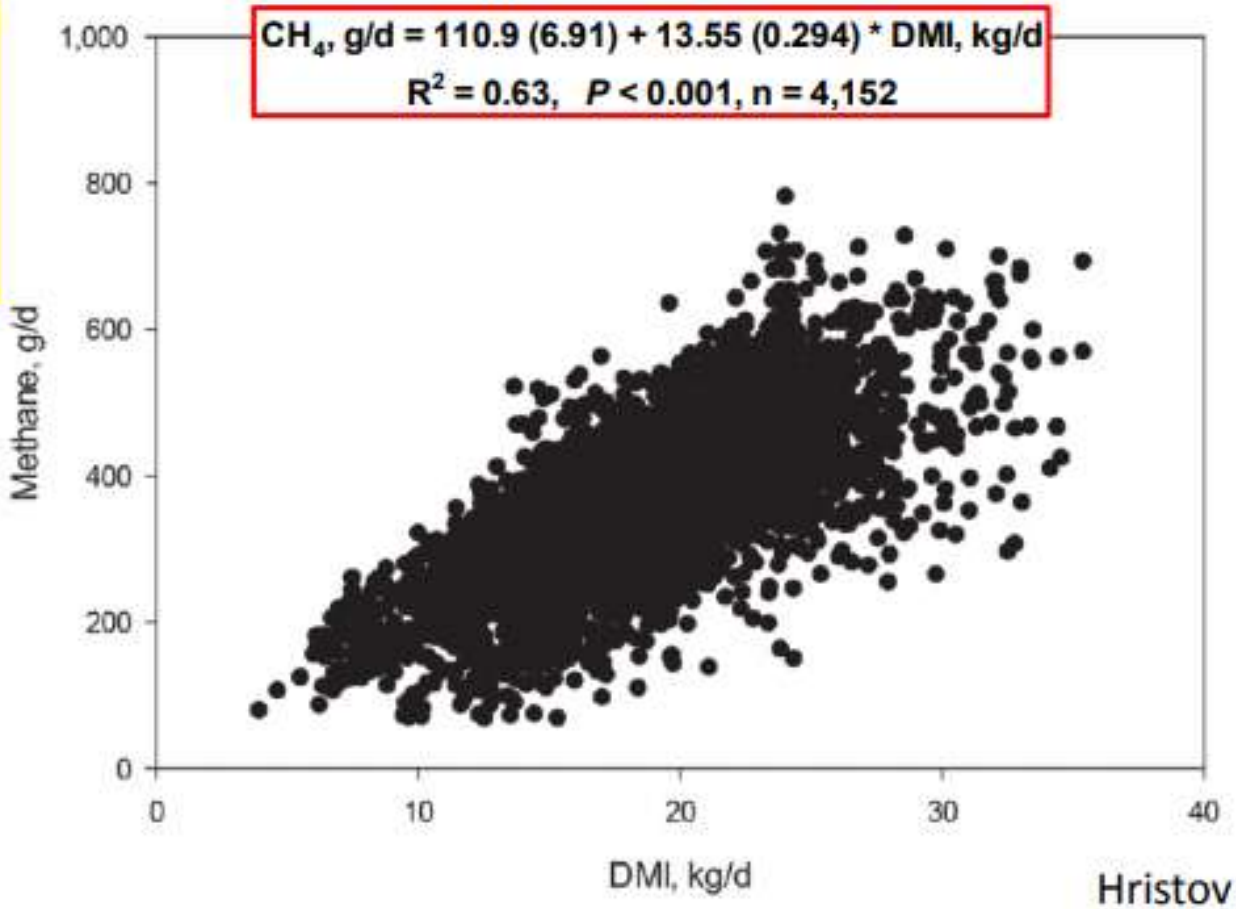
Leip et al., (2010)

Mitigation options

- Improving forage quality
- Feeding concentrates
- Lipids
- Plant-derived bioactive compounds
- Protozoa
- Nitrates
- Ionophores
- Probiotics
- Seaweeds (Asparagopsis taxiformis)
- Methane inhibitors
- Manipulation of the rumen microbiome
- Precision feeding
- Animal genetics, selecting for low-methane emission
- Improving animal health
- Improving animal feed efficiency and productivity
- Vaccine development

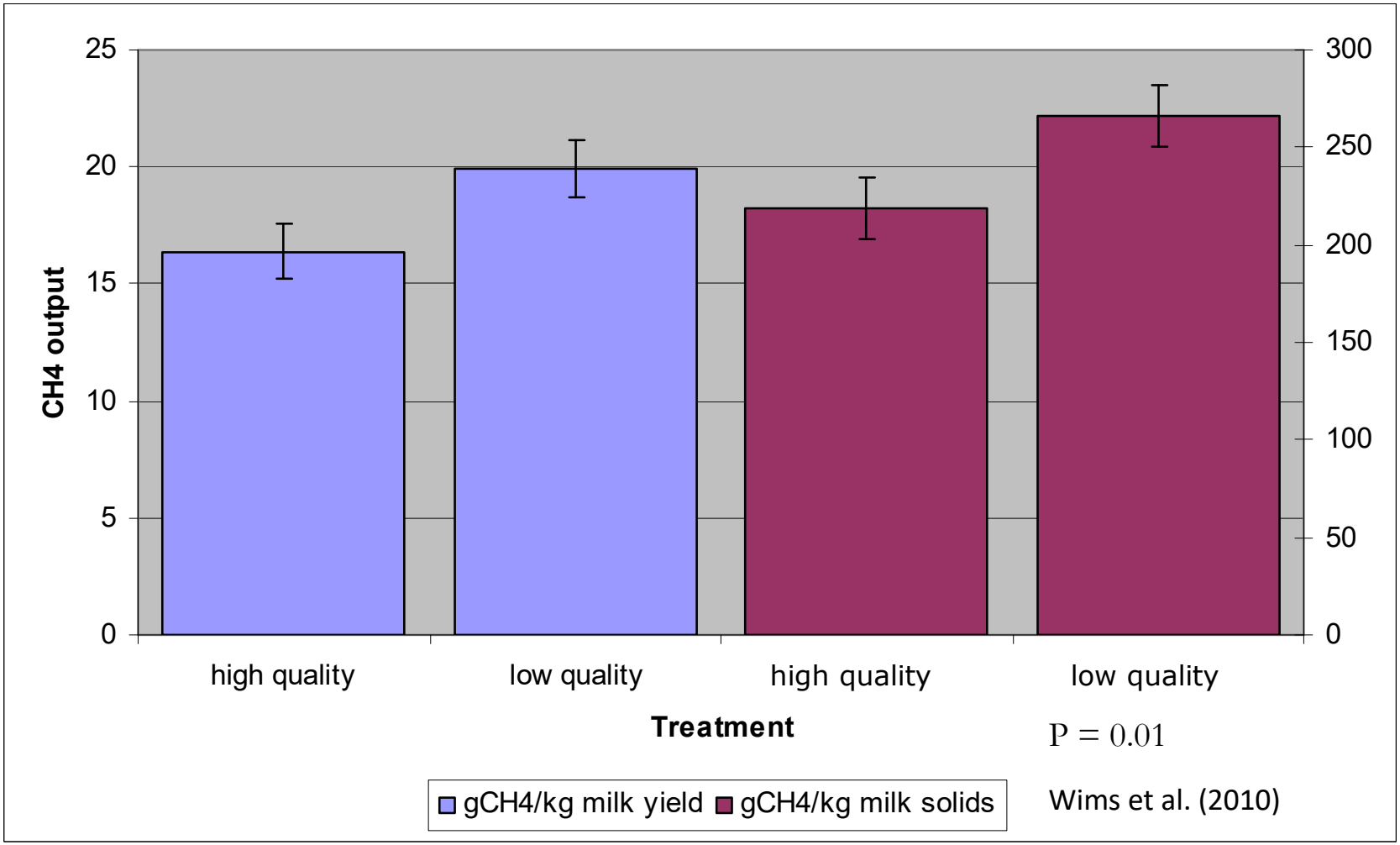
Enteric methane emission is a function of DMI

Other factors:
Animal genetics
Diet composition
- fiber/starch
- fat



Hristov et al., 2018

The effect of sward quality on CH_4 output per kg milk and milk solids in dairy cows

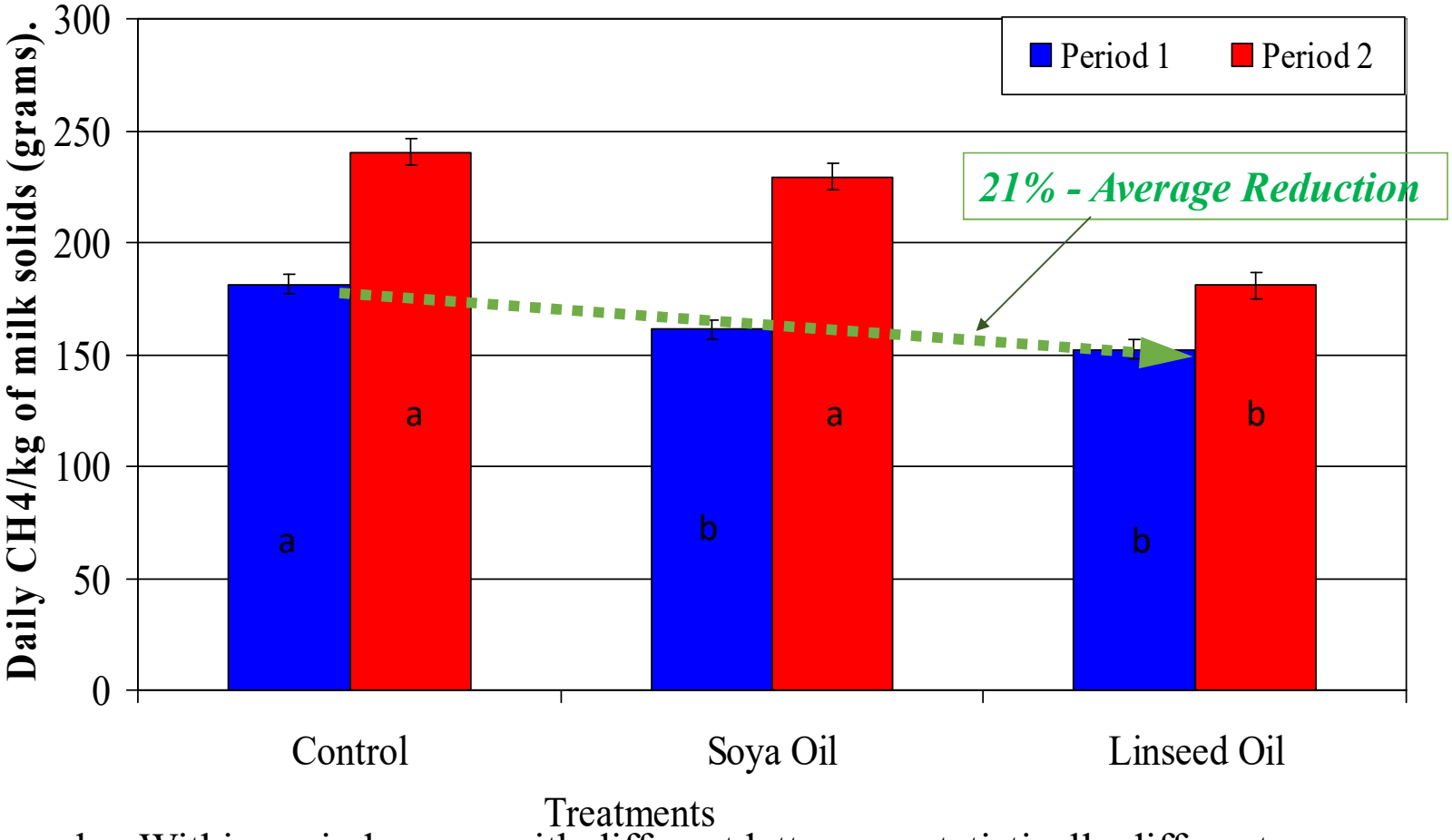


Wims et al. (2010)

Daily CH_4 (grams) per kilogram of milk solids in Period 1 & 2

Treatment (P<0.001) Period (P<0.001)

Treatment x Period (P<0.001)



a, b – Within period means with different letters are statistically different.

J. Dairy Sci. 102:1780–1787
https://doi.org/10.3168/jds.2018-14534

Reducing enteric methane emissions from dairy cattle: Two ways to supplement 3-nitrooxypropanol

D. Van Wesemael,[1,2] L. Vandaele,[1] B. Ampe,[1] H. Cattrysse,[1] S. Duval,[3] M. Kindermann,[3] V. Fievez,[2] S. De Campeneere,[1] and N. Peiren[1]*
[1]Animal Sciences Unit, Flanders Research Institute for Agriculture, Fisheries and Food, Scheldeweg 68, 9090 Melle, Belgium
[2]Department of Animal Sciences and Aquatic Ecology, Laboratory for Animal Nutrition and Animal Product Quality, Ghent University, Coupure Links 653 Block F, 9000 Ghent, Belgium
[3]DNP Innovation Animal Nutrition & Health, DSM Nutritional Products, PO Box 2676, 4002 Basel, Switzerland

- Daily CH4 emissions ↓ 28% (TMR) or 23% (Conc supp)
- CH4/kg DMI ↓ 23% (TMR) or 21% (Conc supp)
- CH4/kg milk ↓ 24% (TMR) or 23% (Conc supp)

- DMI 23.5kg
- MY 31.5kg

Journal of Cleaner Production
Volume 234, 10 October 2019, Pages 132-138

Inclusion of *Asparagopsis armata* in lactating dairy cows' diet reduces enteric methane emission by over 50 percent

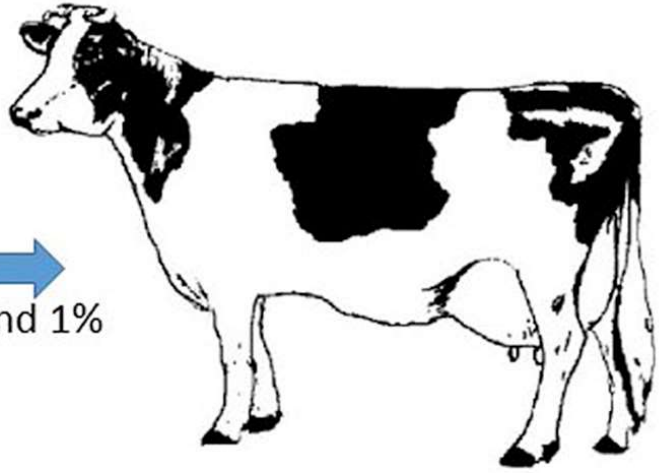
Breanna M. Roque [a], Joan K. Salwen [b], Rob Kinley [c], Ermias Kebreab [a]
Show more

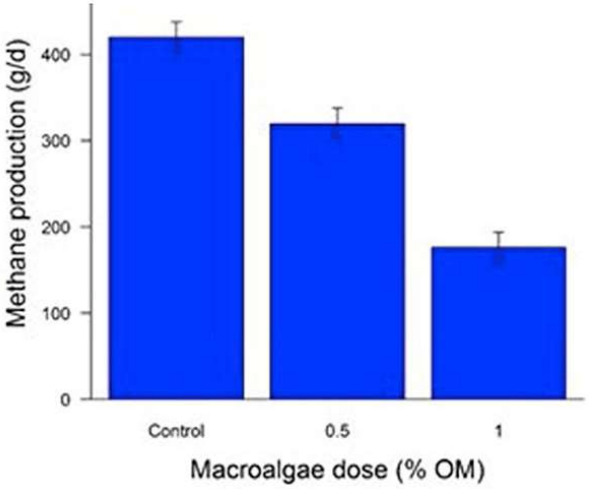
https://doi.org/10.1016/j.jclepro.2019.06.193

- Daily CH4↓ 67%
- CH4/ kg DMI ↓ 43%
- CH4/ kg milk ↓ 60%
- H2 and CO2 ↑

Asparagopsis armata

Fed at 0.5 and 1% feed intake





CSIRO PUBLISHING

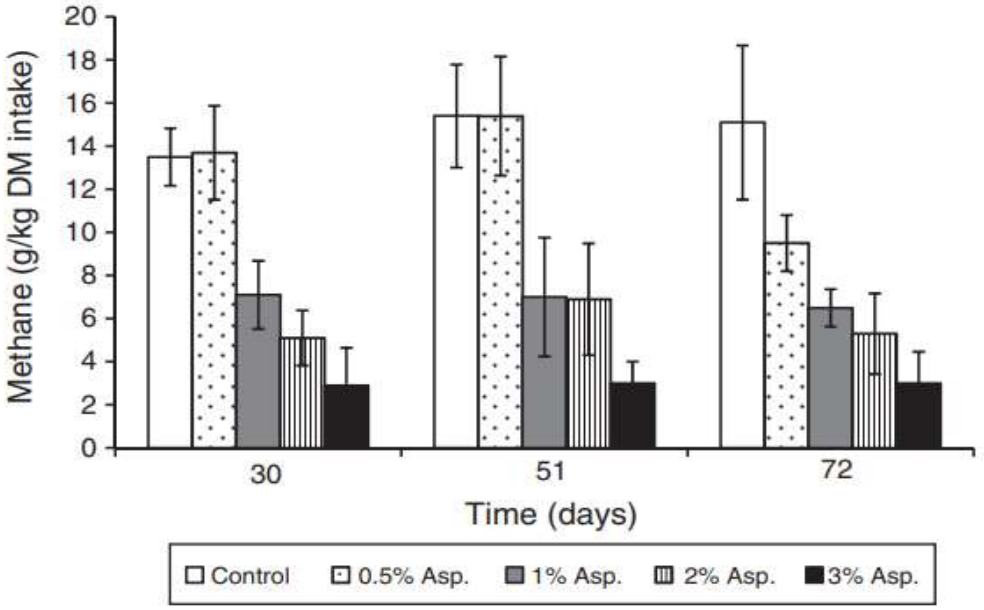
Animal Production Science, 2018, **58**, 681–688
http://dx.doi.org/10.1071/AN15883

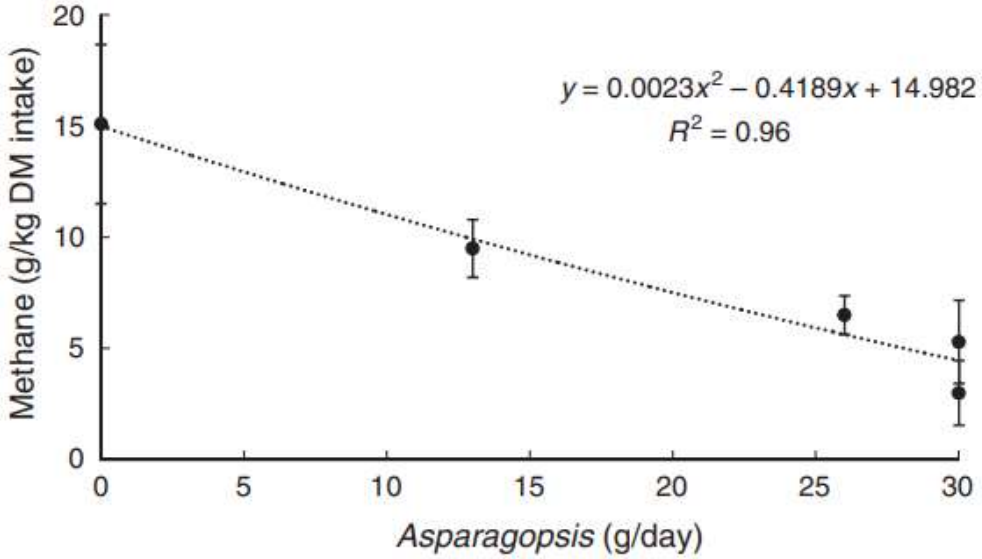
Asparagopsis taxiformis decreases enteric methane production from sheep

Xixi Li[A,F], *Hayley C. Norman*[A], *Robert D. Kinley*[B], *Michael Laurence*[C], *Matt Wilmot*[A], *Hannah Bender*[C], *Rocky de Nys*[D] *and Nigel Tomkins*[B,E]

[A]CSIRO Agriculture, Centre for Environment and Life Sciences, Floreat, WA 6014, Australia.
[B]CSIRO Agriculture, Australian Tropical Sciences and Innovation Precinct James Cook University, Townsville, Qld 4811, Australia.
[C]College of Veterinary Medicine, Murdoch University, Murdoch, WA 6150, Australia.
[D]MACRO, The Centre for Macroalgal Resources and Biotechnology, College of Marine and Environmental Sciences, James Cook University, Townsville, Qld 4811, Australia.
[E]Meat and Livestock Australia, 527 Gregory Terrace, Fortitude Valley, Qld 4006, Australia.
[F]Corresponding author. Email: xixili.r@gmail.com

- Daily CH4 ↓ 81%
- CH4 per kg DMI ↓ 81%





Questions?