School of Sustainable Food and Farming

Harper Adams 2030
Together we will make the difference
Animal Science at HAU

Professor Michael Lee et al.

Deputy Vice-Chancellor, Harper Adams University

Harper Adams University

Insert Video Here

School of **Sustainable Food and Farming**

Together we aim to:

> Educate, Inspire and Empower current and future farmers to achieve net zero within a sustainable farming and food system.

HAU Research Centres/Groups & leads

Centre for Crop and Environmental Science (CCES)
Centre Director Jim Monaghan

Crop Science group
Jim Monaghan

Nematology group
Matt Back

Soil and Water Science group
Simon Jeffery

Plant Pathology group
Simon Edwards

Entomology group
Tom Pope

Centre for Agriculture Data Science (AgriDat)
Ed Harris

Global Institute for Agri-Tech Economics (GIATE)
Karl Behrendt

Centre for Evidence-Based Agriculture (CEBA)
Nicky Randall

Sustainable Agri-food Systems Group (SAFS)
Nicky Randall

Rural Resilience Research Group (3RG)
Richard Byrne

Agri-Tech Research Centre
Paula Misiewicz

Animal Science Research Centre (ASRC)
Centre Director Liam Sinclair

Animal Welfare and Behaviour (AWaB)
Mark Rutter

Monogastric group
Steve Mansbridge

Dairy, heifer, calf group
Liam Sinclair

Beef and sheep group
Jude Capper

Companion Animal Health Sciences Research Group
Zoe Davies

InSHAW
Jonathan Statham

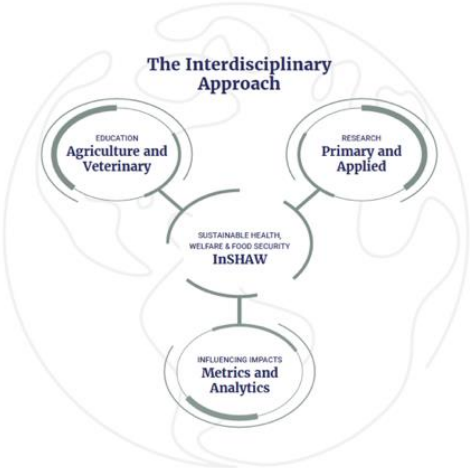
ES group **Productivity** – Nicky Naylor
ES group **Land and Soil** – Julia Casperd

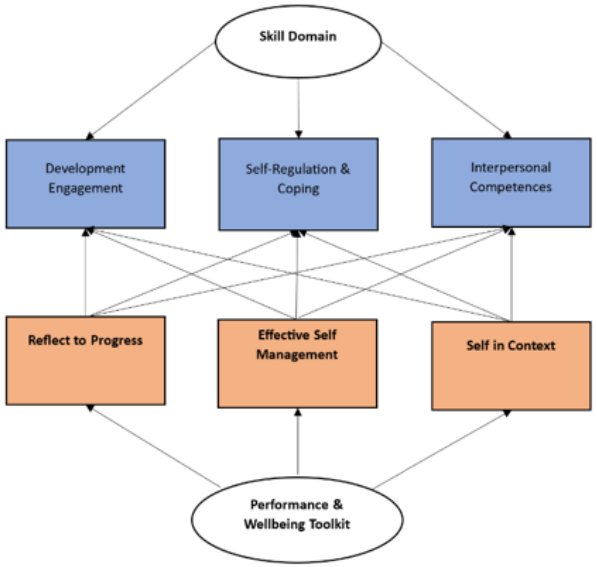
Future Farm
Grace Milburn

ES group **Energy and Water** – Marie Kirby
ES group **Data and systems boundaries** – Eric Siqueiros

HKVS - Strategic themes

Sustainable livestock health & welfare





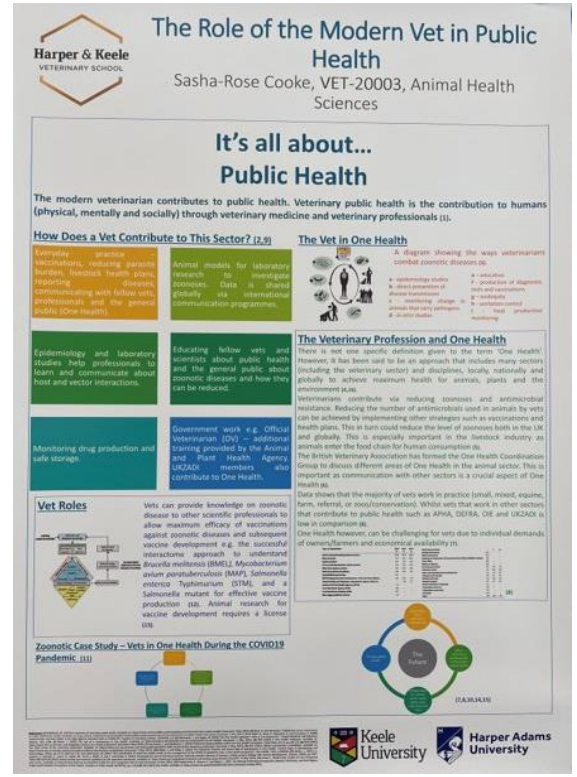
Wellbeing and professional performance

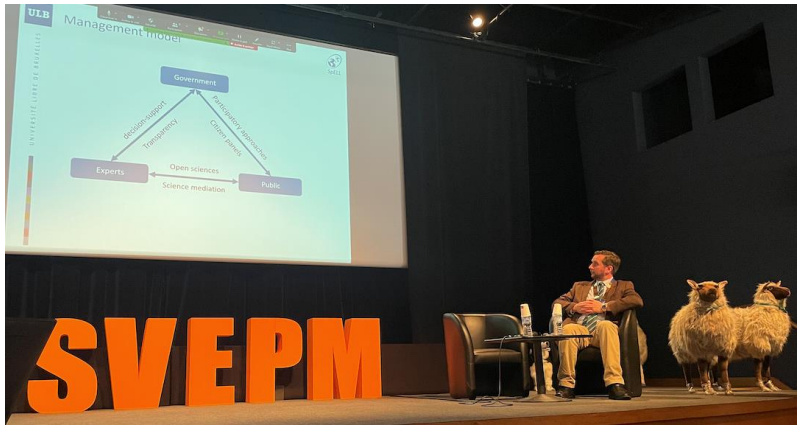
Excellence in primary care research & practice

GARDEN VETS AT KEELE

Harper & Keele
VETERINARY SCHOOL

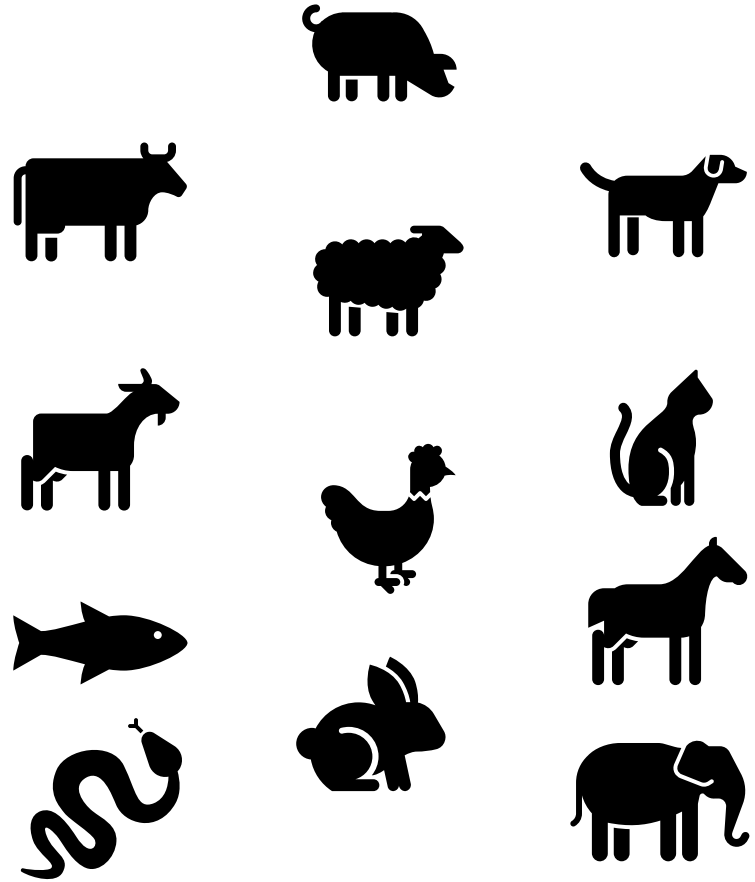
Veterinary public health:
a focus for integrated skills development





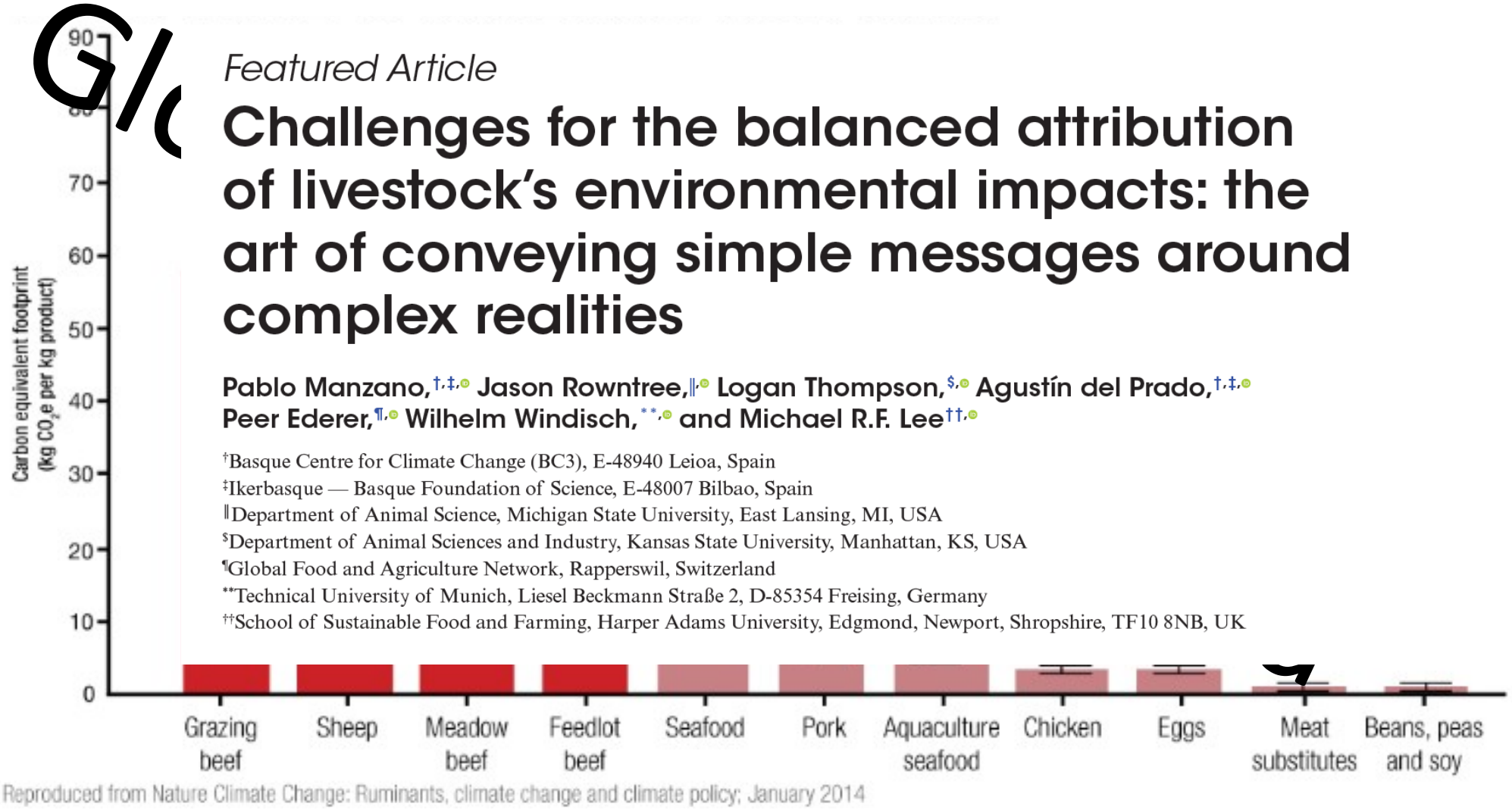
HAU tacking the key challenges in Animal Science through education, research and KE

- Nutrition and performance
- Nutritional value – food science
- Sustainability and environmental footprint
- Behaviour and welfare
- Animal health
- Veterinary public health - OVS training
- Bio-circularity - valorisation



Harper Adams University

Global Warming Potential – mass based assessment (CO_2eq/kg product)



Featured Article

Challenges for the balanced attribution of livestock's environmental impacts: the art of conveying simple messages around complex realities

Pablo Manzano,[†,‡] Jason Rowntree,[‖] Logan Thompson,[$] Agustín del Prado,[†,‡] Peer Ederer,[¶] Wilhelm Windisch,[**] and Michael R.F. Lee[††]

[†]Basque Centre for Climate Change (BC3), E-48940 Leioa, Spain
[‡]Ikerbasque — Basque Foundation of Science, E-48007 Bilbao, Spain
[‖]Department of Animal Science, Michigan State University, East Lansing, MI, USA
[$]Department of Animal Sciences and Industry, Kansas State University, Manhattan, KS, USA
[¶]Global Food and Agriculture Network, Rapperswil, Switzerland
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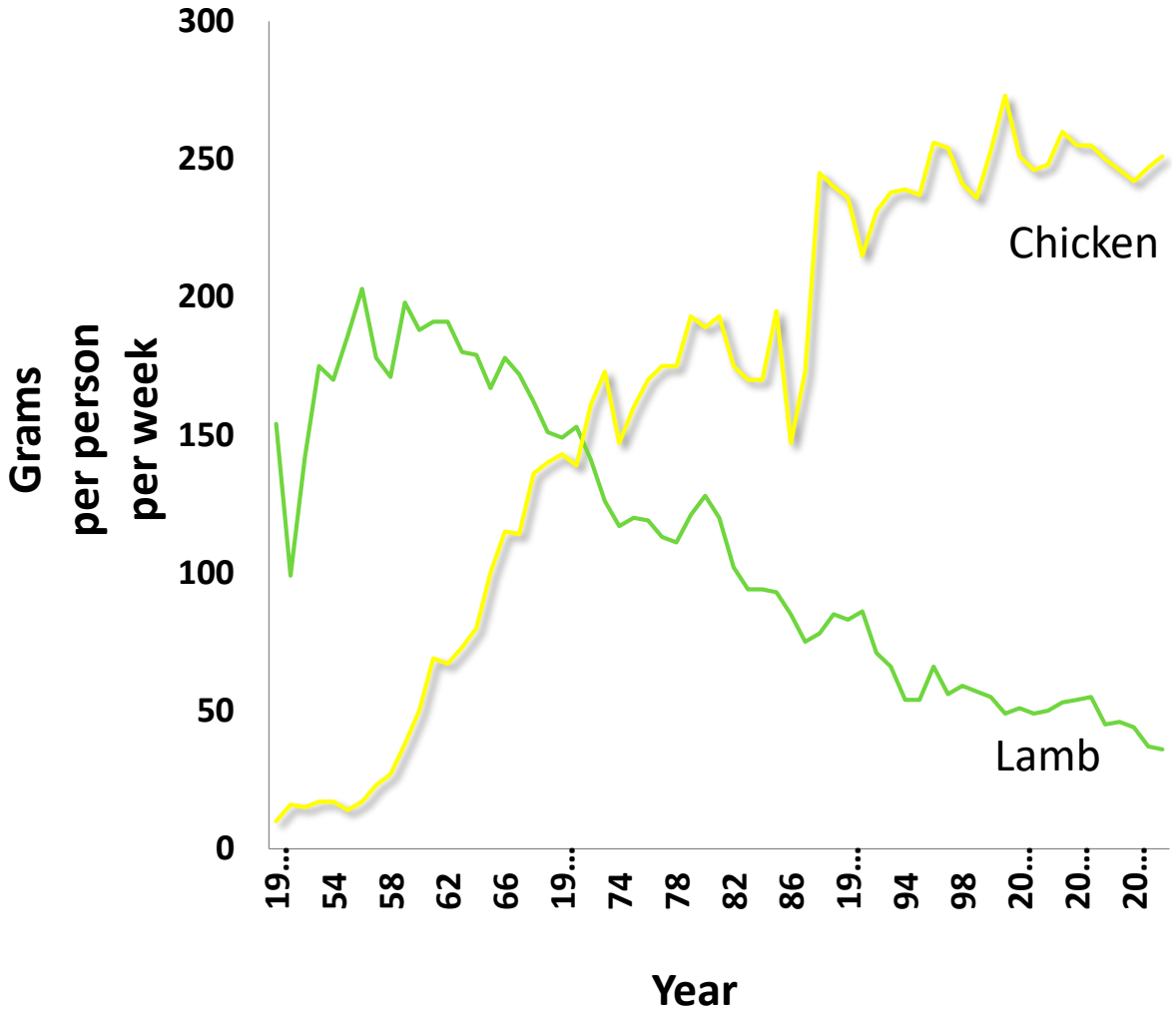
[††]School of Sustainable Food and Farming, Harper Adams University, Edgmond, Newport, Shropshire, TF10 8NB, UK

Reproduced from Nature Climate Change: Ruminants, climate change and climate policy; January 2014

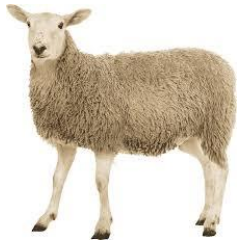
Danger of global averages

UK livestock consumption



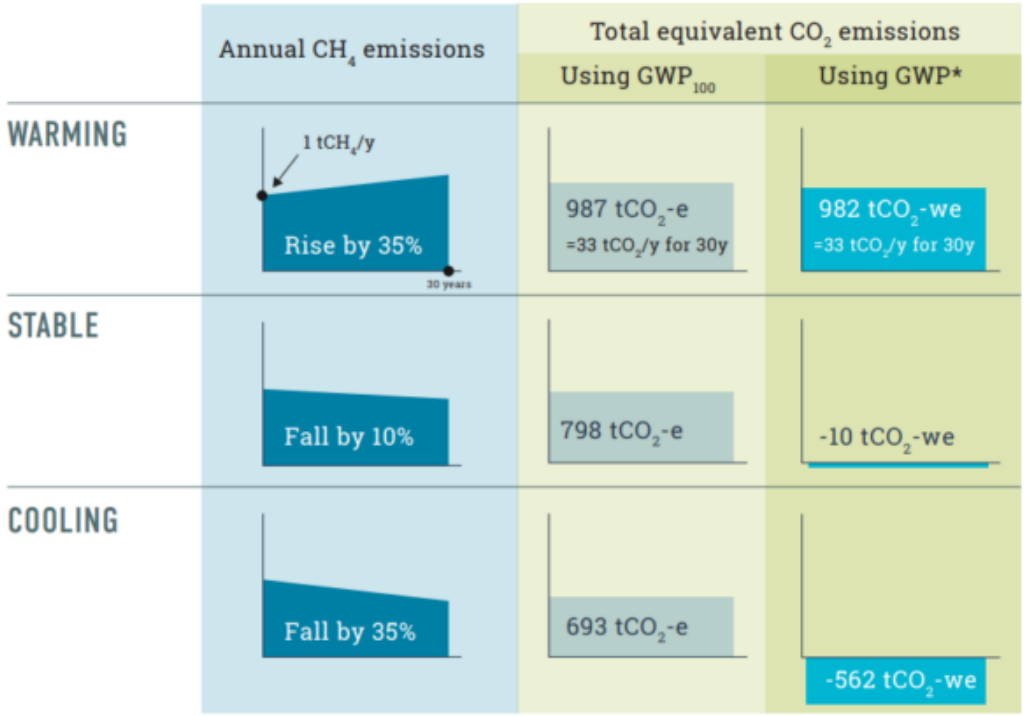
UK ruminant livestock footprint

	Lowland	Upland	Hill
Enteric fermentation (methane)	4.62	5.59	8.61
Nitrous oxide (soils)	3.79	4.18	5.91
Upstream inputs and others	2.44	3.08	3.34
Total mean carbon footprint	**10.85**	**12.85**	**17.86**



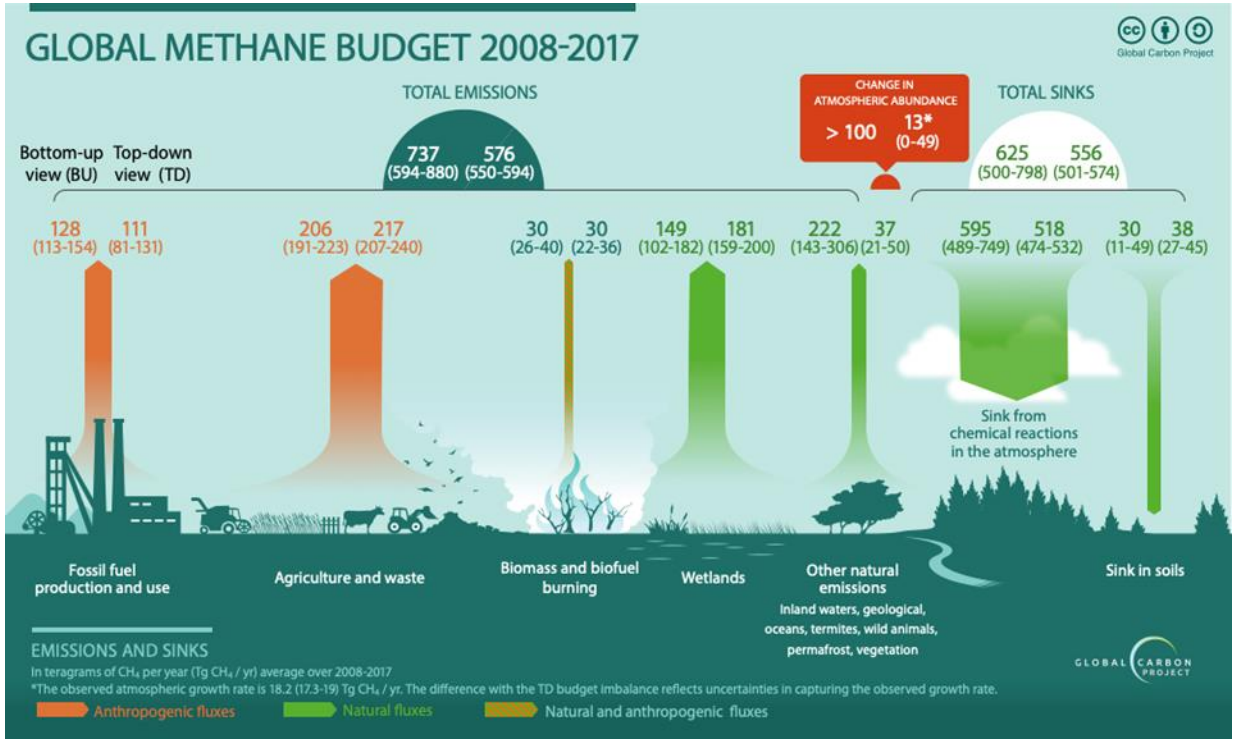
	Permanent pasture
Enteric fermentation (CH_4)	7.09
Manure management (CH_4 + N_2O)	2.51
Ammonium nitrate fertiliser production	3.56
Fertiliser application (N_2O)	2.03
Others	3.28
Total	**18.47**

GWP* vs GWP100



30% < total CH_4

CH_4 vs OH- (sinks)



Biogenic CH_4 (Natural + Agriculture)

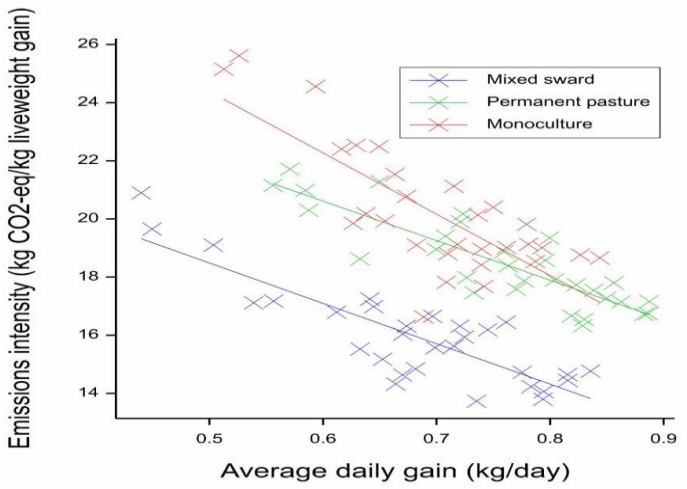
Biogenic CH_4 + Fossil CH_4

Biogenic CH_4 + Fossil CH_4 + Fossil CO

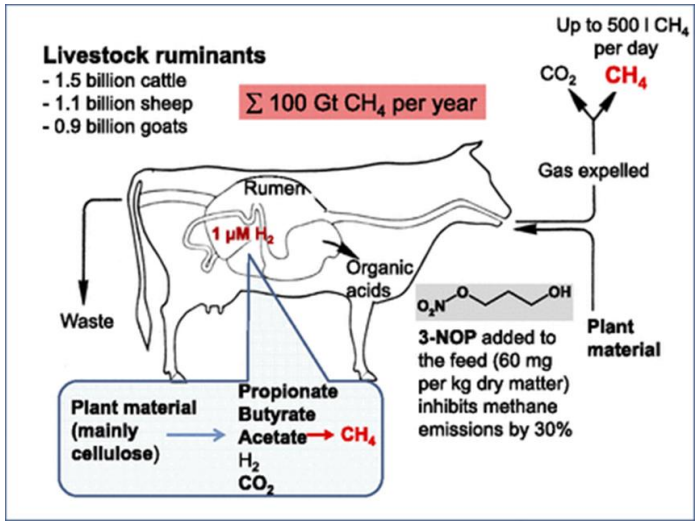
OH-

Approaches to Net Zero – 4 steps

1. Animal



2. Diet (composition and supplements)



3. Land

Table 5. Carbon storage for different types of UK plantations.

Species	Yield Class ($m^3 ha^{-1} year^{-1}$)	Rate of storage[1] ($Mg C ha^{-1} year^{-1}$)	Equilibrium carbon storage[2] ($Mg C ha^{-1}$)				
			Trees	Wood products[3]	Litter	Soil	Total
P. sitchensis[4] (unthinned)	24	5.6	90	42	34	89	254
	22	5.3	88	41	32	90	251
	20	5.1	86	40	30	92	249
	18	4.7	83	39	28	87	237
	16	4.5	79	37	26	87	229
	14	4.1	74	34	24	83	215
	12	3.7	68	32	21	77	198
	10	3.4	62	30	18	79	189
	8	2.9	54	27	15	72	169
	6	2.5	45	22	12	72	152
P. sitchensis[4] (thinned)	24	4.4	67	31	29	84	211
	22	4.3	67	31	29	87	214
	20	4.1	65	29	26	88	208
	18	3.8	62	28	25	83	198
	16	3.6	59	27	23	84	192
	14	3.3	54	26	21	80	181
	12	3.0	50	24	19	75	167
	10	2.8	46	22	17	77	162
	8	2.4	41	20	14	71	146
	6	2.1	36	16	11	71	134
Populus	12	7.3	66	36	23	87	212
Salix	..	5.9	13	9	6	65	93
Nothofagus	16	4.6	40	17	27	96	179
P. sitchensis[5]	12	3.0	52	24	19	75	170
P. sylvestris	10	2.7	53	26	19	81	178
P. contorta	8	2.5	44	19	15	78	155
F. sylvatica	6	2.4	60	26	27	87	200
Quercus	4	1.8	48	19	20	68	154

[1] Initial rate of increase in total carbon storage, calculated as total C storage at end of first rotation divided by rotation length. [2] Time-averaged storage of carbon at equilibrium. [3] In the case of thinned stands, contributions to the wood product pool from stem thinnings are calculated assuming a 5-year lifetime. [4] 2.0 m initial spacing. [5] 1.8 m initial spacing.

4. Energy and Buildings

Accounting for nutritional quality

Nutrient	Unit (per 100 g meat)	RDI	Beef Concentrate	Beef Forage	Chicken Intensive	Chicken Free range	Lamb Lowland	Lamb Upland	Pork Intensive
Protein	g	50.25	23.5	23.5	26.3	26.3	20	20	18.6
MUFA	g	37.5	1.13	1.63	3.70	5.44	1.30	1.07	0.85
EPA+DHA	mg	250	3.4	27.4	17.6	14.7	26.4	31.7	14.8
Ca	mg	700	5	5	11	11	12	12	10
Fe	mg	11.75	1.6	1.6	0.7	0.7	1.4	1.4	0.4
Riboflavin	mg							0.2	0.18
Folic acid	µg							6	1
Vitamin B12	µg							1	1
Se	µg							3	11
Zn	mg							2	1.3
Na	g						7	0.07	0.05
SFA	g						4	1.21	0. 90

The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-019-01679-7

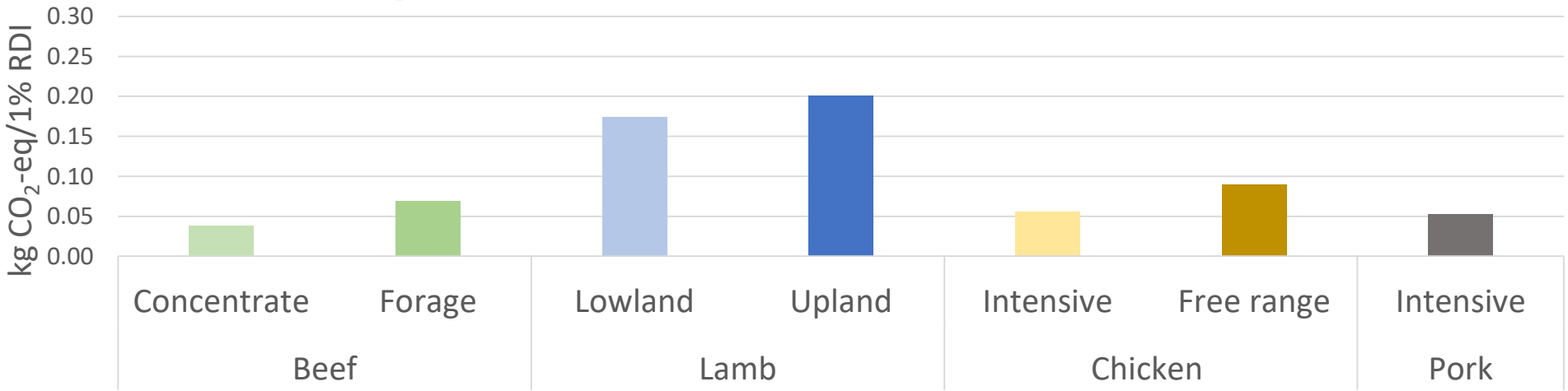
CRITICAL REVIEW

Check for updates

Applications of nutritional functional units in commodity-level life cycle assessment (LCA) of agri-food systems

Graham A. McAuliffe [1] · Taro Takahashi [1,2] · Michael R. F. Lee [1,2]

Received: 13 March 2019 / Accepted: 23 August 2019



Rebalancing the metric

Animal 15 (2021) 100257

Contents lists available at ScienceDirect

Animal

The international journal of animal biosciences

Need to consider nutrient content when defining environmental impact – KgCO2e/1% RDI

Nutritional value of su

M.R.F. Lee [a,b,*], G.A. McAuliff
T. Takahashi [a,b], L. Cardenas

[a] Rothamsted Research, North Wyke, Okehampt
[b] University of Bristol, Bristol Veterinary School,
[c] Aberystwyth University, Institute of Biological,

RDI of key nutrients

The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-022-02123-z

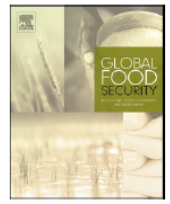
COMMENTARY AND DISCUSSION ARTICLE

Protein quality as a complementary functional unit in life cycle assessment (LCA)

G. A. McAuliffe[1] · T. Takahashi[1,2] · T. Beal[3,4] · T. Huppertz[5,6] · F. Leroy[7] · J. Buttriss[8] · A. L. Collins[1] · A. Drewnowski[9] · S. J. McLaren[10] · F. Ortenzi[11] · J. C. van der Pols[12] · S. van Vliet[13] · M. R. F. Lee[14]

Received: 1 October 2022 / Accepted: 29 November 2022

e/gfs



Need to consider defining environmental impact – KgCO2e/DIAAS corrected protein

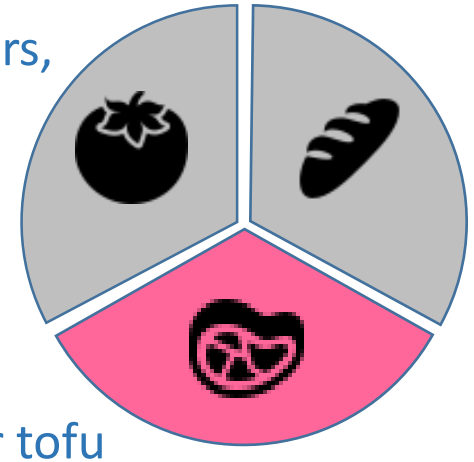
Population protein intakes and food sustainability indices: The metrics matter

Paul J. Moughan *

Riddet Institute, Massey University, Private Bag 11-222, Palmerston North, New Zealand

Diet level analysis and NDS

Carrots, tomatoes or cucumbers, always with apples



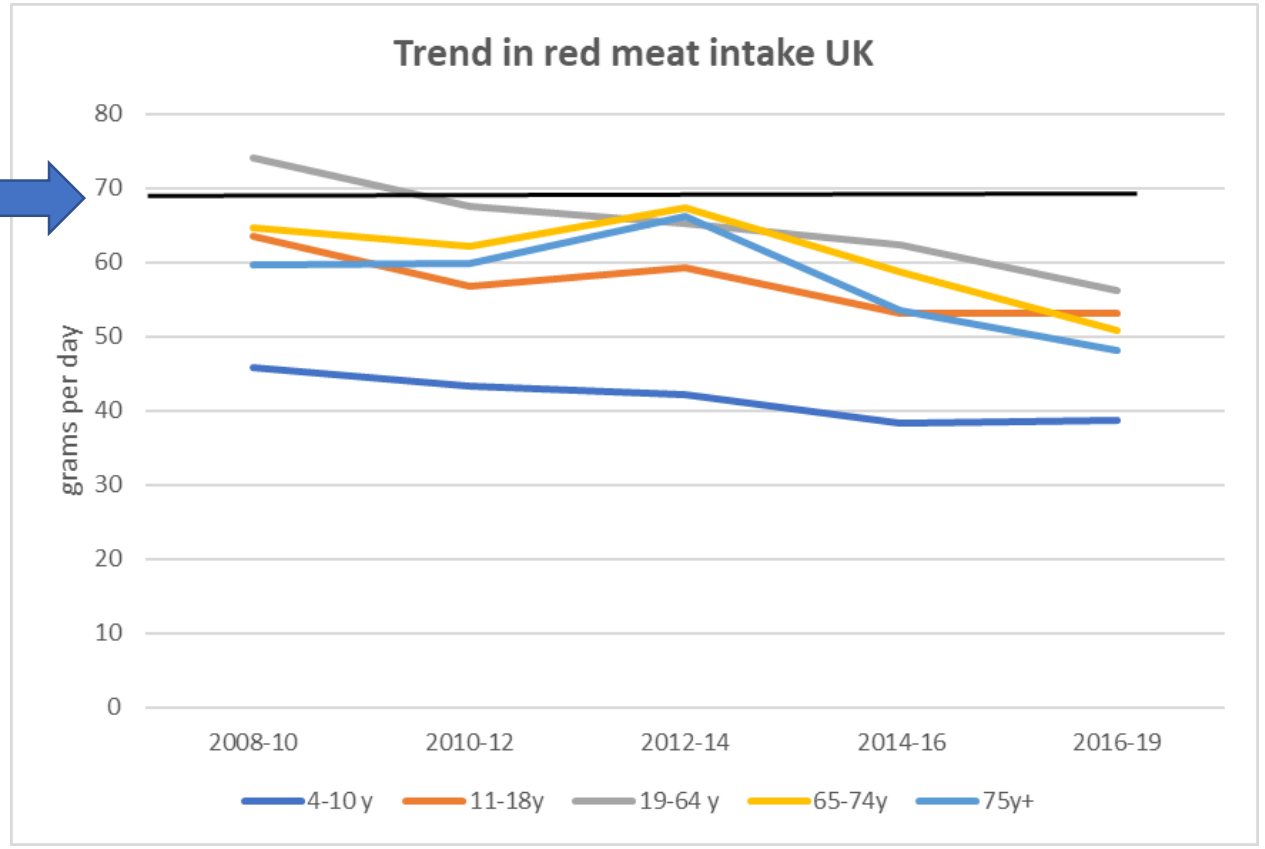
Potatoes, bread or rice

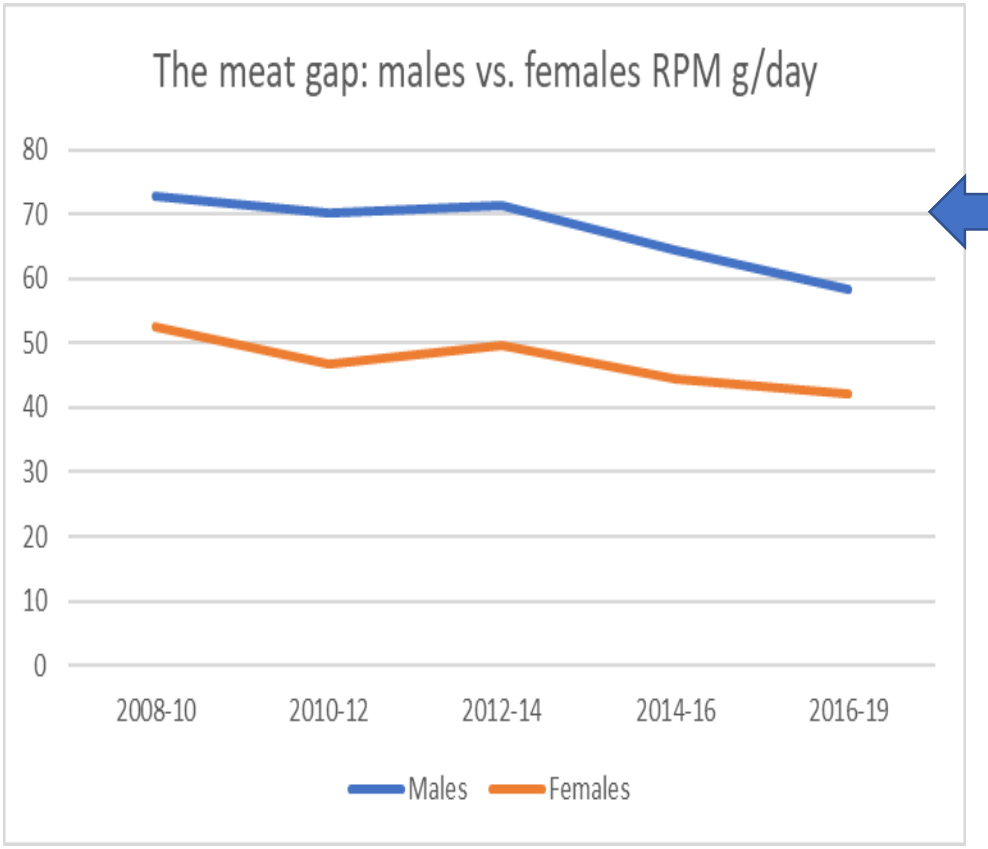
Beef, pork or tofu

Tofu Carbon footprint comparison (only protein bioavailability corrected*)

	CO2e/Kg	CO2e/NDS	CO2e/bNDS*
Beef	x15.4 tofu	x2.2 tofu	x1.7 tofu
Pork	x3.5 tofu	x1.3 tofu	x1.0 tofu

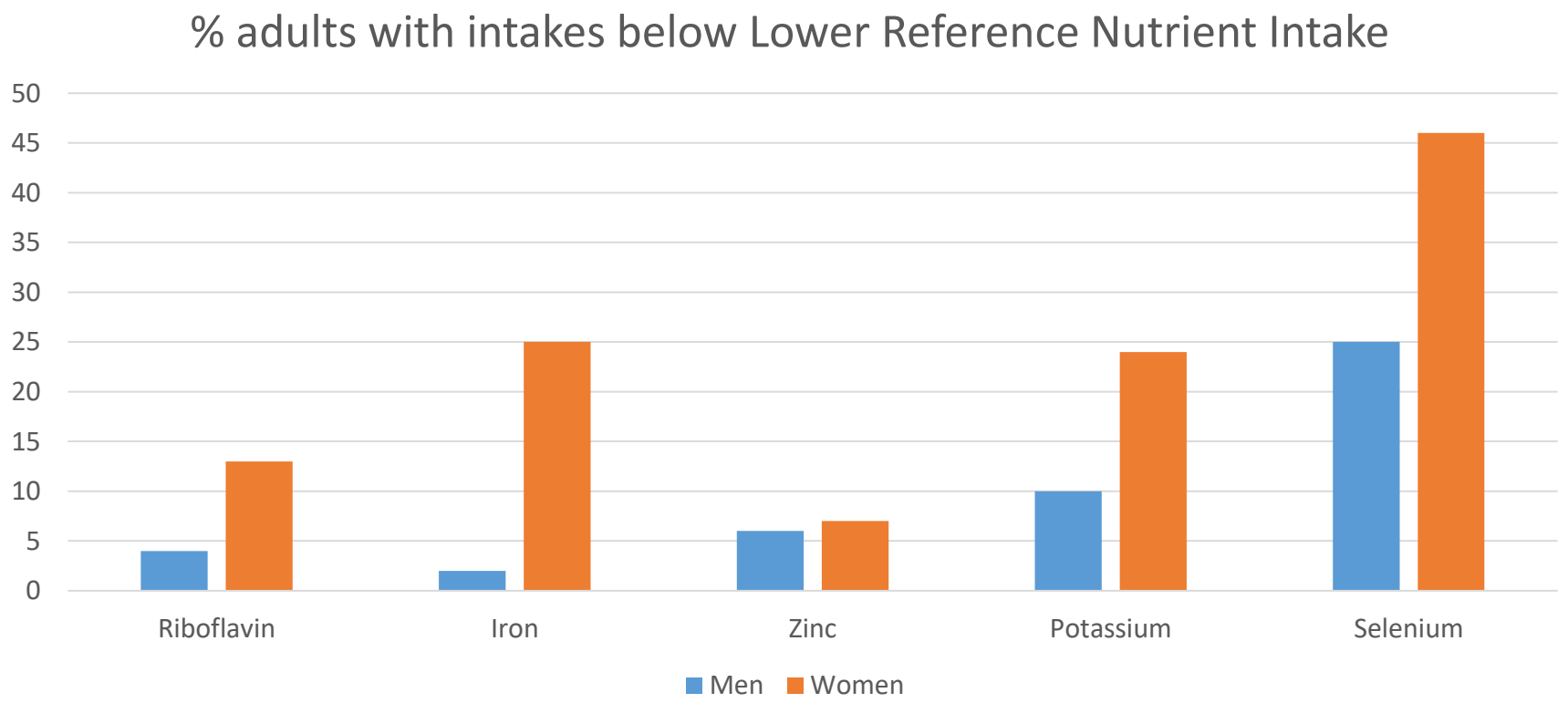
Care needed with current advice for low meat intake diets - Declining meat intakes





With thanks to Carrie Ruxton – Nutrition Communications

We are already seeing deficiency in meat-sourced nutrients



PLUS:
Around 20% of adults have low vitamin D status <25 nmol/L

DEFINITION:
The LRNI meets the needs of **<2.5%** of the population and indicates risk of deficiency

National Diet & Nutrition Survey 2020

With thanks to Carrie Ruxton – Nutrition Communications

Evidence of benefit of meat-sourced nutrients from meta-analyses of human studies

- Improving iron status may reduce fatigue
- Low zinc status associated with respiratory infections & autoimmune conditions
- Vitamin D positively correlated to bone health in adults
- Adequate intake of potassium is desirable to achieve lower blood pressure
- Selenium reduces oxidative stress

Review > Br J Nutr. 2017 May;117(10):1422-1431. doi: 10.1017/S0007114517001349. Epub 2017 Jun 19.

Iron deficiency without anaemia is a potential cause of fatigue: meta-analyses of randomised controlled trials and cross-sectional studies

Review > Nutrients. 2018 Jan 11;10(1):68. doi: 10.3390/nu10010068.

Zinc Status and Autoimmunity: A Systematic Review and Meta-Analysis

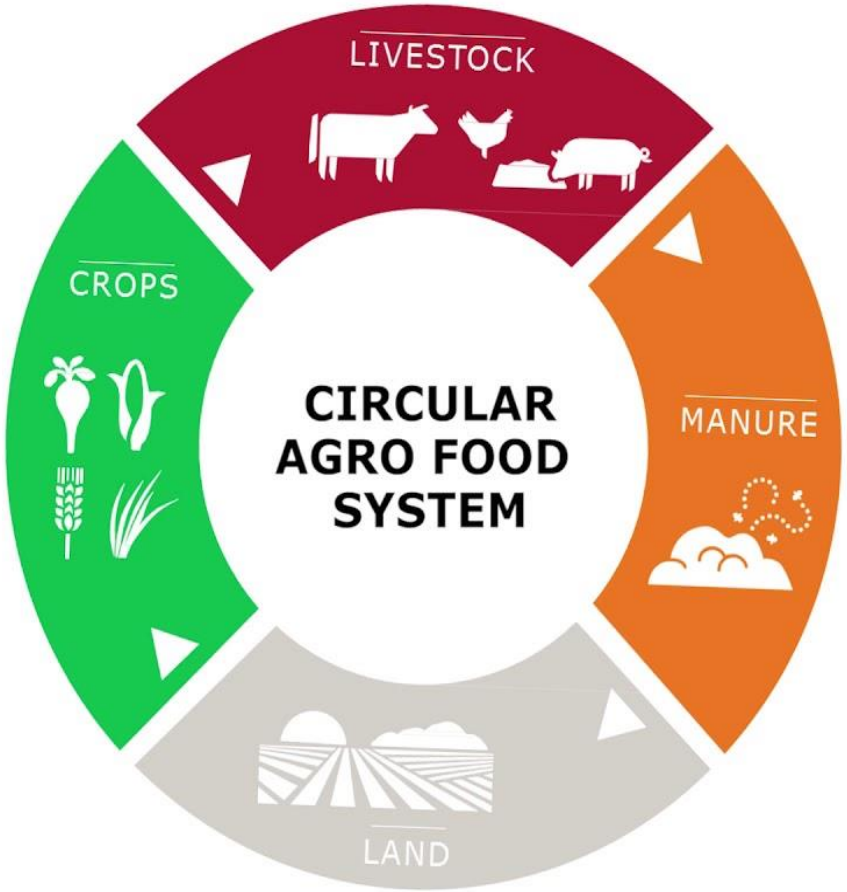
Meta-Analysis > Cien Saude Colet. 2021 Aug;26(8):3221-3244. doi: 10.1590/1413-81232021268.15012020. Epub 2020 May 28.

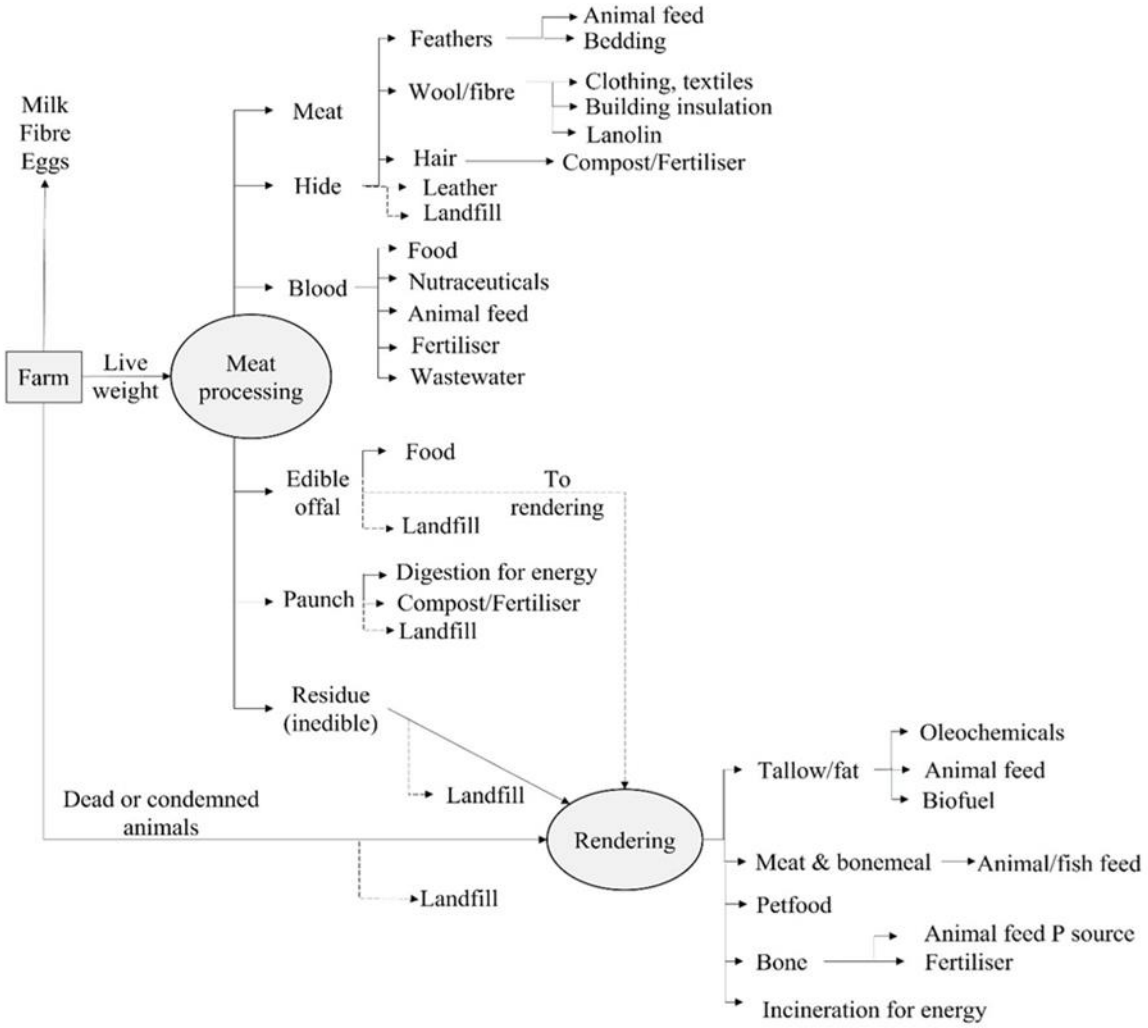
Vitamin D and bone health in adults: a systematic review and meta-analysis

Meta-Analysis > Hormones (Athens). 2019 Dec;18(4):451-462. doi: 10.1007/s42000-019-00143-3. Epub 2019 Dec 10.

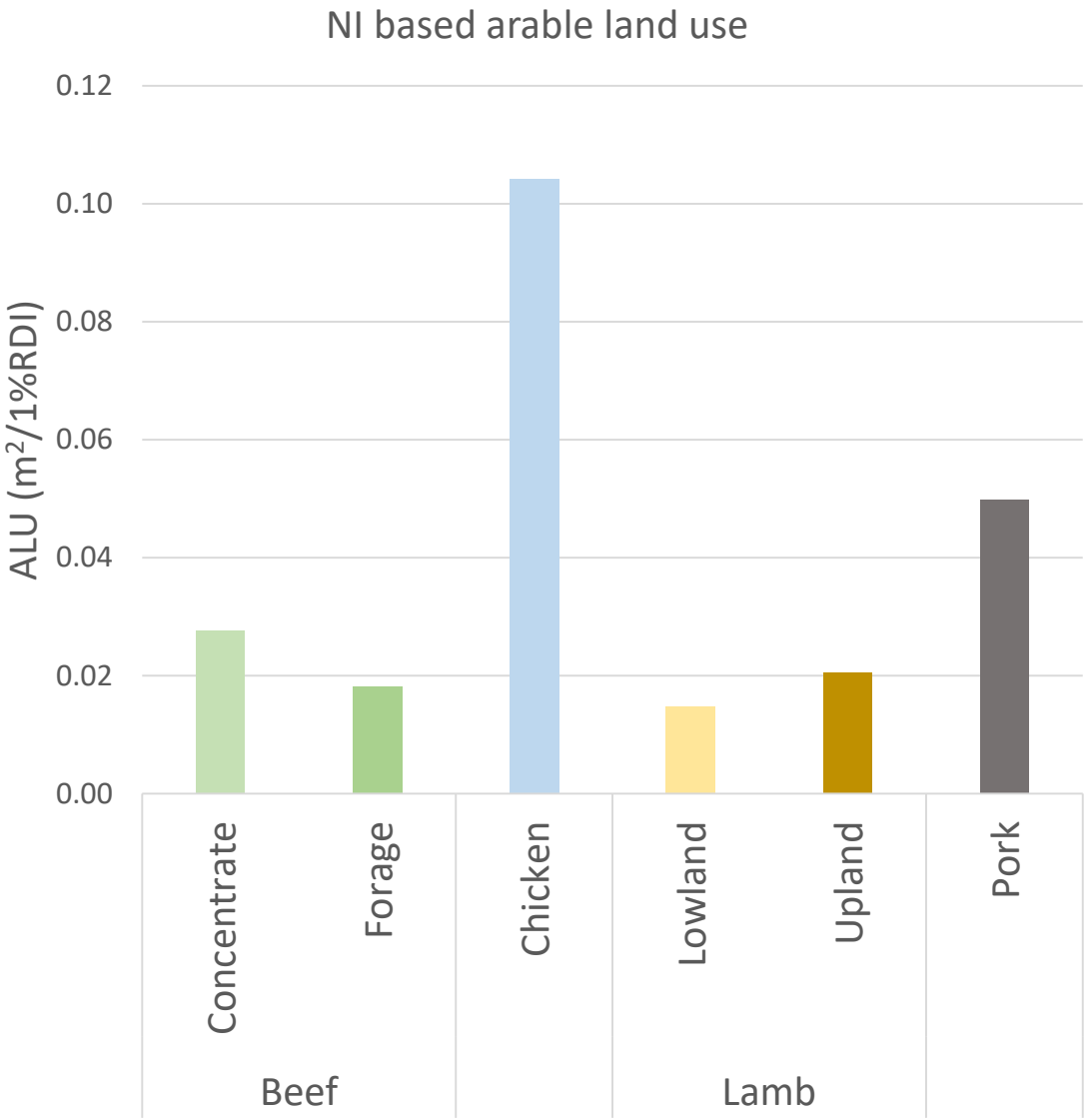
Effect of selenium supplementation on antioxidant markers: a systematic review and meta-analysis of randomized controlled trials

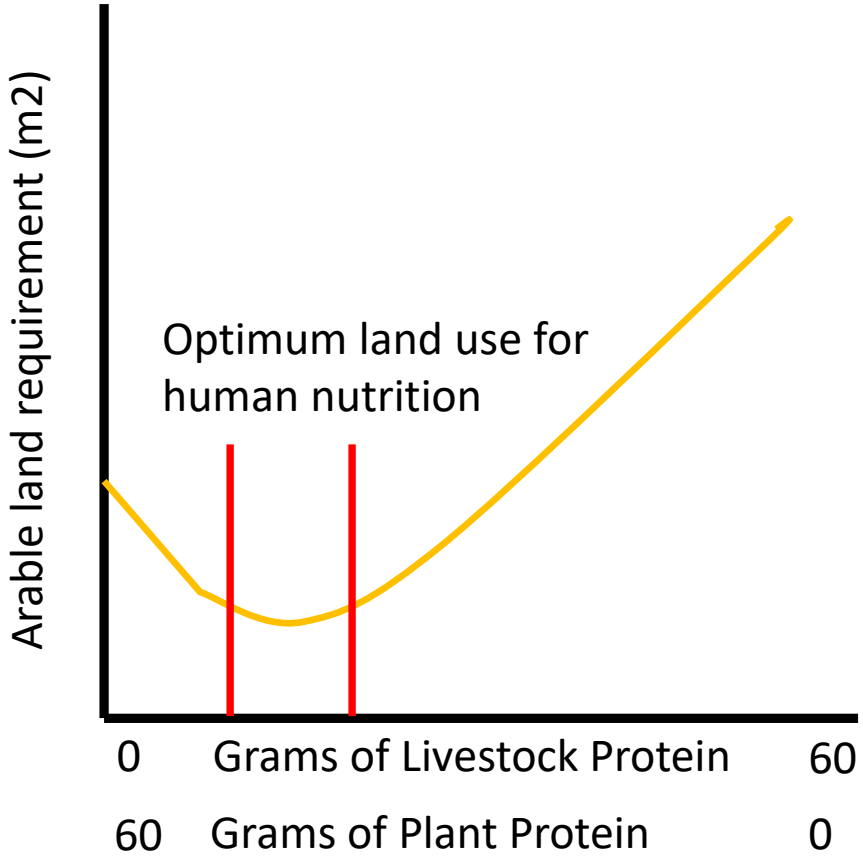
Bio-circularity – FAO role





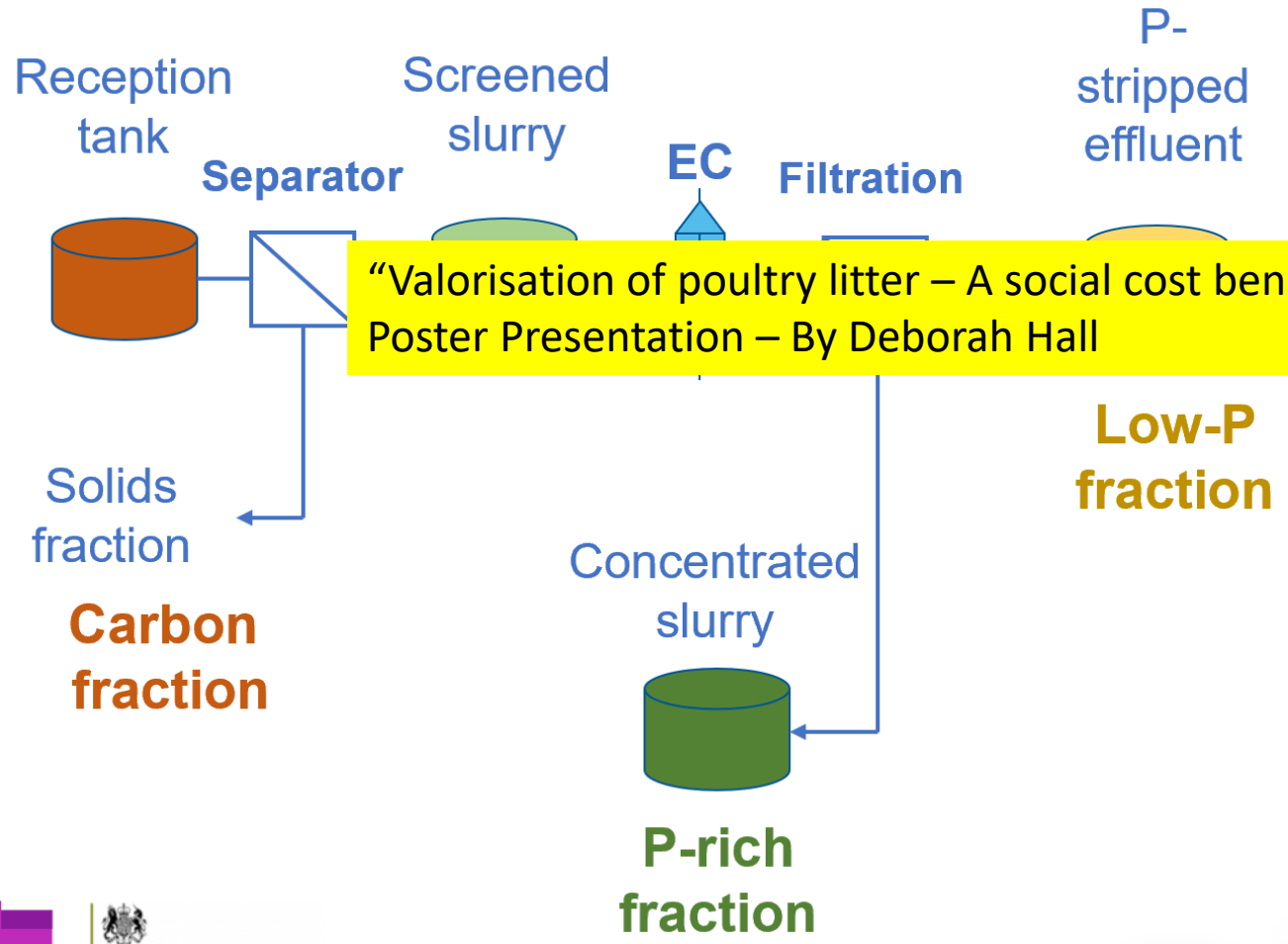
Arable land use (ALU) per NI provision





Phosphorous recovery from slurry to grassland agronomy

Rhiannon Evans, Simon Jeffery, James McCaughern, Harry Davies and Marie Kirby



"Valorisation of poultry litter – A social cost benefit comparison". Poster Presentation – By Deborah Hall

Innovate UK
Department for Environment Food & Rural Affairs

Innovate UK project number 10003082

elentec Electrochemical Environmental Technology
Merigan