Eating our troubles away? The crucial role of food systems in tackling climate change

Dr Helen Harwatt
Animal Law & Policy Program
Harvard Law School

Statement from the World Health Organization:

*"**Climate change** is the greatest **threat to global health** in the 21st century. Health professionals have a duty of care to current and future generations."*

Paris Agreement requires global mean temperature rise to stay *well below* 2°C above pre-industrial levels, ideally to no more than 1.5°C

Context:

- Global temperature is >1°C - already having negative impacts
- Impacts at 1.5°C > current but < 2°C
- Impacts greater if temperature overshoots 1.5°C then returns to 1.5°C
- Best option for adhering to precautionary principle & equity = 1.5°C with no overshoot.
  - Requires:
    - 45% reduction in CO_2 by 2030
    - Net zero by 2050

Raftery et al., 2017. Nature Climate Change; IPCC 2014. Brown and Caldeira, 2017. Nature. UNEP, 2017. Emissions Gap Report; Rahmstorf and Levermann., 2017; IPCC, 2018.

Progress report:

- Current pledges to the Paris Agreement >3°C
- Chances of meeting Paris goals could be depleted by 2030
- 2020 revision of pledges is final opportunity to bring emissions in line with Paris goals

The coming decade is CRUCIAL

UNEP, 2017. Emissions Gap Report.

.

What's needed:

- Global emissions to **peak** asap
- **Strong** and **rapid** reductions before **2030**
- Enhanced **longer term** commitments

Delaying action now = greater dependence on unproven technologies

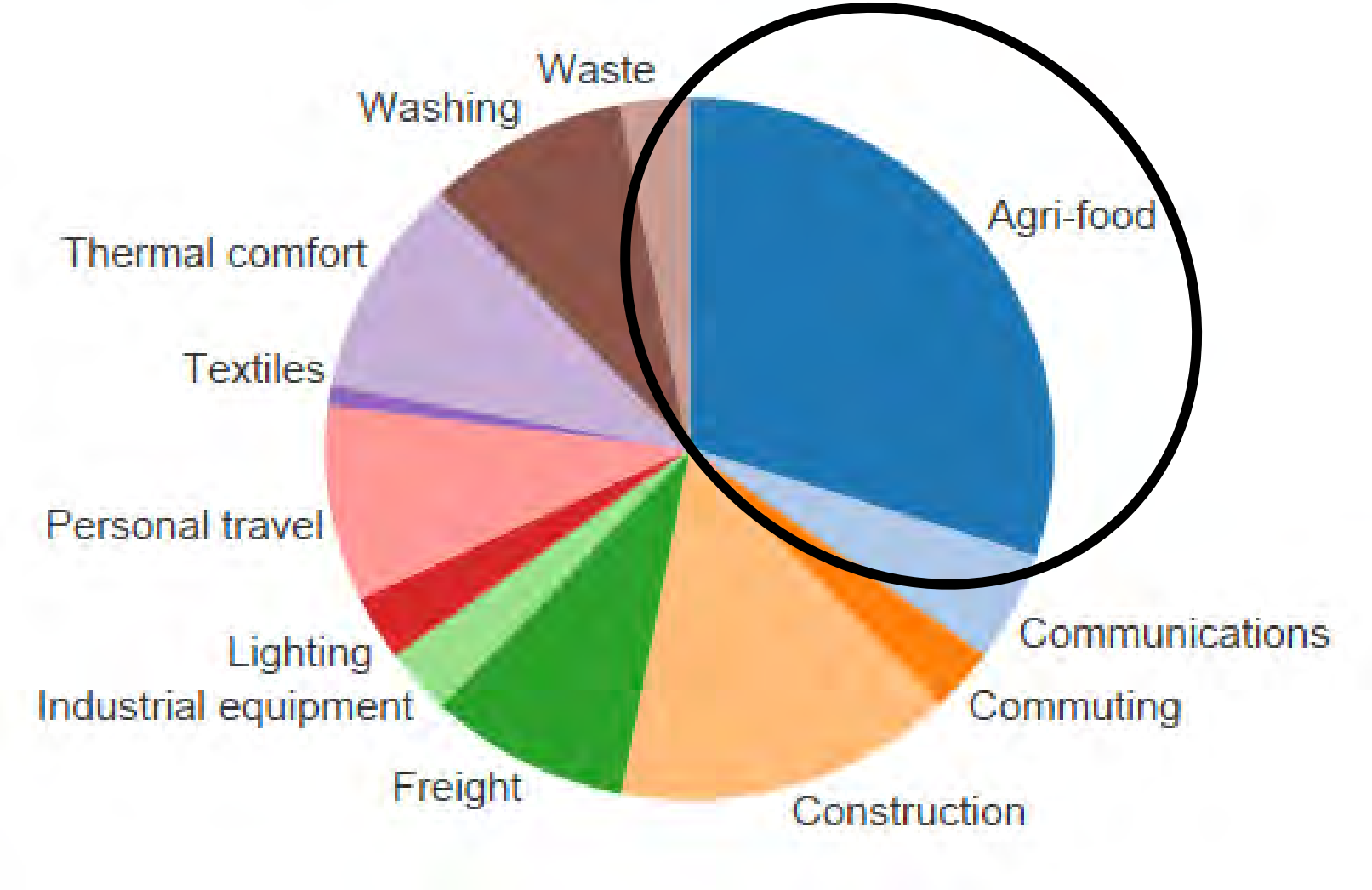
UNEP, 2017. Emissions Gap Report.

Unprecedented change is needed to meet ambitious climate change targets

- **Net zero greenhouse gas emissions this century – by 2050 for 1.5°C goal.**
- **MAJOR change from ALL sectors is required.**

IPCC, 2018

Global Greenhouse Gas Emissions



Bajzelji et al 2014. NCC

Livestock contributes:

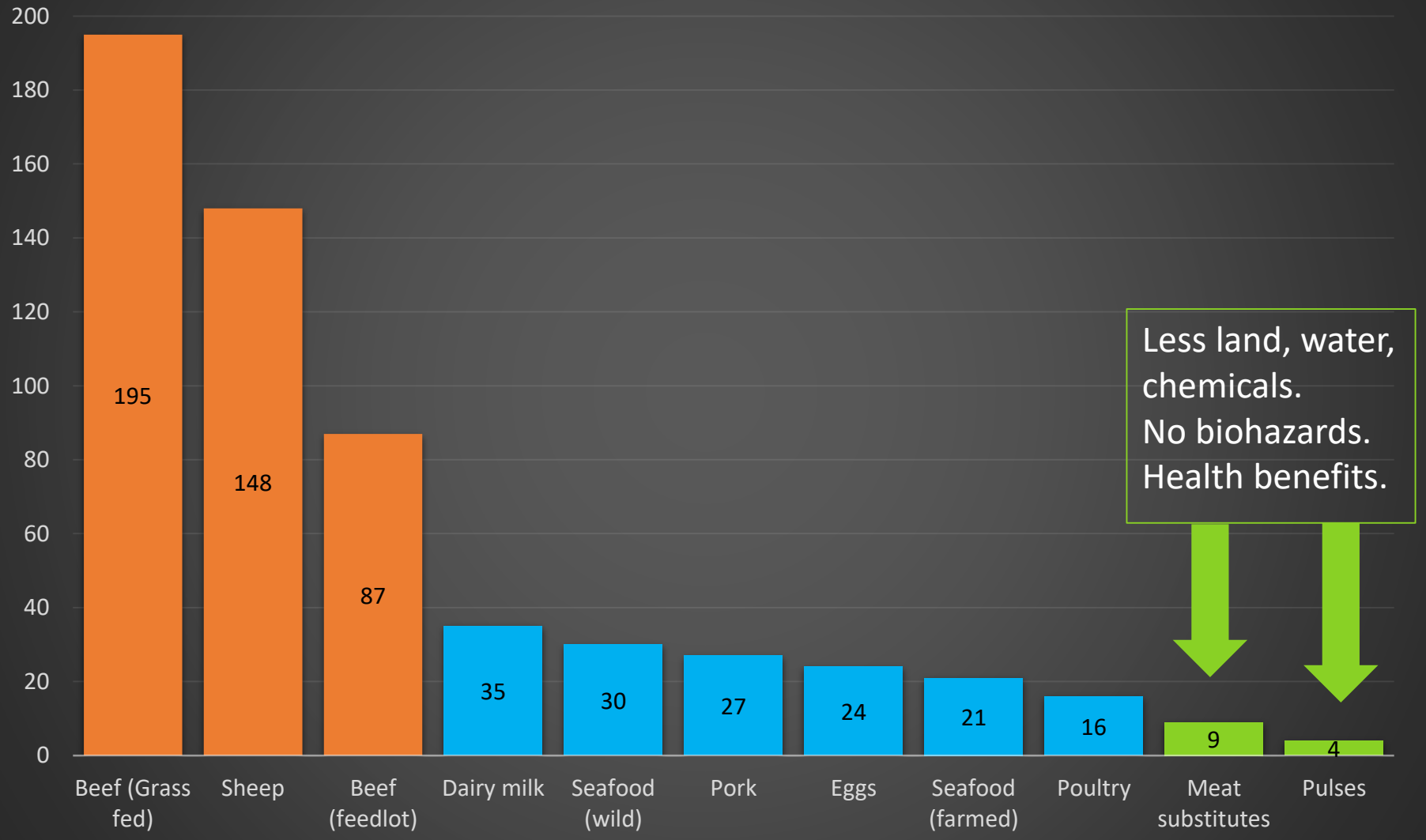
- 16.5% of global CO_2e
- 5% of global CO_2

- 53% nitrous oxide
- 44% methane
  - **expected to increase by 60% by 2030**

UN FAO 2018; Smith et al., IPCC, 2007; Gerber et al., 2013; Sims et al., 2014. Reisinger and Clark, 2017. Global Change Biology.

Average greenhouse gases emitted for high protein foods

(kg CO_2e per 1kg protein)



Nijdam et. al. 2012

Good news for tofu lovers

Kg of CO_2e/kg product:

Tofu = 1
Lamb = 39
Beef = 27
Cheese = 14
Pork = 12
Farmed salmon = 12
Chicken = 7
Eggs = 5

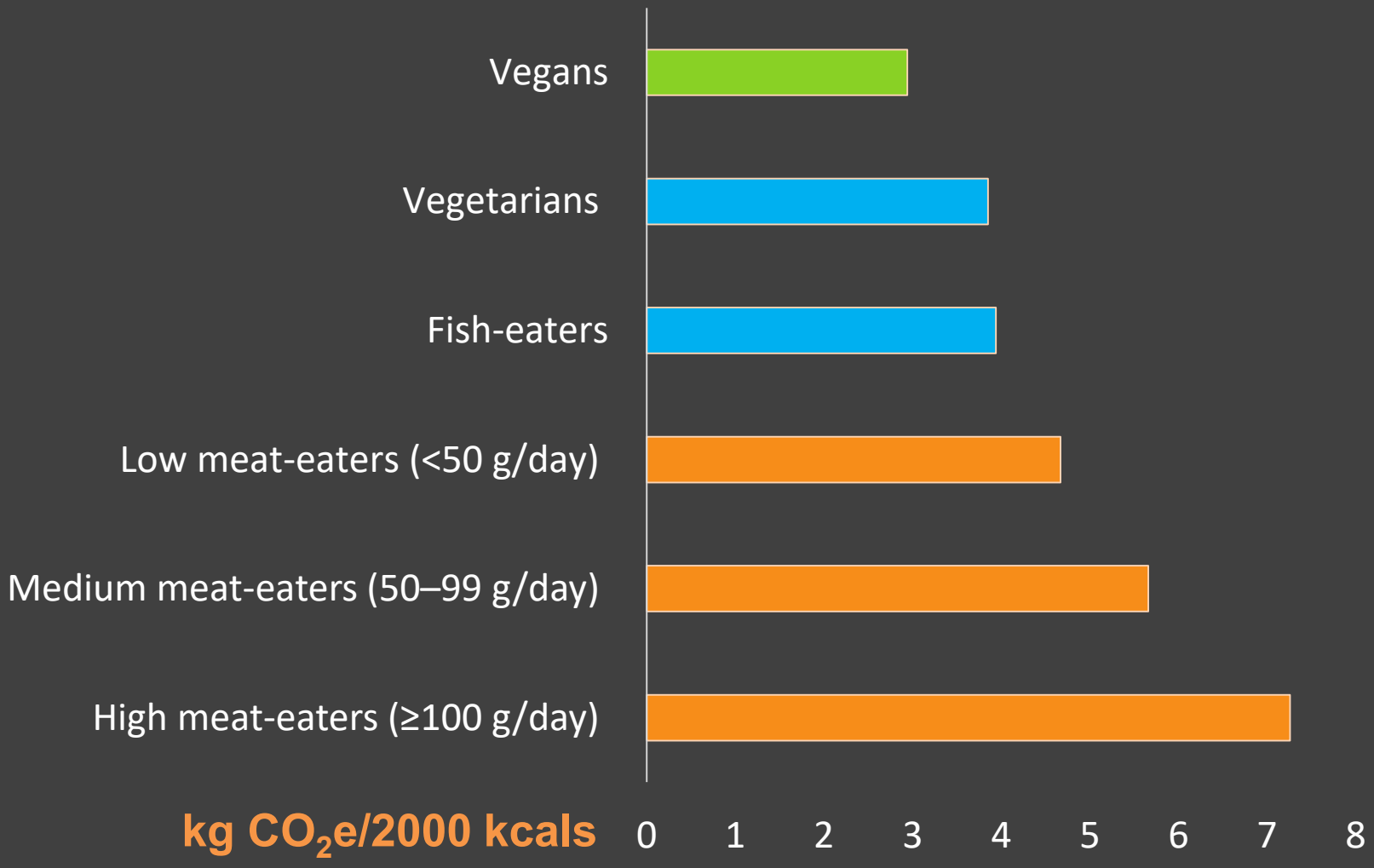
Mejia and Harwatt et al., 2017. Journal of Hunger and Environmental Nutrition. Hamerschlag et al, 2011.

Good news for meat analog lovers

2.2 kg CO_2e/kg product

Mejia and Harwatt et al, JHEN, *2019*

Greenhouse Gas Emissions by Diet Pattern



GHG emissions of meat-eaters are twice as high as those of vegans

Scarborough et al. Climatic Change 2014:1-14

The American Journal of Clinical Nutrition

Climate change mitigation and health effects of varied dietary patterns in real-life settings throughout North America[1–4]

Samuel Soret, Alfredo Mejia, Michael Batech, Karen Jaceldo-Siegl, Helen Harwatt, and Joan Sabaté

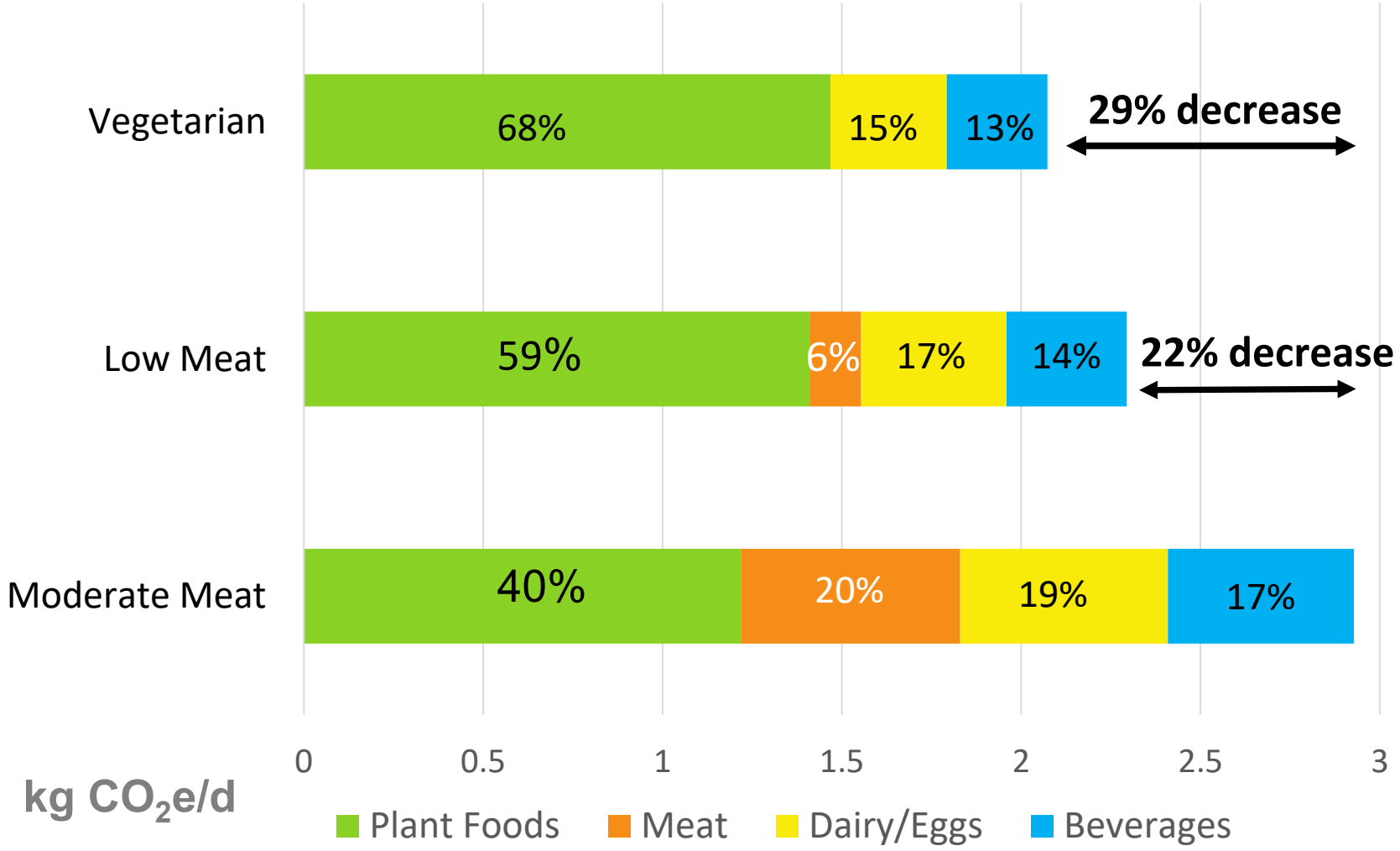
ABSTRACT

Background: Greenhouse gas emissions (GHGEs) are a major consequence of our dietary choices. Assessments of plant-based compared with meat-based diets are emerging at the intersection of public health, environment, and nutrition.

GHGEs based on a range of conservative and more inclusive assessments (11, 12).

To alleviate the environmental pressure imposed by the modern food system, both the average worldwide consumption of animal products and the intensity of emissions from livestock production

Greenhouse Gas Emissions By Dietary Pattern And Food Groups * (With % Contribution)



*Adjusted to 2000 kcal

Soret et al., 2014. AJCN.

What are the impacts of animal to plant-sourced food shifts on climate change targets?

Food system hotspot: beef

- **41%** of **livestock sector** emissions.
- Contributes **6% of global CO_2e** emissions

- Contributes **17% of global methane**.

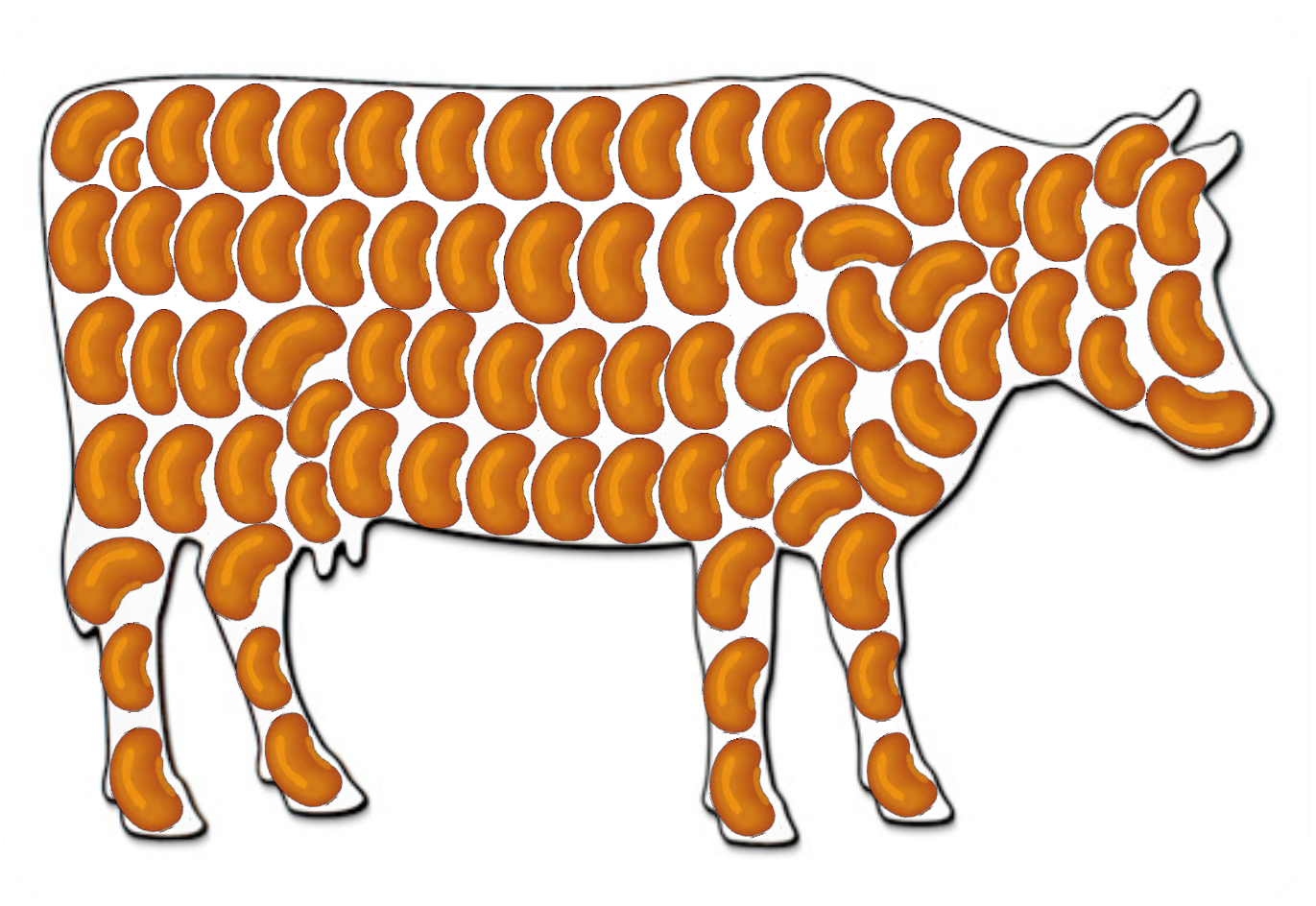
Gerber et al., 2013. FAO; IPCC, 2014.

Climatic Change
DOI 10.1007/s10584-017-1969-1

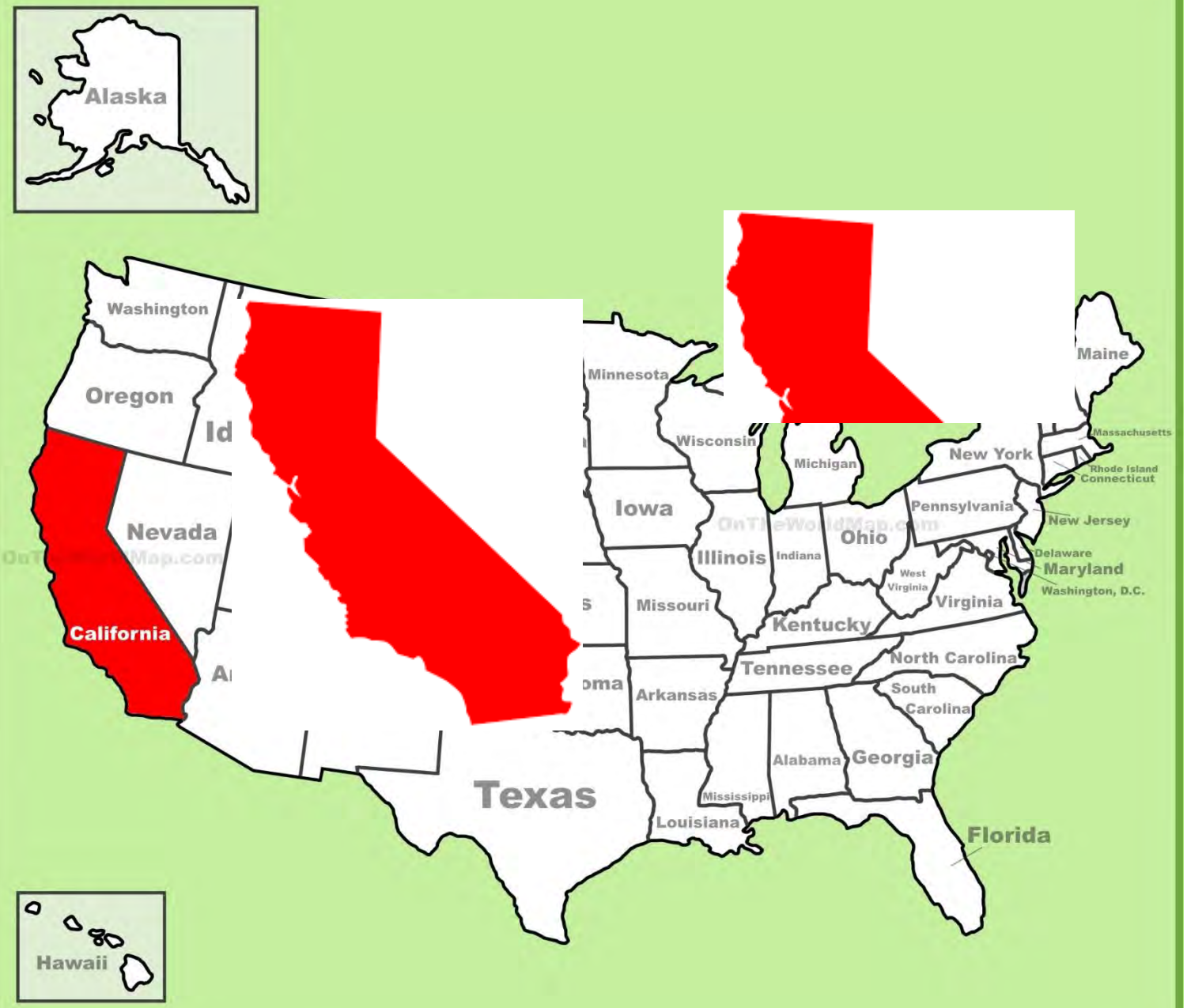
Substituting beans for beef as a contribution toward US climate change targets

Helen Harwatt[1] · **Joan Sabaté**[1] · **Gidon Eshel**[2,3] · **Sam Soret**[1] · **William Ripple**[4]

Received: 16 February 2016 /Accepted: 10 April 2017




75%
U.S. 2020
emissions target



Inaction on Animal Agriculture

- **Livestock** could use **49% of 1.5°C** and a **37% of 2°C** budget by **2030**
- **Would require other sectors to increase mitigation efforts.**

Harwatt 2018, *Climate Policy.*

Can technology save the day?

- **32% reduction** through technology and ambitious farming techniques **outpaced** by increasing **demand** for meat.
- **Only 10%** of the livestock-related technical GHG mitigation potential is **viable**.

Reducing the consumption of animal products is unavoidable….

Gerber et al., 2013. FAO; Herrero et al., 2016. Nature Climate Change.
Springmann et al 2016, PNAS. Hedenus et al 2014. Climatic Change.

Why does animal agriculture have a huge environmental footprint?

- Population size
- Feed crops
- Farm operations
- Manure
- Greenhouse gas from the animals

Animal sourced foods are inefficient to produce…

To produce **1 calorie** of:

- **Beef** = **37** calories of plants
- **Pork** = **12** calories of plants
- **Chicken** = **9** calories of plants
- **Eggs or dairy** = **6** calories of plants

Eshel et al., 2014. PNAS. Cassidy et al. 2013. ERL.

>third of all crop calories are fed to animals – only 12% of those calories come back as human food.

Eshel et al., 2014. PNAS. Cassidy et al. 2013. ERL.

Much more efficient for humans to eat plants, not animals…

U.S. uses **67% of total calories for livestock feed**

- Could feed **twice** (350 million) as many people by from same land by optimizing food production for human health and least resources.

Cassidy et al. 2013. ERL. Shepon et al., 2018. PNAS.

Global CO_2 budget for 1.5°C:
12 years of current emissions

Deep and rapid emissions reductions
+ ~730 Gt CO_2 removal
- requires large areas of land

IPCC, 2018

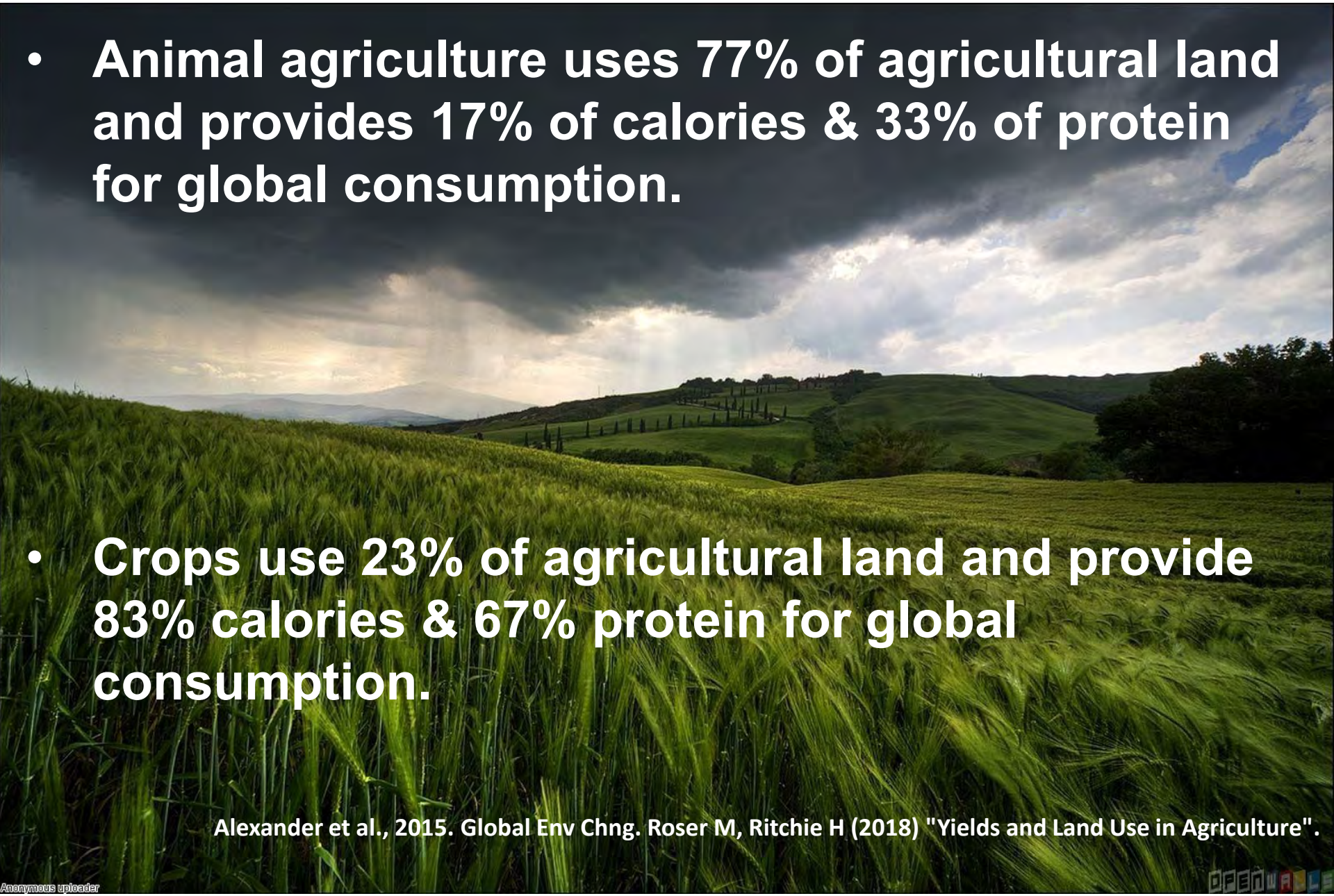


Photo credit: Open Walls

Creating Paris-compliant food systems is essential

- UK far from this – most reductions so far from energy.
- GHGs from agriculture not decreased in past 5 years.
- Off track to deliver reforestation target and industry-led voluntary approach to reduce agricultural GHGs.
- Agriculture will be one of largest emitters in the UK.
- UK must use large areas of land to rapidly ramp-up reforestation, habitat restoration and soil carbon.
- Agriculture uses 72% of land in the UK.

Henderson et al., 2018; CCC 2018; DEFRA 2018.

EATING AWAY AT CLIMATE CHANGE WITH NEGATIVE EMISSIONS

Repurposing UK agricultural land to meet climate goals

Helen Harwatt* and
Matthew Hayek*

11 April, 2019

*Animal law and policy program
Harvard Law School
hharwatt@law.harvard.edu
mhayek@law.harvard.edu

Radical action, far beyond that currently planned, is required across ALL sectors - including agriculture.

- We focus on CDR potential of returning UK land used for animal agriculture to forest cover:
  - Large land occupation
  - Large contribution to loss of natural carbon sinks
  - Low food output to land use ratio

IPCC, 2018

Our scenarios - CDR potential of:

1. **Returning permanent pasture and animal feed cropland to forest**

- Maximises CDR but might not meet micronutrient needs of UK population.

2. Returning permanent pasture to forest and keeping all cropland in production

- Reduces potential for CDR compared to scenario 1
- Increases potential to meet population-wide nutritional needs.

We model deep transformations to UK agriculture without consideration of or attempt to maintain BAU.

Findings

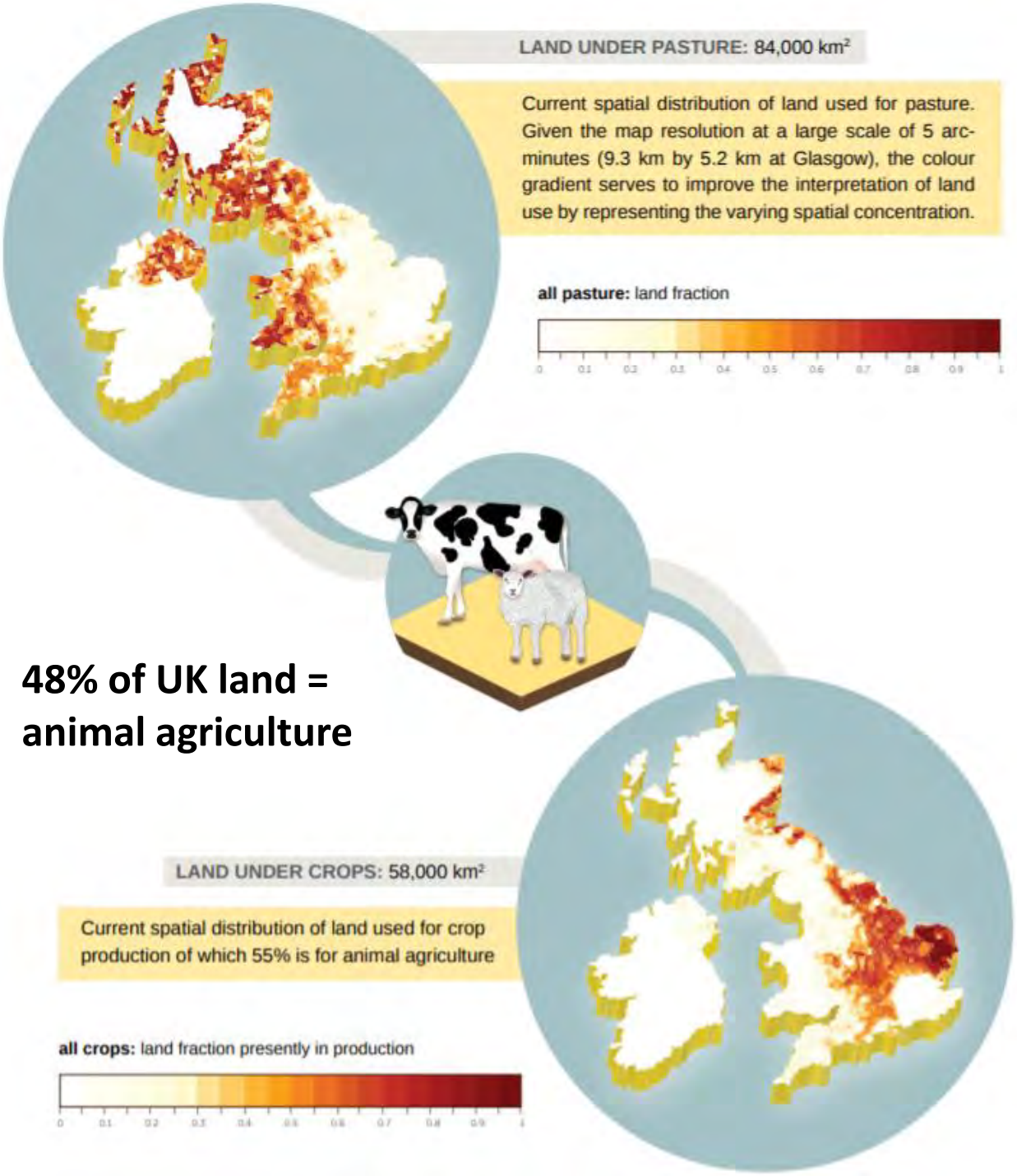
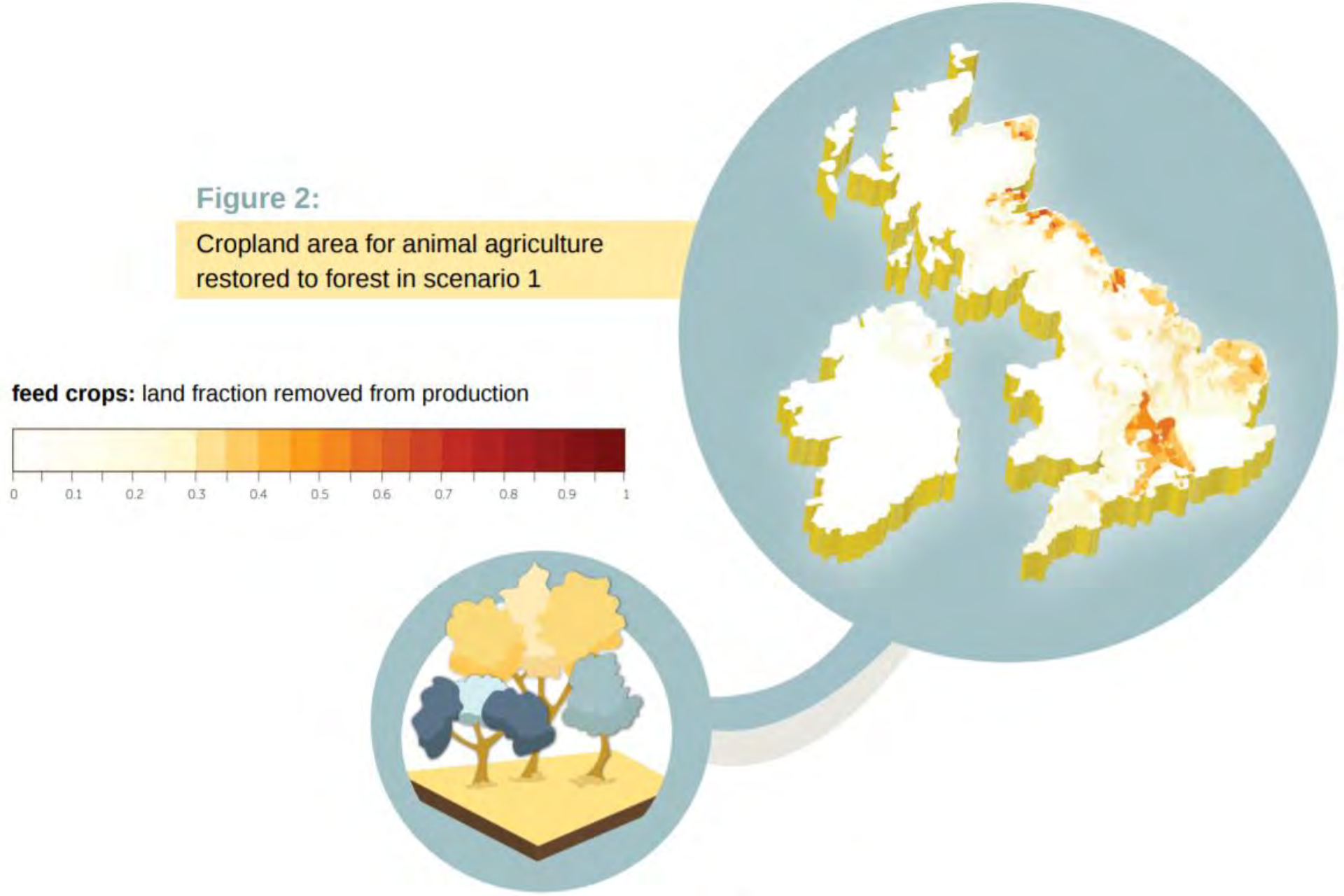
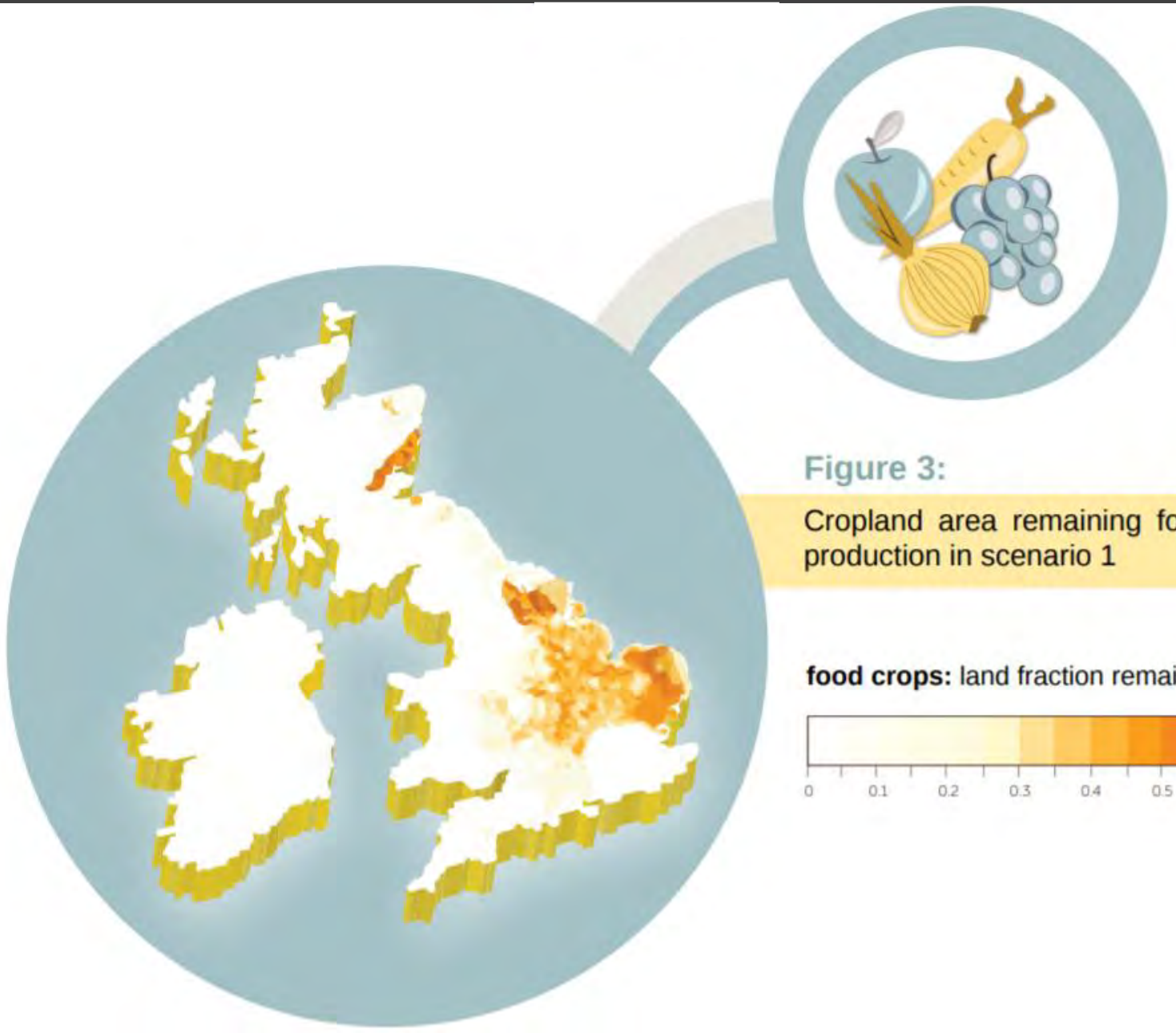

LAND UNDER PASTURE: 84,000 km²
Current spatial distribution of land used for pasture. Given the map resolution at a large scale of 5 arc-minutes (9.3 km by 5.2 km at Glasgow), the colour gradient serves to improve the interpretation of land use by representing the varying spatial concentration.
all pasture: land fraction
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
48% of UK land = animal agriculture
LAND UNDER CROPS: 58,000 km²
Current spatial distribution of land used for crop production of which 55% is for animal agriculture
all crops: land fraction presently in production
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

Figure 2:

Cropland area for animal agriculture restored to forest in scenario 1





Enough protein and calories for the UK population

Figure 3:

Cropland area remaining for human food production in scenario 1

food crops: land fraction remaining in production

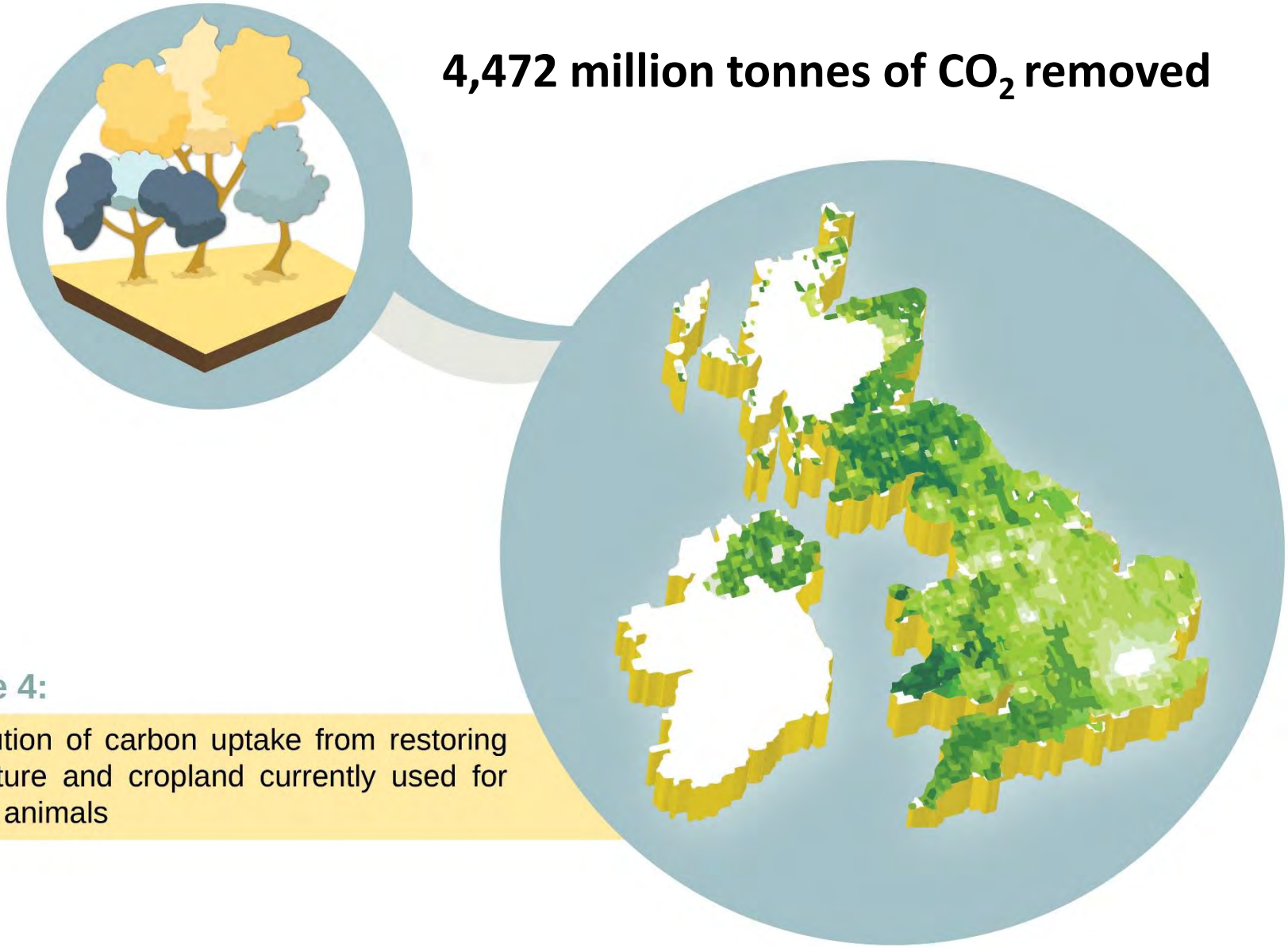
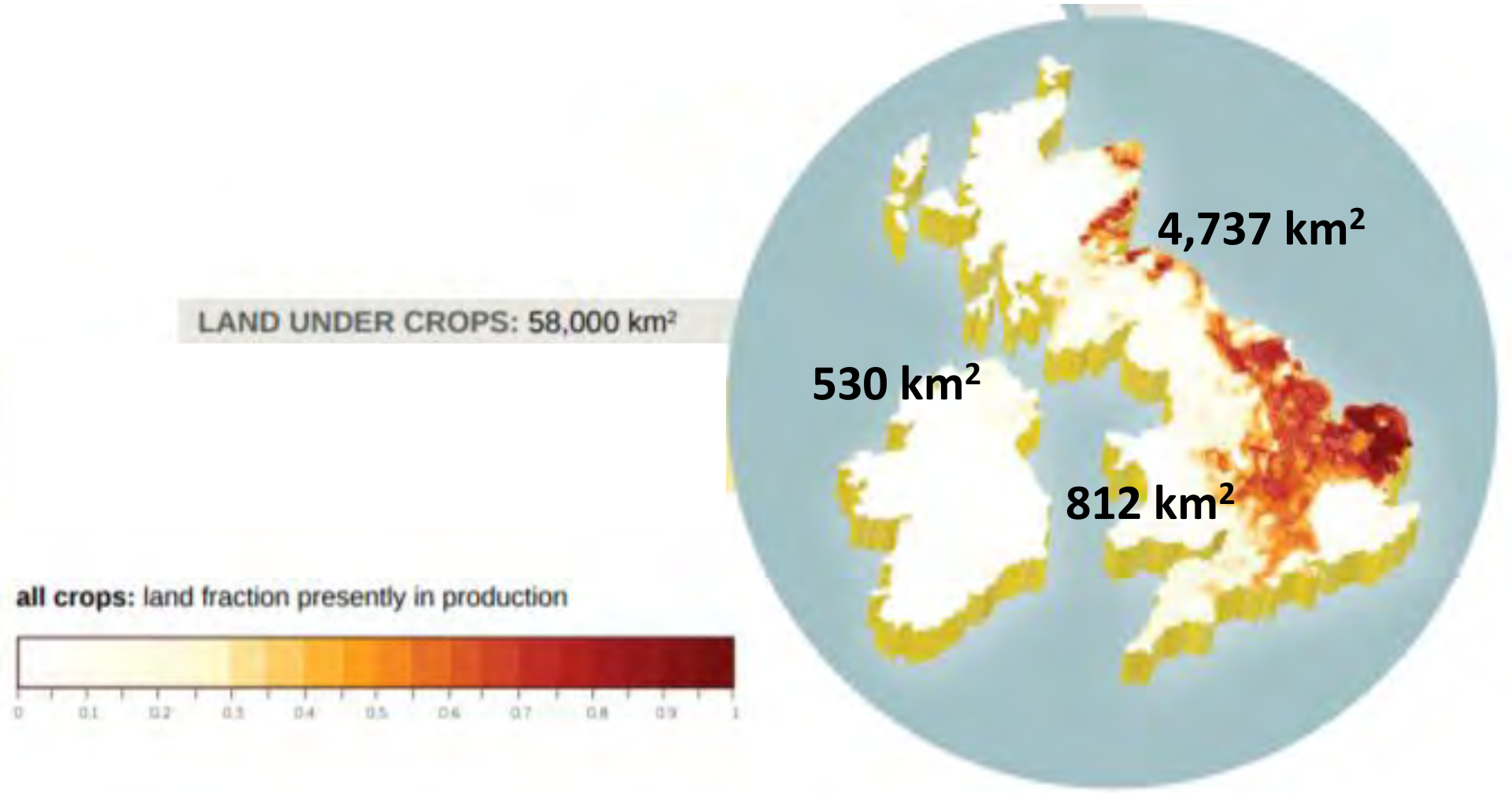


Figure 4:

Distribution of carbon uptake from restoring all pasture and cropland currently used for farmed animals

Scenario 2: Reforesting pasture land

Retain all cropland for food production



3,236 million tonnes of CO_2 removed

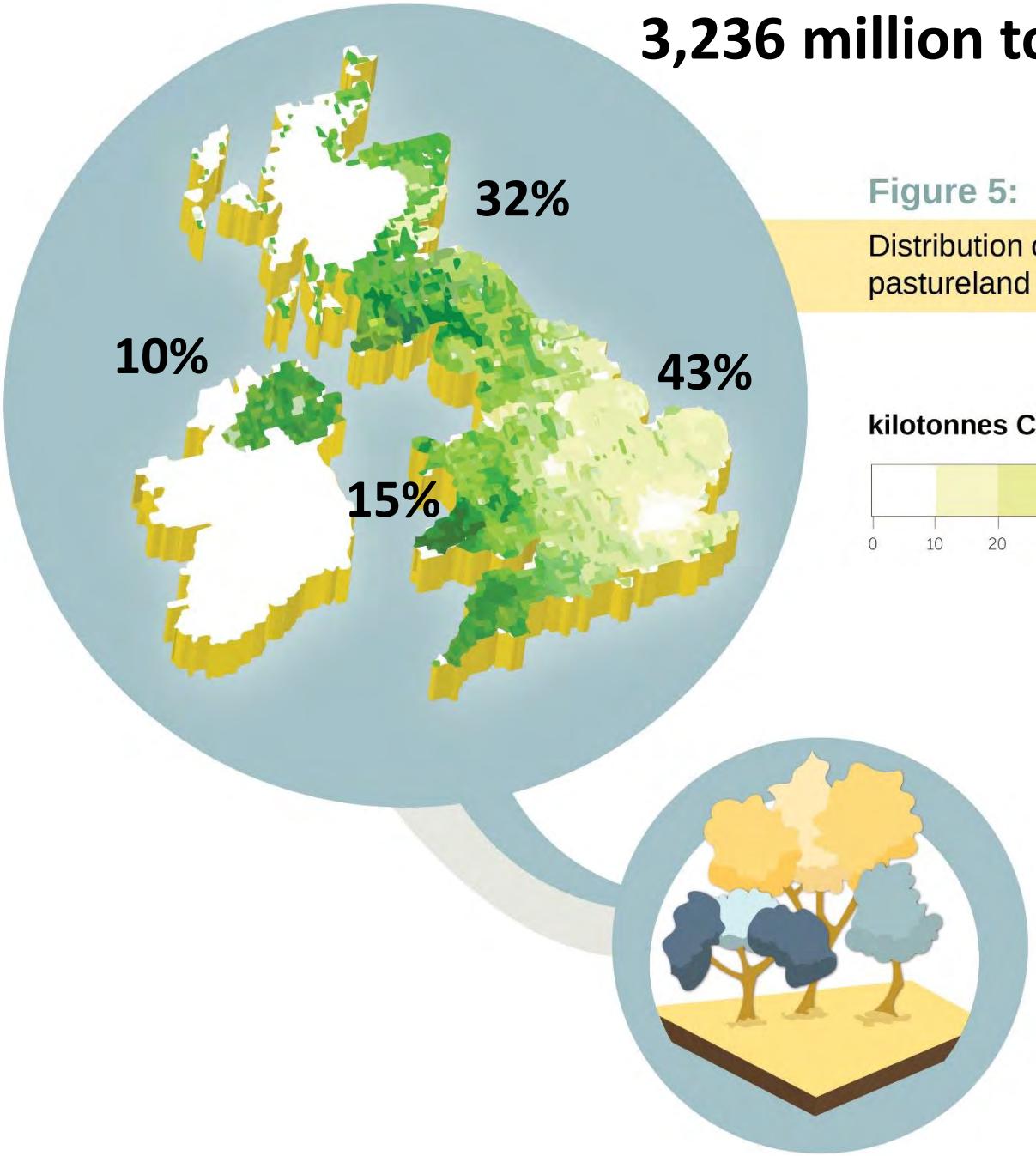
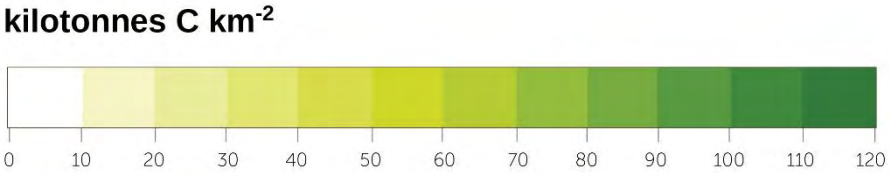


Figure 5:

Distribution of carbon uptake from restoring all UK pastureland currently used for farmed animals



How this relates to UK emissions and climate goals

- **Scenario 1: Pasture and cropland to forest**
  - 12 years of UK CO_2 emissions
  - Doubles 1.5°C budget up to 2050
  - Meets 113% of zero emissions shortfall
- **Scenario 2: Pasture to forest**
  - 9 years of UK CO_2 emissions
  - Increases 1.5°C budget by 75% up to 2050
  - Meets 83% of zero emissions shortfall

Average annual CDR of 108 – 149 Mt CO_2 makes UK agriculture net negative

UK cropland

Repurposing animal feed to human-edible fruit and vegetable crop production

Crop name	Total current UK production (tonnes)	Amount that could be produced on 1% of current UK animal feed cropland (tonnes)	Increase to domestic supply
apple	299,685	348,963	116%
cabbage	292,805	510,648	174%
carrot	1,088,551	431,374	40%
cauliflower	148,938	48,180	32%
chilli	13,137	228,224	1,737%
cucumber	153,227	314,272	205%
currant	12,046	148,888	1,236%
gooseberry	1,603	80,595	5,028%
green peas	394,940	78,206	20%
linseed	127,728	4,122	3%
onion	377,596	483,160	128%
split pea	325,607	59,236	18%
pear	48,906	203,171	415%
plum	11,922	37,869	318%
raspberry	13,223	182,660	1,381%
strawberry	56,973	270,635	475%
tomato	142,909	303,056	212%

Strawberry example:
1/3 of cropland currently used to grow animal feed could provide 62 million adults 5 a Day for a year

UK agriculture is not diverse or self-sufficient

Crop name	Potential production (tonnes) on 1% (316 km^2) of current UK animal feed cropland
apricot	28,818
beans	53,023
chickpea	28,711
eggplant	161,052
garlic	137,908
groundnut (peanut)	67,745
lentil	35,753
peach	256,511
pumpkin	616,357
sesame	29,697
cherry	61,827
sunflower	51,680
sweet potato	690,188

- Crop production dominated by 7 crops, which take 91% of cropland: wheat, grass/forage, barley, rapeseed, sugar beet, potatoes, oats.
- 50% of food consumed is imported.
- 90% of fruit and vegetables are imported.
- Less than a third of adults and less than a fifth of children eat 5 A Day.

Full report publicly available:

http://animal.law.harvard.edu/publications/

Scientists' Warning to Humanity: A Second Notice

"promoting dietary shifts towards mostly plant-based foods"

- Signed by >15k scientists from 184 Countries.

Ripple et al., 2017. BioScience.

How to bring animal to plant-protein shifts to the table?

- 3-step strategy for reshaping food systems:
  1. 'Peak livestock' & reduction targets
  2. 'Worst first' approach
  3. 'Best Available Food' (e.g. 'beans for beef')

Harwatt, 2018. *Climate Policy.*

CLIMATE POLICY
https://doi.org/10.1080/14693062.2018.1528965

Taylor & Francis
Taylor & Francis Group

OUTLOOK ARTICLE

Including animal to plant protein shifts in climate change mitigation policy: a proposed three-step strategy

Helen Harwatt

Farmed Animal Law and Policy Fellow, Animal Law & Policy Program, Harvard Law School, Harvard University, Cambridge, MA, USA

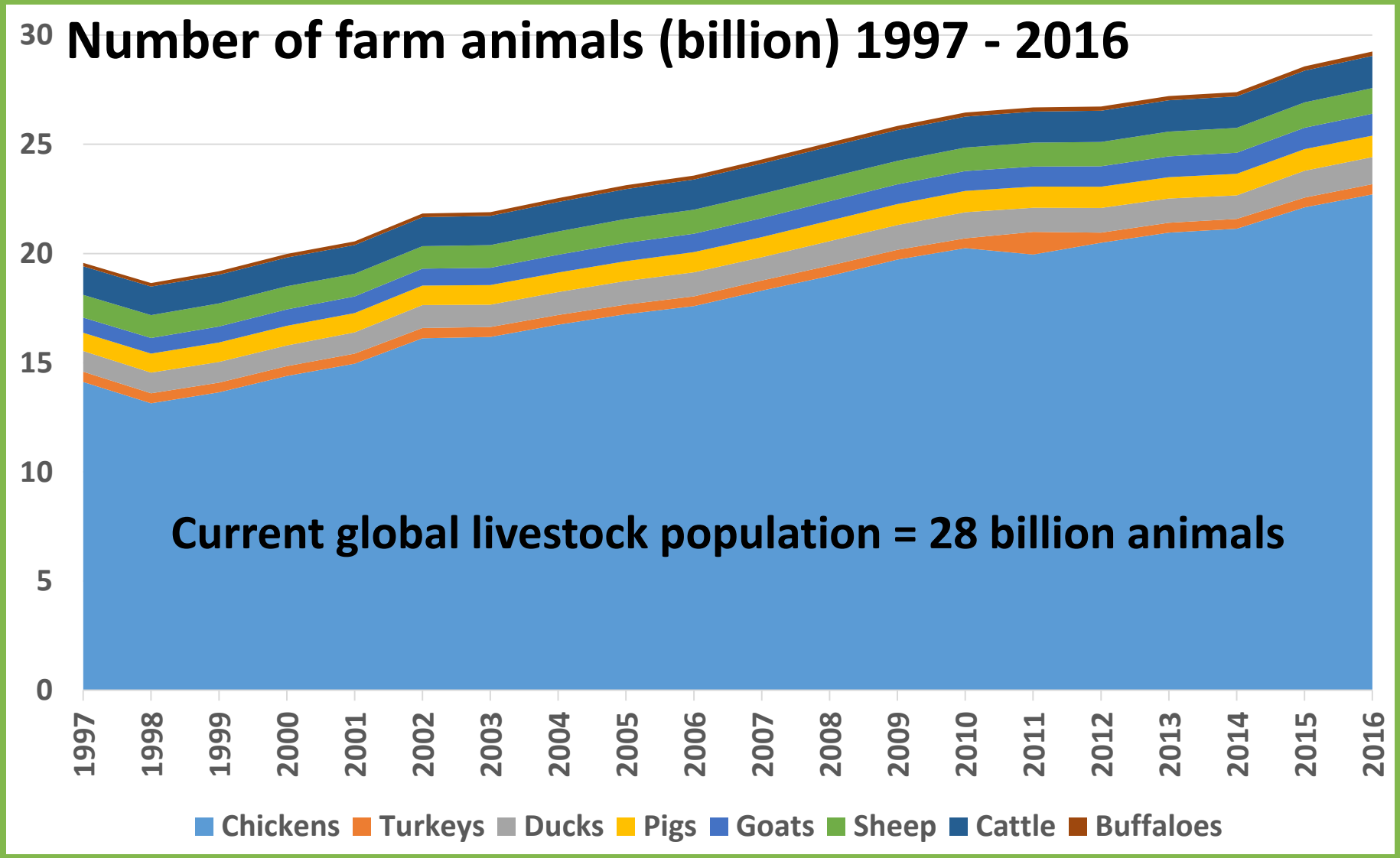
ABSTRACT

Strong and rapid greenhouse gas (GHG) emission reductions, far beyond those currently committed to, are required to meet the goals of the Paris Agreement. This allows no sector to maintain business as usual practices, while application of the precautionary principle requires avoiding a reliance on negative emission technologies. Animal to plant-sourced protein shifts offer substantial potential for

ARTICLE HISTORY
Received 12 March 2018
Accepted 21 September 2018

KEYWORDS
Climate change mitigation;

Step 1: Peak Livestock

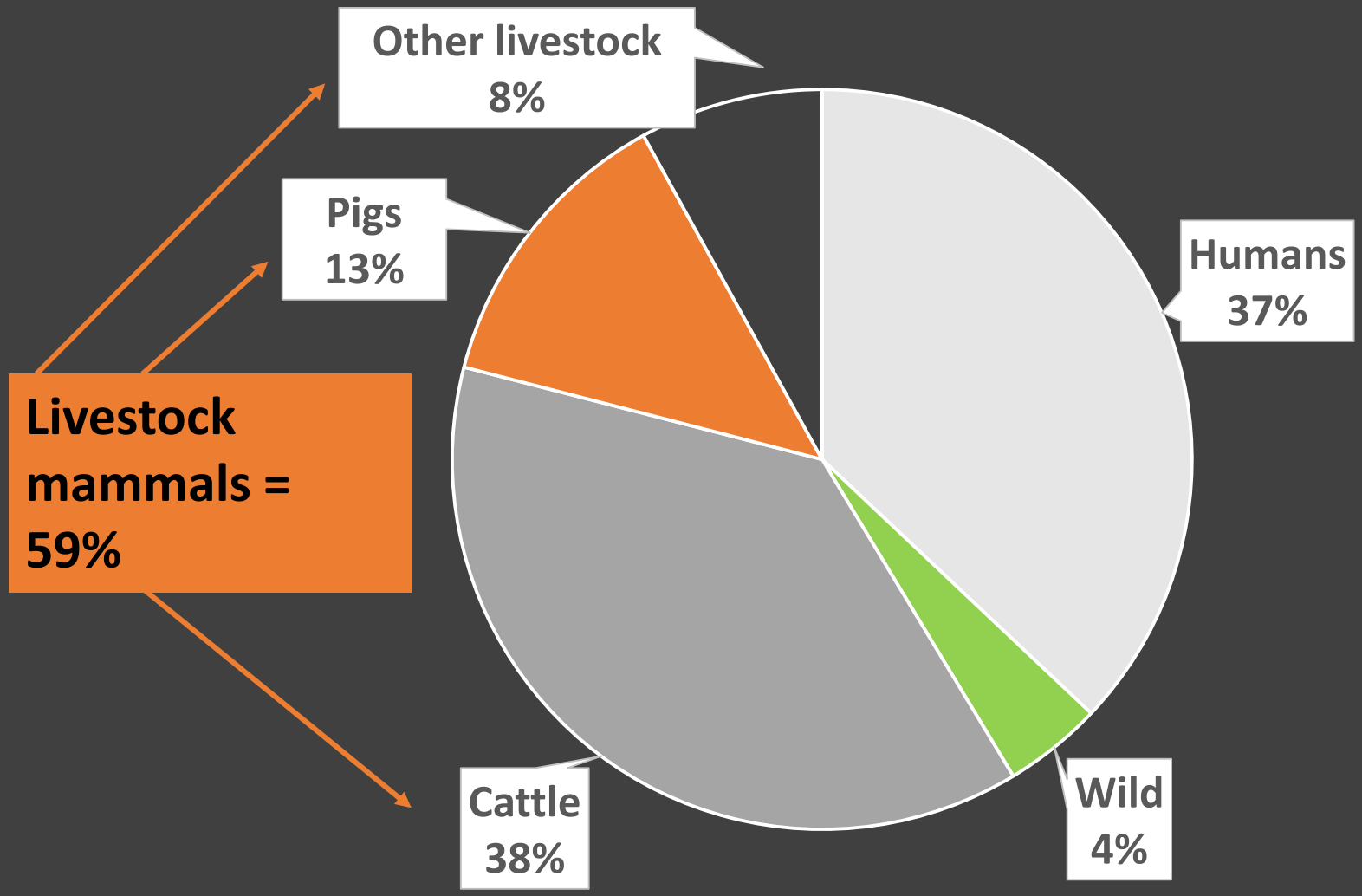


Harwatt, H. 2018 *Climate Policy.*

The global livestock population is growing quickly…

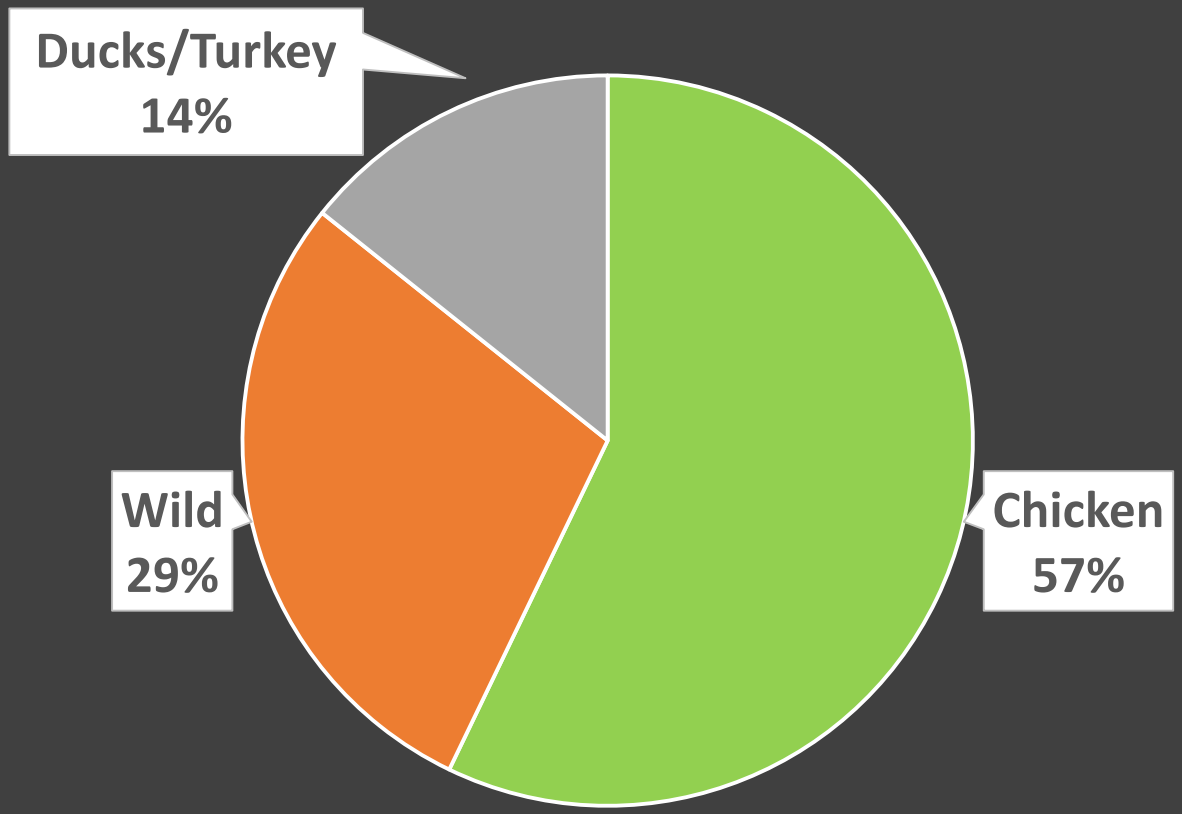
Wolf and Ripple, 2016.

Global Biomass Distribution: Mammals



The biomass distribution on Earth. Bar-On et al. PNAS, 2018.

Global Biomass Distribution: Birds



The biomass distribution on Earth. Bar-On et al. PNAS, 2018.

Step 2: Worst First

- Set reduction targets using a ‘Worst first’ approach to identify highest emitters.
- Identify within worst – the low hanging fruit e.g., ground beef replaced with plant-based alternative.

Harwatt, H. 2018. *Climate Policy.*

Global greenhouse gas emissions from the top 5 emitting livestock products.

Product	Emissions ($mt CO_2e$)	Proportion of global CO_2e emissions (%)
Beef (and veal)	3,048	5.9
Cow milk	1,846	3.6
Pig meat	721	1.4
Chicken meat	579	1.1
Buffalo milk	377	0.7

Harwatt, H. 2018. *Climate Policy.*

Step 3: Best Available Food

- Replaces livestock products with the best food available, to maximise GHG reductions, other environmental impacts, and health outcomes.
- Ties to other Sustainable Development Goals.

Harwatt, H. 2018. *Climate Policy.*


Pulses
likely
to be
important

Best Available Food?

Three-step strategy maximises co-benefits

- Increases food security (part of Paris Agreement)
- Land sparing – supplementary C sequestration, ecosystem restoration, rewilding.
- Nutrient pollution - water quality, dead zones.
- Human health – reduces antibiotic use, reduces risk of non-communicable disease.
- Cost savings – environmental remediation, health care.

Harwatt, 2018. *Climate Policy.*

Animal to plant protein shifts can be spearheaded by food service sector

- Use the science.
- Embed in sustainability, health, wellness and CSR strategies and targets.

Harwatt, 2018. *Climate Policy.*

CONCLUSIONS

CONCLUSIONS:

WHAT WE EAT MATTERS:

‘MAKE IT OR BREAK IT’ FOR OUR PERSONAL, PUBLIC AND PLANETARY HEALTH.

CONCLUSIONS:

TO MAINTAIN A SAFE PLANET FOR CURRENT AND FUTURE GENERATIONS:

ANIMALS → PLANTS

Individual actions count – responsibility of each person.

The clock is ticking!

TUCO GHG Calculator

- A tool for catering professionals to use in the kitchen to calculate GHG footprint of menu options.
- User friendly.
- Comprehensive list of foods and impacts.
- Provide a footprint per serving for menu labelling.

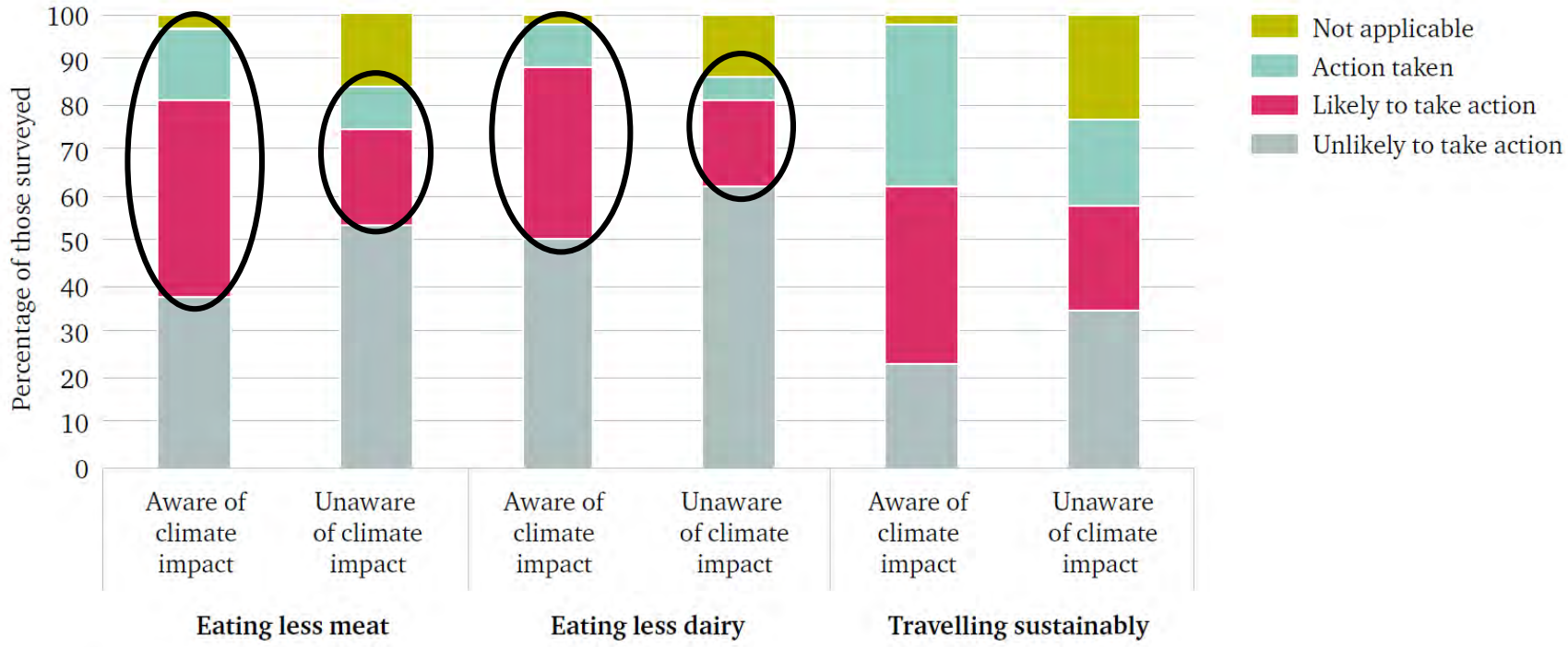
Consumers want to know about environmental impacts of food… & it influences their decision making

- Top 3 reasons for meat reduction
- Most consumers changed how they use plastic after viewing Blue Planet:
  - 44% = drastic change
  - 44% = somewhat changed
  - 12% = didn’t change

Waitrose Food & Drink Report 2018

Higher level of awareness
= higher likelihood of taking action

Figure 8: Comparison of the impact of awareness on willingness to take individual action on transport habits and on meat and dairy consumption



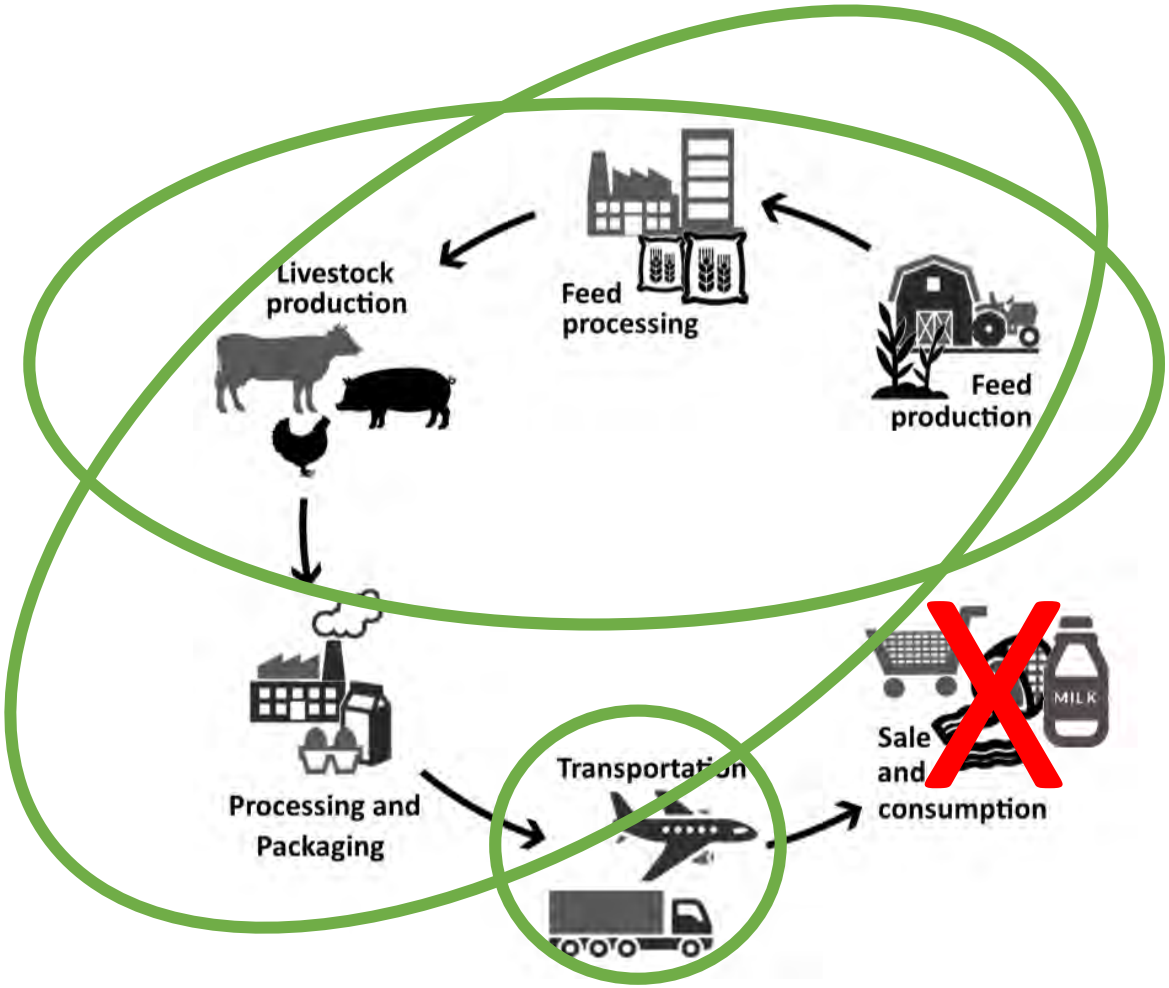
Source: Ipsos MORI/Chatham House (2014).

Calculator: Project collaborators

Basis for the calculator tool: LCA data

- Life Cycle Assessment (LCA) - internationally recognized and commonly used method to analyse the environmental impacts of products, standardized by the International Organization for Standardization.
- Most published food LCAs measure impacts up to the farm gate.
- LCA dataset used by the calculator can be updated and maintained.

What the calculator includes



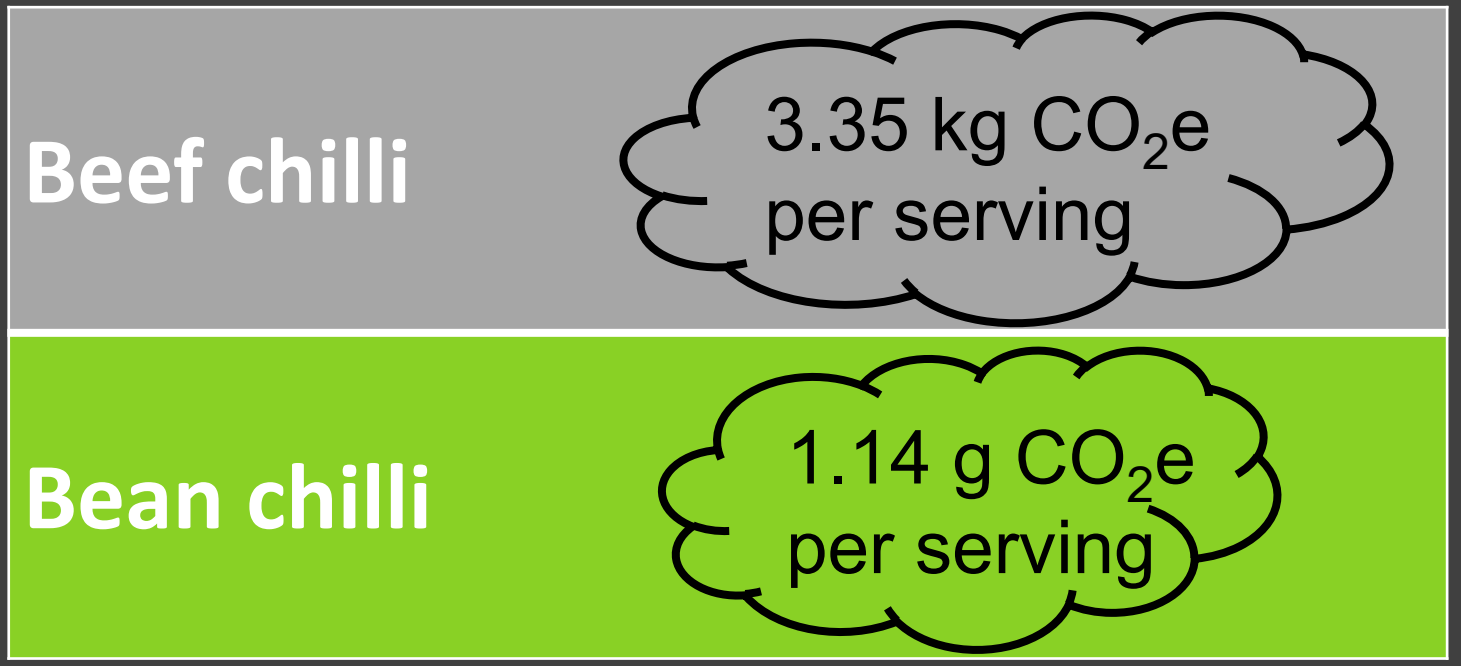
LCA data sources

- ‘Comparative Life Cycle Assessment of Food Commodities Procured for UK Consumption through a Diversity of Supply Chains’. Williams et al – Cranfield University. Funded by DEFRA.
- ‘Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities’. Williams et al – Cranfield University. Funded by DEFRA.
- ‘The relative greenhouse gas impacts of realistic dietary choices’. Berners-Lee et al. Energy Policy.

Calculating transport:

- Transport from farm gate in country of origin to port, and UK port to UK distribution centre.
- Road and sea modes.

Menu labelling - example

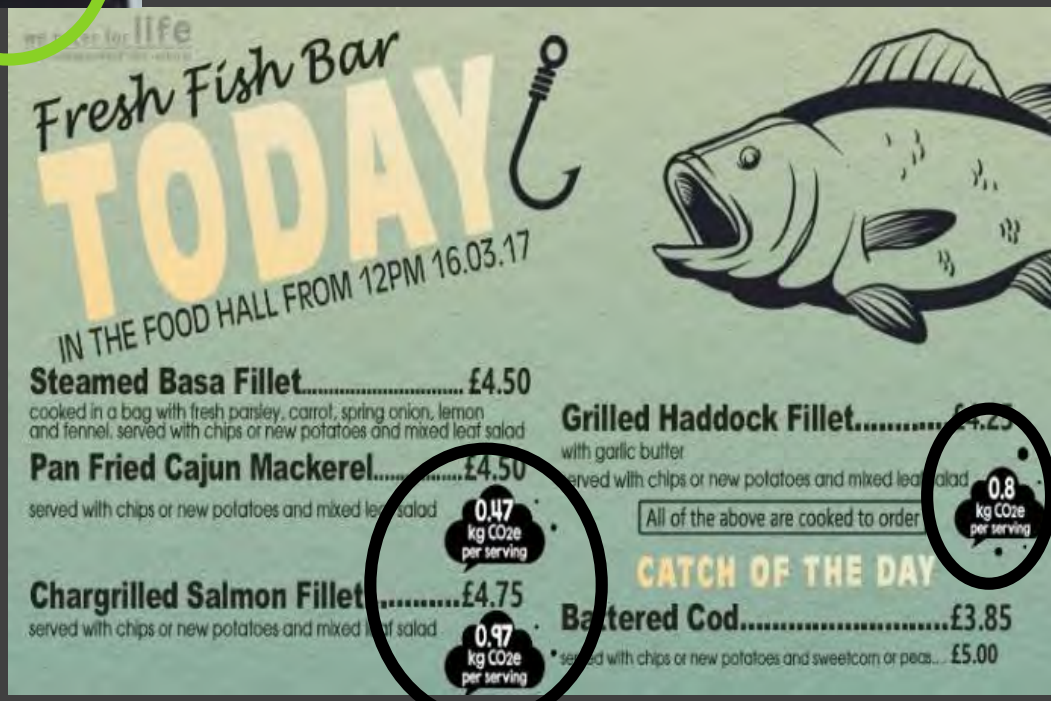


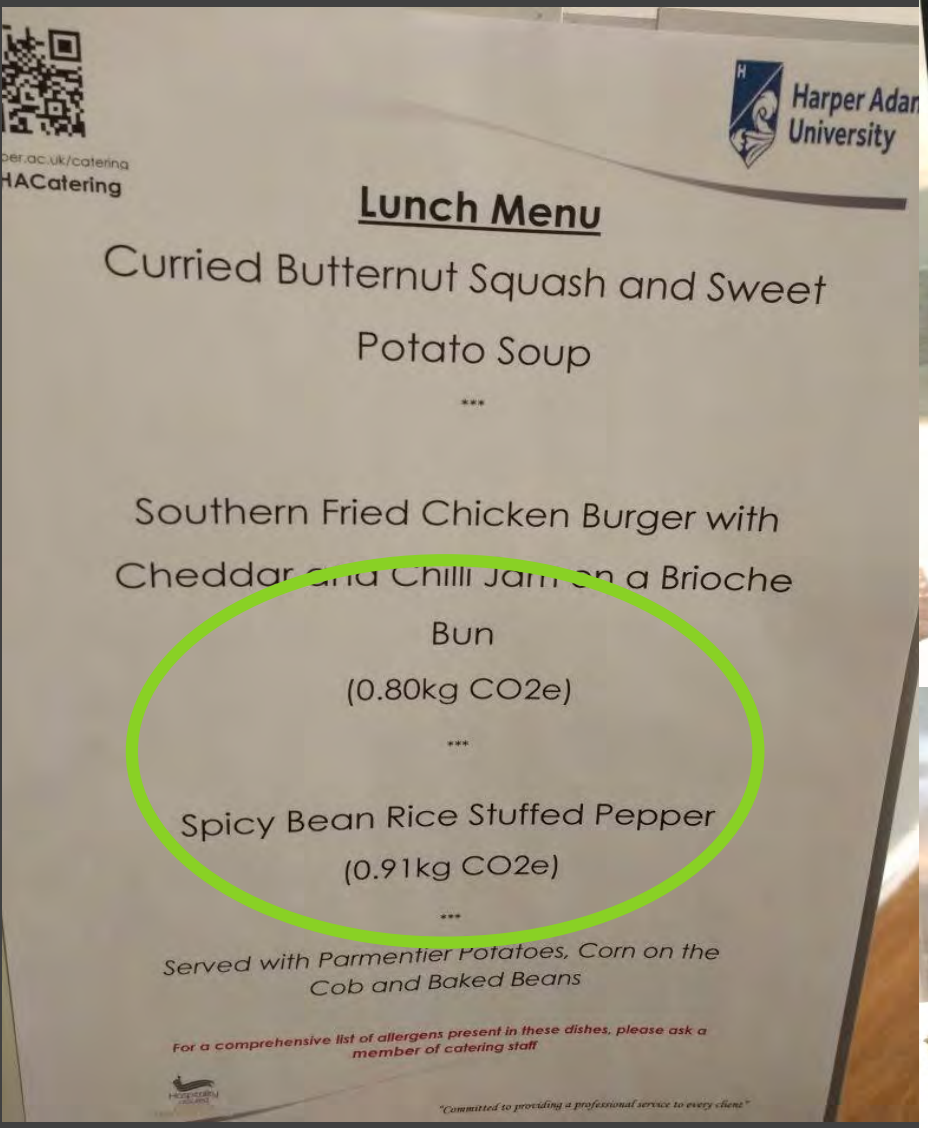
Piloting process

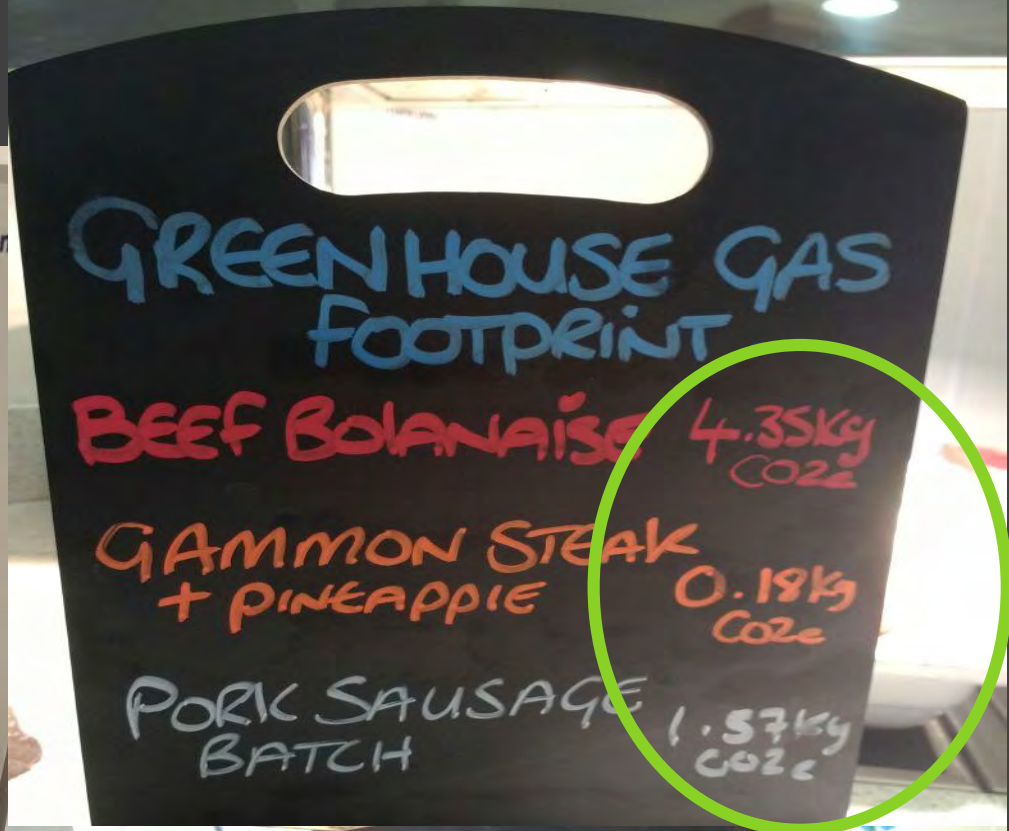
- 3 institutes
- Site visits
- Interviews

Poster to explain & draw attention

Examples of menu labelling




Harper Adam University
HACatering
Lunch Menu
Curried Butternut Squash and Sweet Potato Soup
***
Southern Fried Chicken Burger with Cheddar and Chilli Jam on a Brioche Bun
(0.80kg CO2e)
***
Spicy Bean Rice Stuffed Pepper
(0.91kg CO2e)
***
Served with Parmentier Potatoes, Corn on the Cob and Baked Beans
For a comprehensive list of allergens present in these dishes, please ask a member of catering staff
"Committed to providing a professional service to every client"


GREENHOUSE GAS FOOTPRINT
BEEF BOLANAISE
4.35kg CO2e
GAMMON STEAK + PINEAPPLE
0.18kg CO2e
PORK SAUSAGE BATCH
1.57kg CO2e


GREENHOUSE GAS FOOTPRINT
VEGGIE SAUS + MUSHROOM (VEGAN)
0.49kg CO2e
BROCCOLI PASTA (GF) (VEGAN)
0.66kg CO2e

Anecdotes

- Most students noticed the labels.
- Want to know more about the environmental footprint of their food.
- Assumed the footprint label was food miles only.
- Find the menu labels useful but need to know more about their meaning.

"I know it's important but I don't know what it means"

"Why isn't this being taught on my nutrition course?"

"I noticed the labels but it doesn't interest me"

Amendments

- Additional products - now has 208 foods.
- More measurements – including liquid, g & imperial.
- Clearer instructions.
- Food search & drop down list.
- Can change quantity after submitting.
  - **Further amendments:**
    - Car mileage equivalent (based on average UK petrol car)

Calculator demonstration

www.tuco.ac.uk/ghgcalculator

Calculator demonstration: Plate up for the Planet

https://www.vegansociety.com/take-action/campaigns/plate-planet/carbon-calculator

Next steps?

- Standard label design.
- Integrated with recipe and nutrition software.
- Posters with infographics for dining halls.
- Could be part of SHEFS accreditation scheme?

Hungry for Change Food Forum

- 1 day symposium – latest evidence, trends and tools.
- Forum:
  - Sharing experiences.
  - Case studies.
  - Future plans.
  - Troubleshooting.
- Different venues around the country.
- Increase awareness of urgent issues – also demonstrate huge potential and opportunity.


Thank you!
Twitter: @hharwatt
hharwatt@law.harvard.edu