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University



Ruminants and climate change in the UK – what we need to know

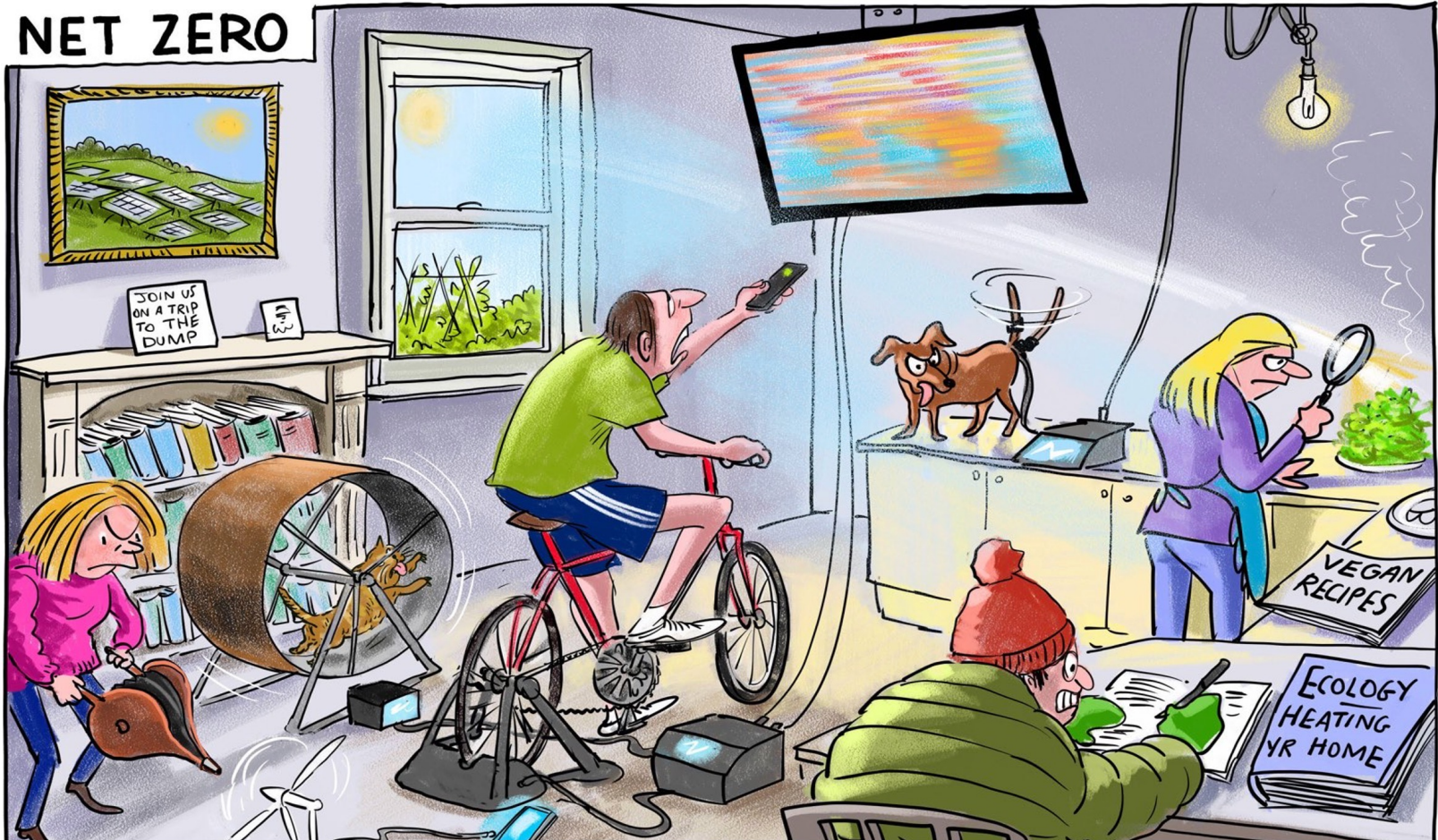
21st April 2022

Source: Dr. Jude L. Capper, 2022

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Net Zero is a clear priority



Source: Created by Dr. Jude L. Capper, 2021. Cartoon from: <https://twitter.com/Cartoon4sale/status/1384537729460056067?s=20>

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S

Committee on Climate Change aims to free 22% of agricultural land by 2050

Actions must be taken now...




Increase **low-carbon farming practices** for soils & livestock.




Increase annual tree-planting to between **90-120 million** trees, equivalent to 30,000 hectares per year.



Use **10%** of farmland for agro-forestry.



Restore at least **55%** of peatland area by 2050.



Increase the use of land for energy crops to **23,000 hectares** per year.

Behaviour change is also needed:

Reduce beef, lamb and dairy consumption by **20%** per capita by 2050.



Reduce food waste by **20%** by 2030.

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Source: Created by Dr. Jude L. Capper, 2021. Infographic from Committee on Climate Change (2020) : <https://www.theccc.org.uk/wp-content/uploads/2020/01/Land-use-Policies-for-a-Net-Zero-UK-Infographic.pdf>

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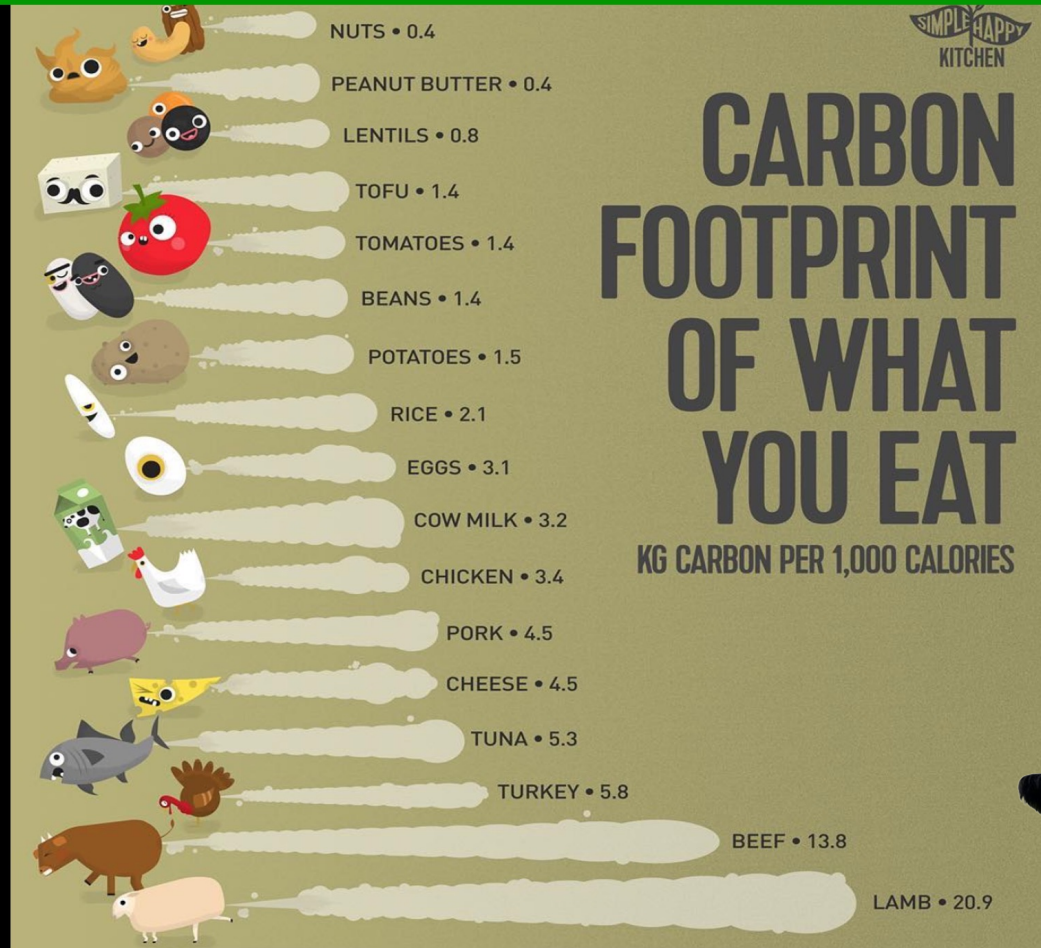
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Source: Created by Dr. Jude L. Capper, 2021. Infographic from Committee on Climate Change (2020) : <https://www.theccc.org.uk/wp-content/uploads/2020/01/Land-use-Policies-for-a-Net-Zero-UK-Infographic.pdf>

B

Global averages are meaningless

The carbon footprints of the foods we eat vary considerably – global average figures are inappropriate when food production is regional



Source: Created by Dr. Jude L. Capper, 2020, infographic from: https://www.instagram.com/simple_happy_kitchen/

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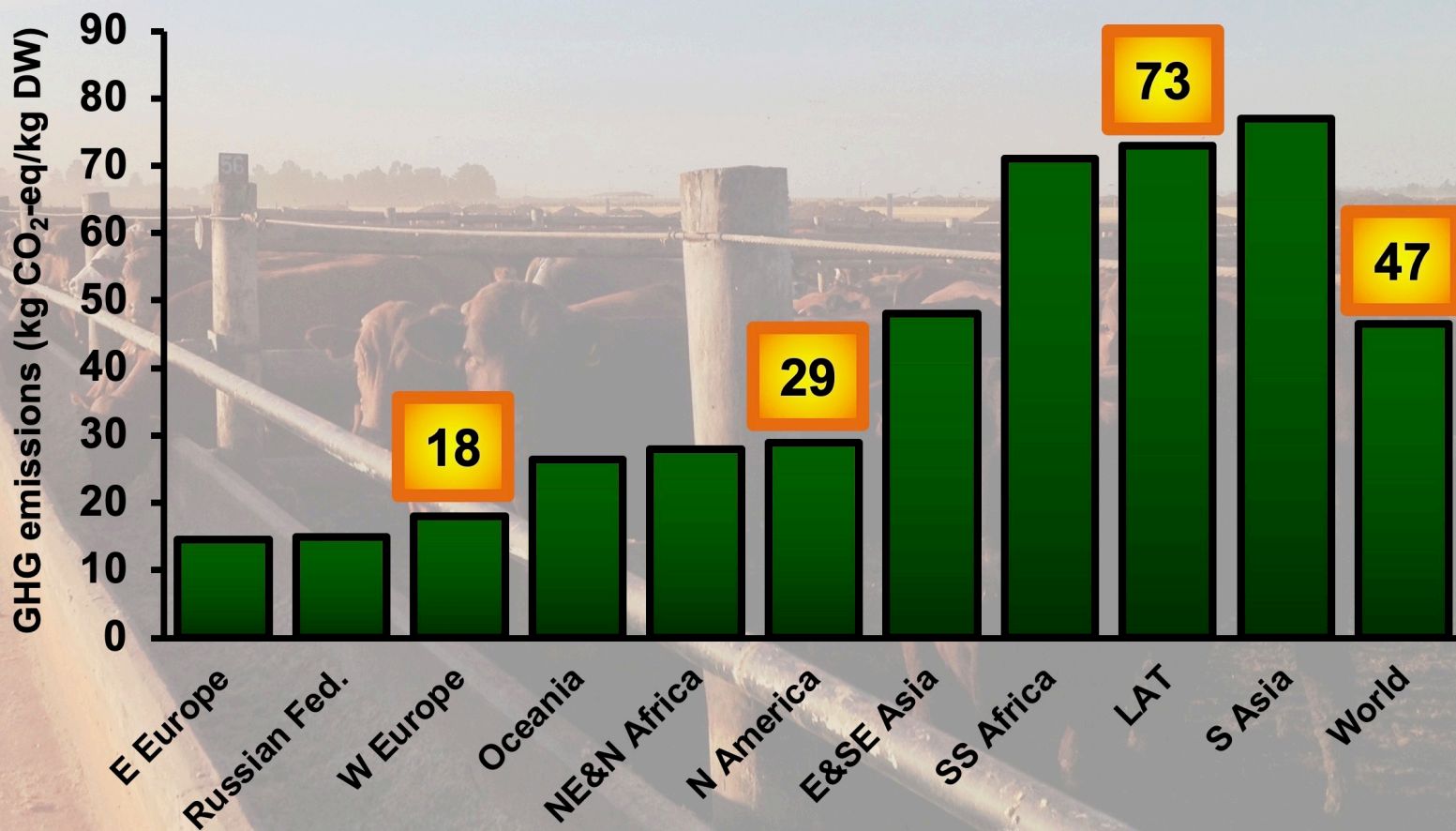
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The carbon footprint of beef production varies across the globe



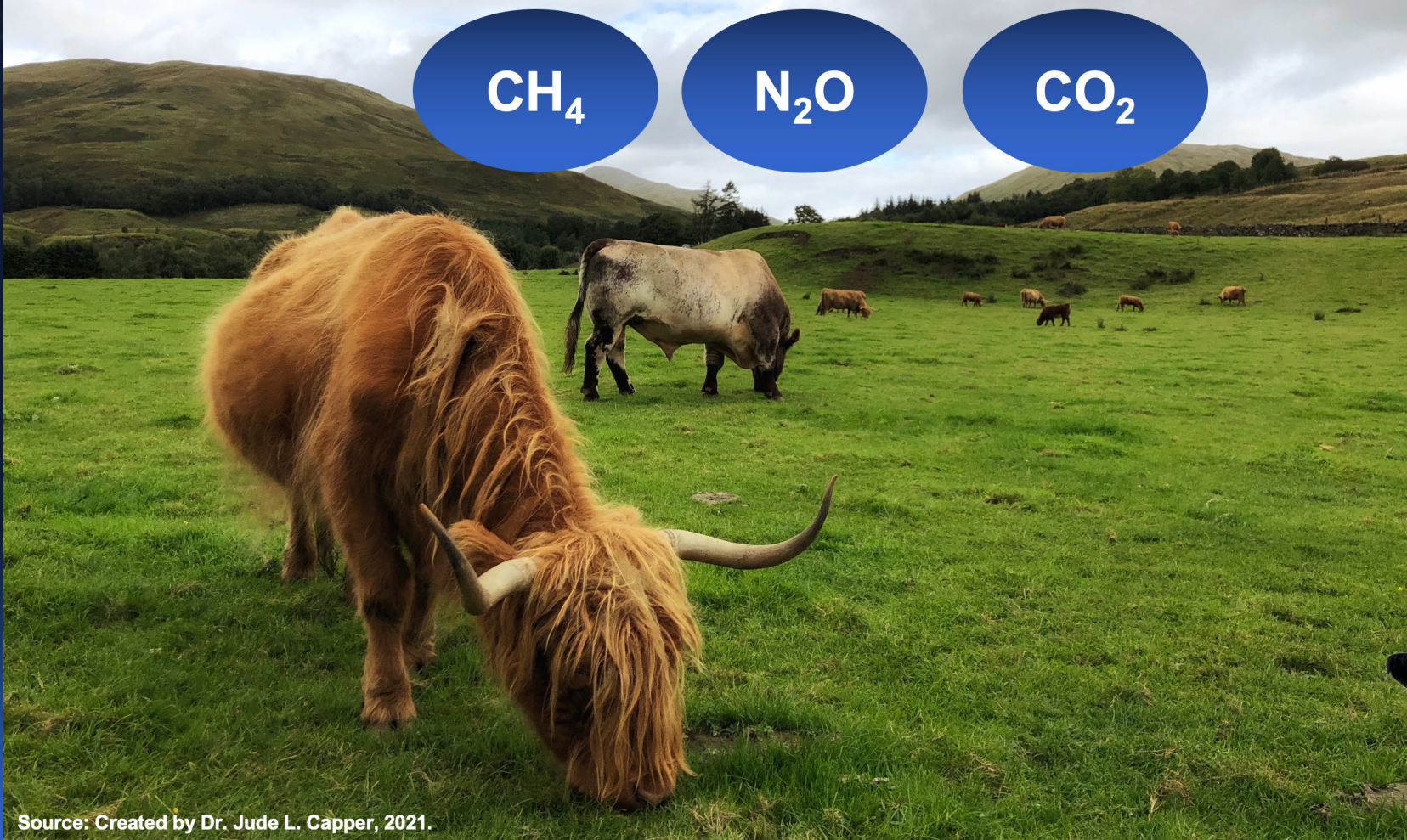
Source: Created by Dr. Jude L. Capper, 2020; data from Gerber et al. (2013) Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. FAO, Rome, Italy.

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All components of the carbon cycle must be accounted for



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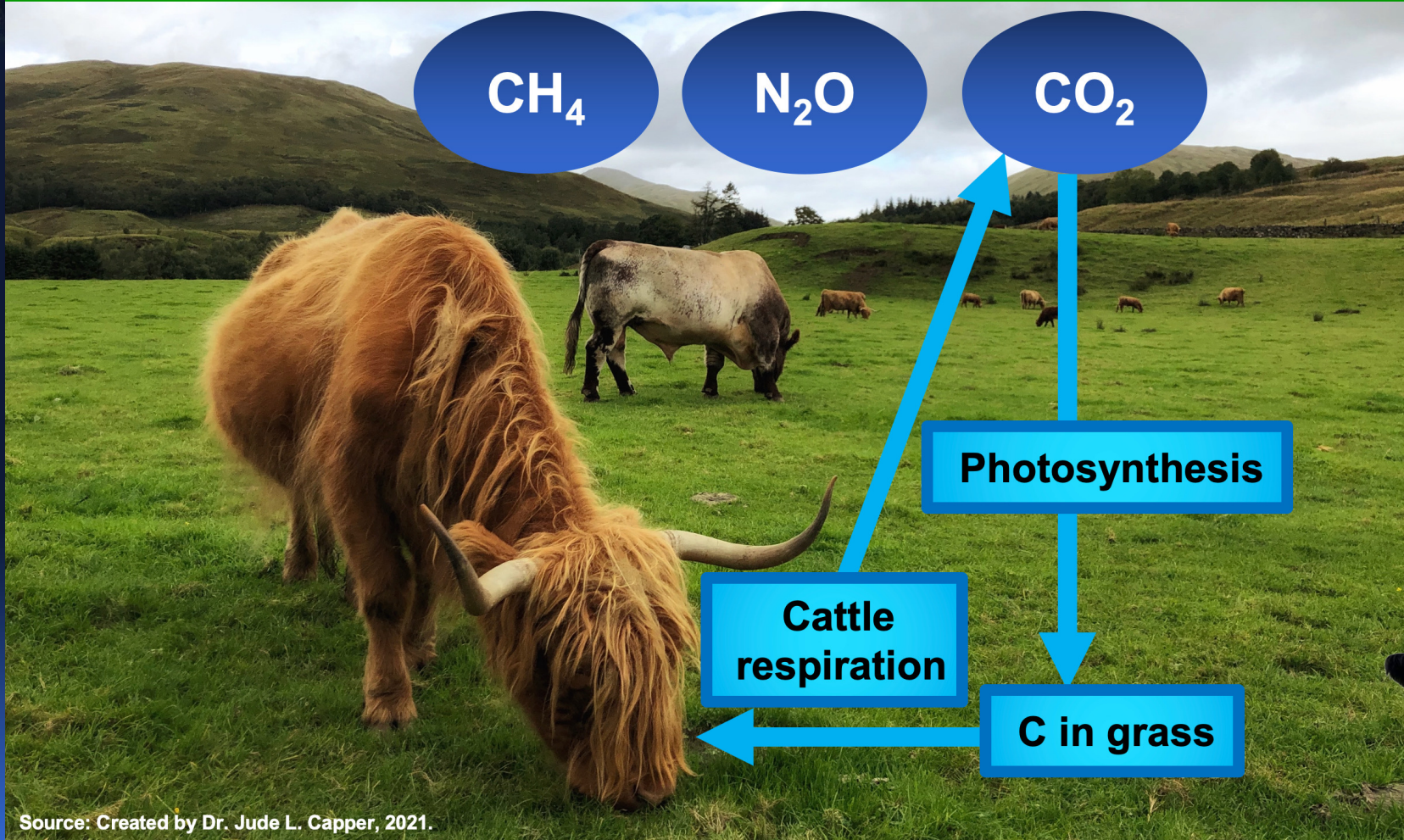
Source: Created by Dr. Jude L. Capper, 2021.

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Source: Created by Dr. Jude L. Capper, 2021.

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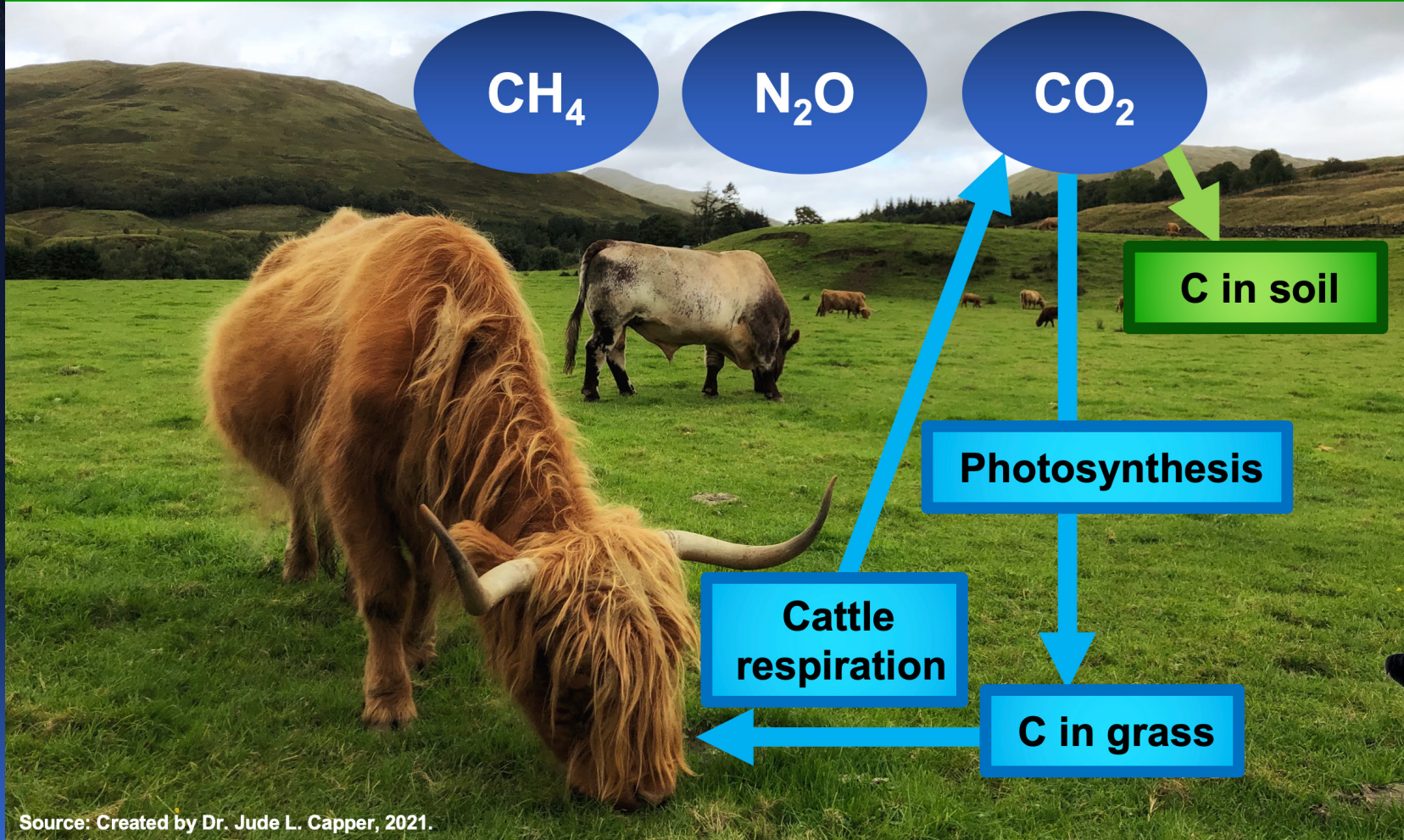


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Source: Created by Dr. Jude L. Capper, 2021.

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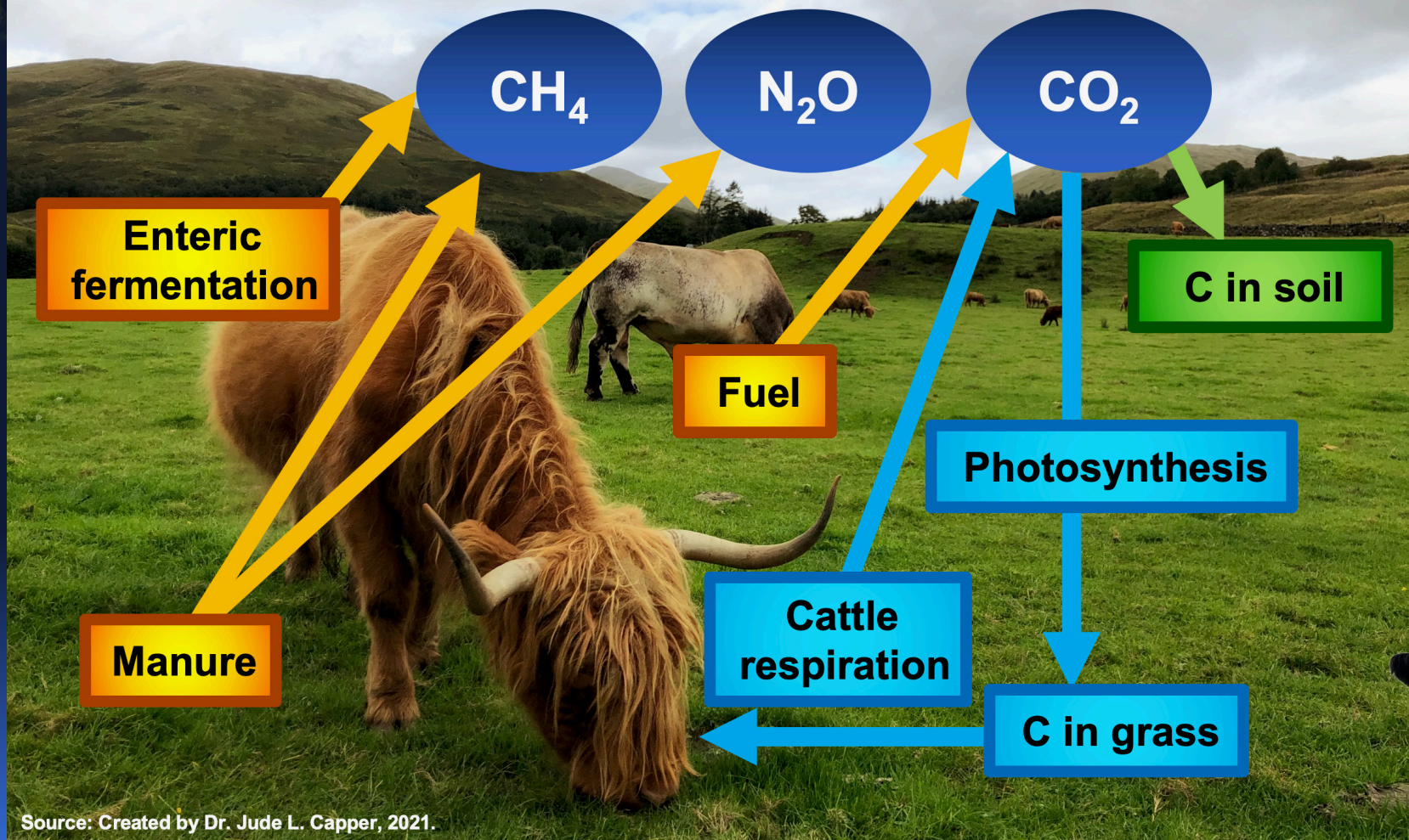


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All components of the carbon cycle must be accounted for



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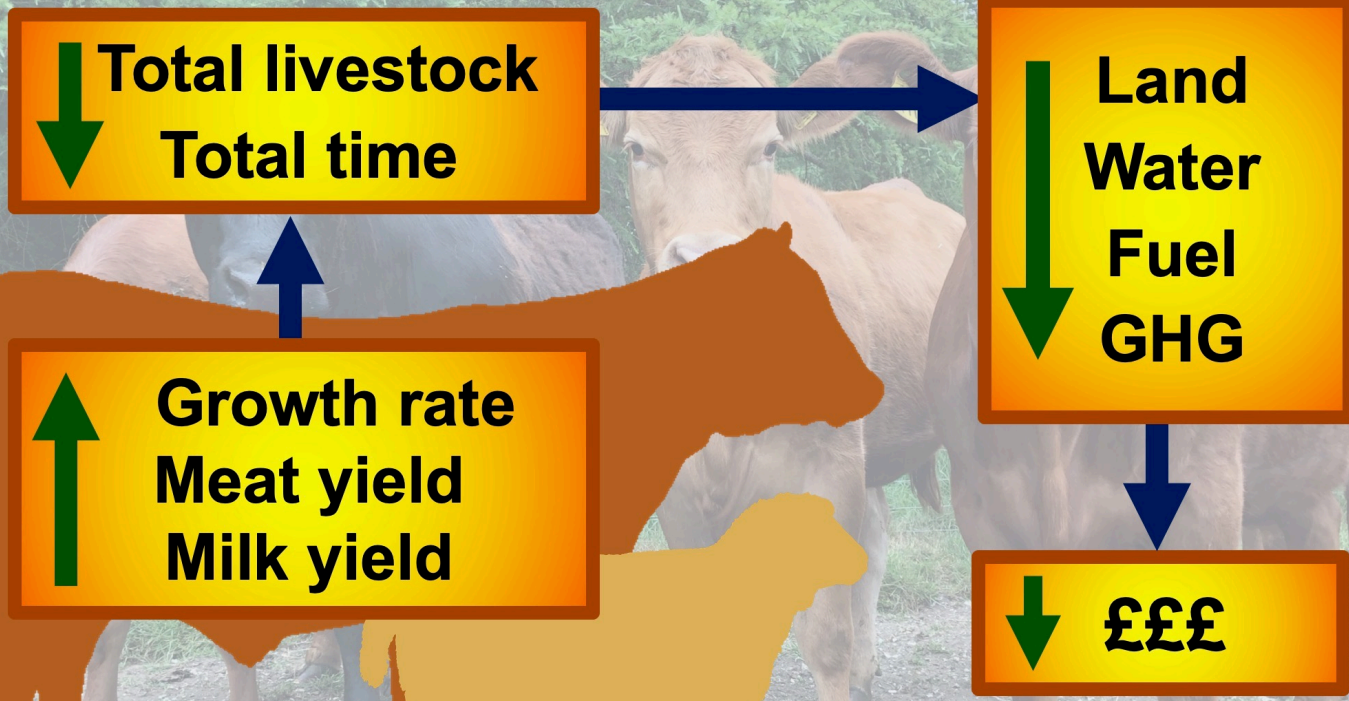
Source: Created by Dr. Jude L. Capper, 2021.

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Improving animal productivity reduces the environmental impact of milk and meat



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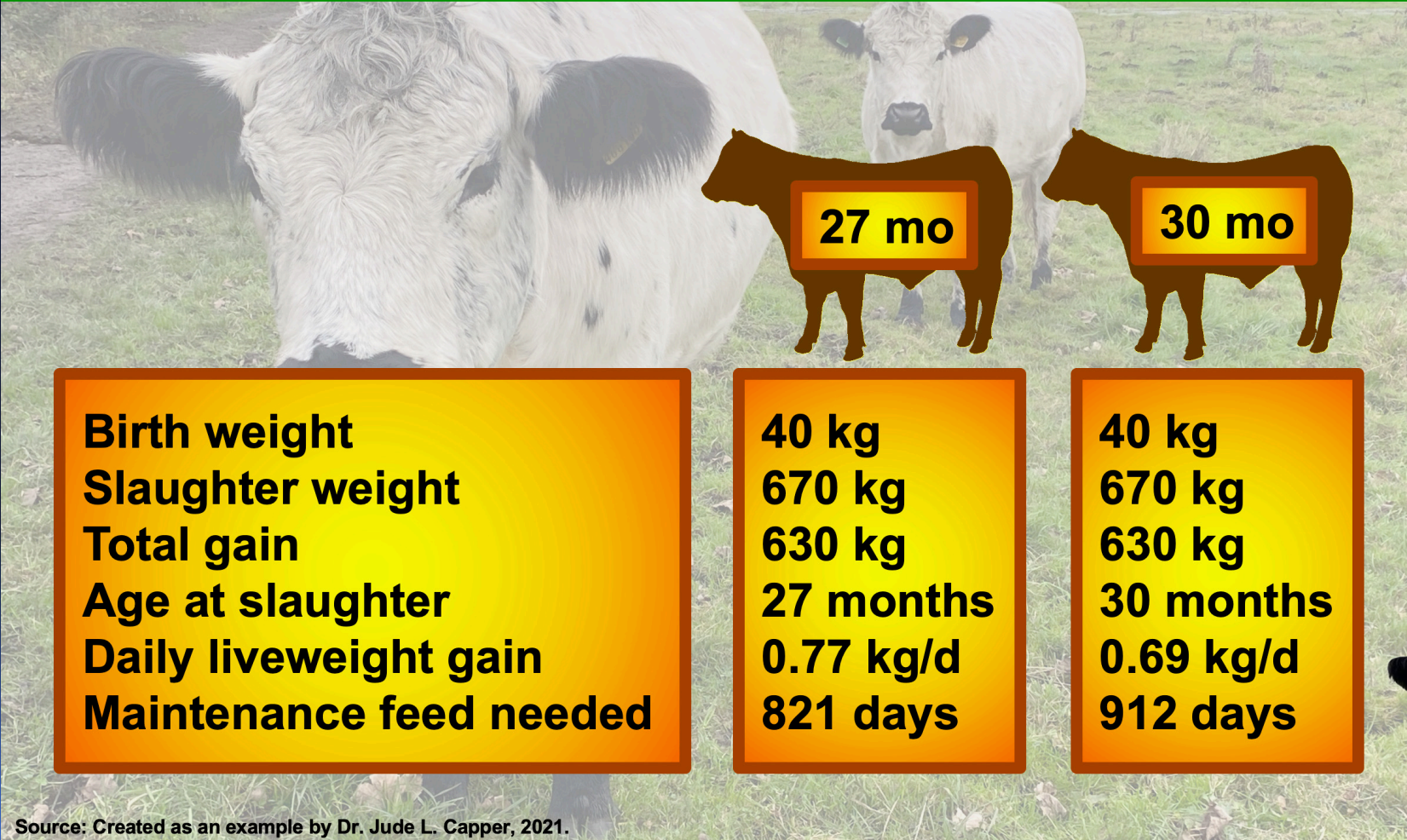
Source: Created by Dr. Jude L. Capper, 2020. Data from: Capper, JL. 2015. Sustainability and One Health. In: Cockcroft, P. *Bovine Medicine*. Wiley-Blackwell, Oxford, UK.

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Reducing age at slaughter has both economic and environmental benefits



Source: Created as an example by Dr. Jude L. Capper, 2021.

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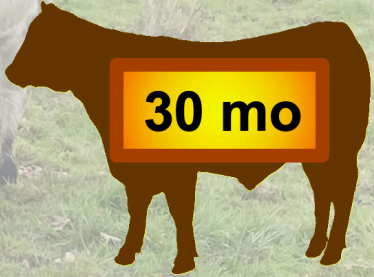
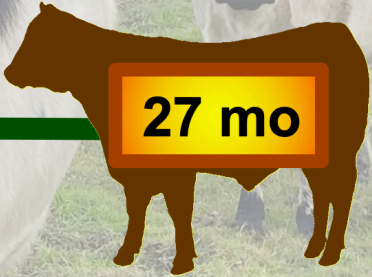
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Reducing age at slaughter has both economic and environmental benefits

91 fewer days of feed, land and greenhouse gases. Opportunity cost?



Birth weight
Slaughter weight
Total gain
Age at slaughter
Daily liveweight gain
Maintenance feed needed

40 kg
670 kg
630 kg
27 months
0.77 kg/d
821 days

40 kg
670 kg
630 kg
30 months
0.69 kg/d
912 days

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Source: Created as an example by Dr. Jude L. Capper, 2021.

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Reproductive interventions must be economically and environmentally sustainable

Improving maternal trait genetics via AI over 20 yrs

95 - 2,009 kg CO₂ reduction in GHG emissions per cow

Decreased mature weight and calving interval

£47-344 improved economics per cow calving

Source: Created by Dr. Jude L. Capper, 2022. Data from Quinton et al. (2018) Predicted economic and greenhouse gas benefits from using improved maternal genetics in UK beef cattle. Proceedings of the World Congress on Genetics Applied to Livestock Production, 11.364

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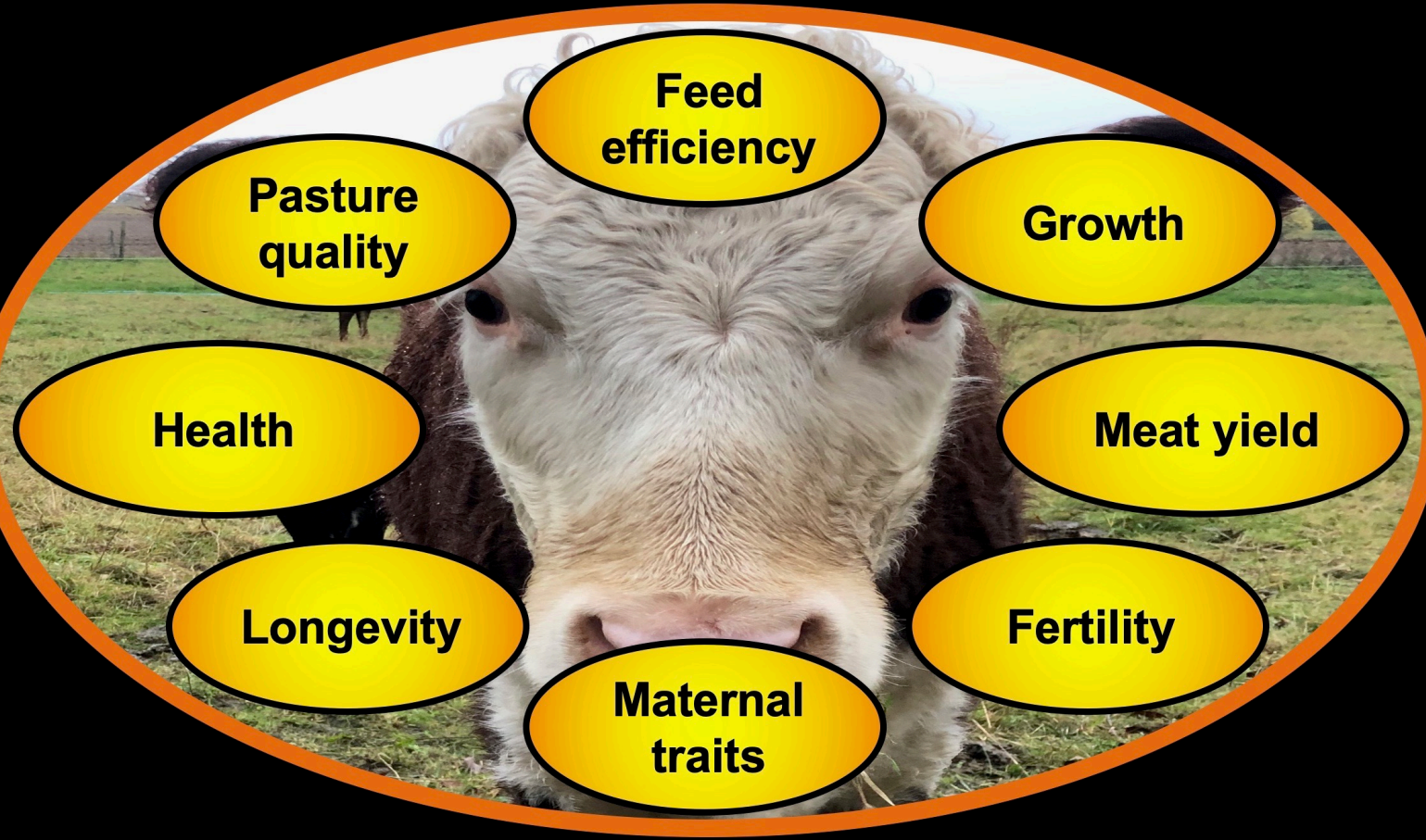
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Improving key performance indicators reduces environmental impacts



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Source: Created by Dr. Jude L. Capper, 2020

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GHG benefits of dairy-beef now recognized – sucklers will need to demonstrate benefits

Annual requirements of one suckler cow:

- 3,954 kg feed DM
- 20,047 litres water
- 2,459 kg CO₂

Need to justify these impacts vs. beef from dairy.

Source: Created by Dr. Jude L. Capper, 2021. Calculation based on feed and water requirements of one Angus cow weighing 544 kg producing 7.8 kg of milk per day, with calf weaned at 207 days of age.



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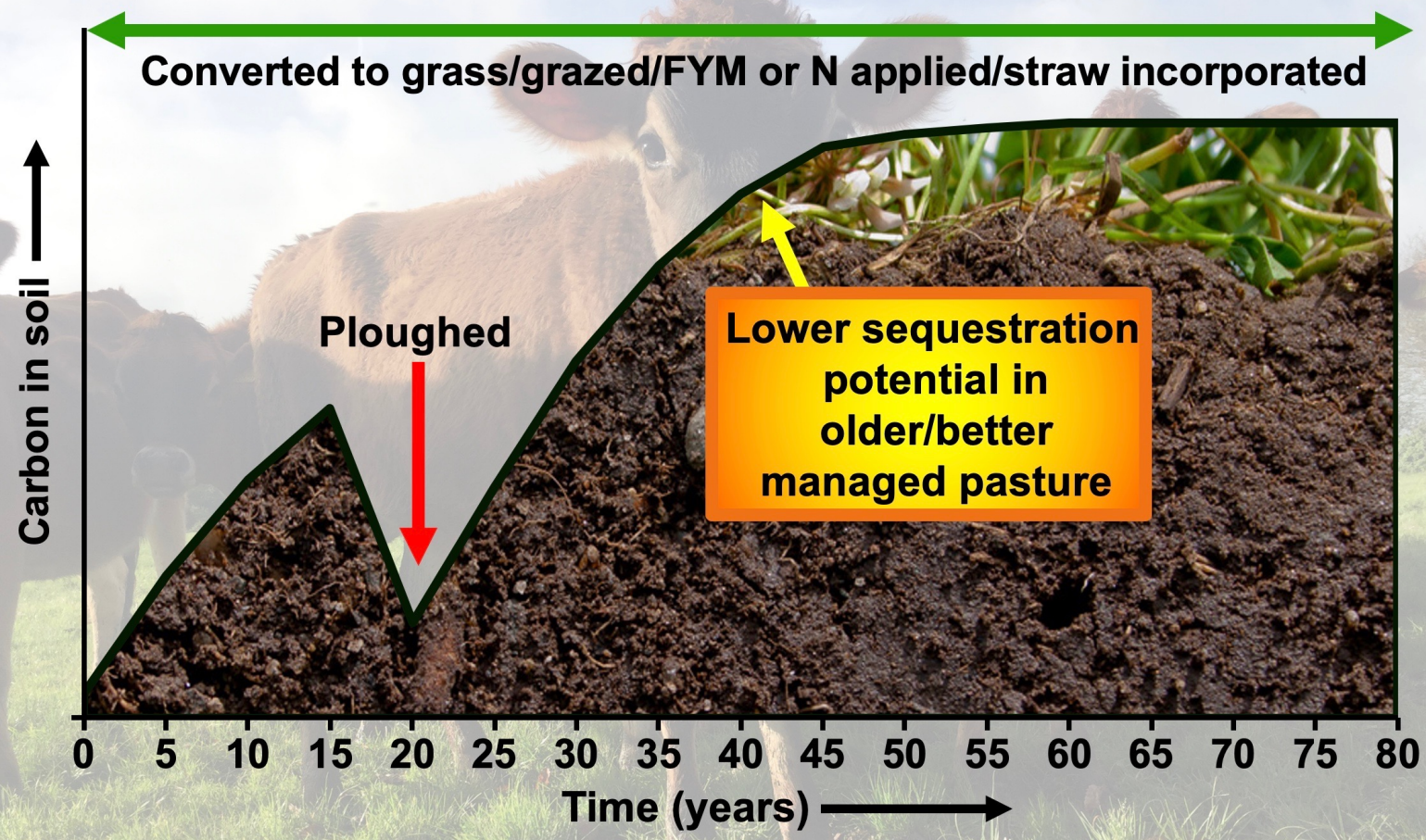
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Carbon sequestration offers promise – but isn't a magic bullet



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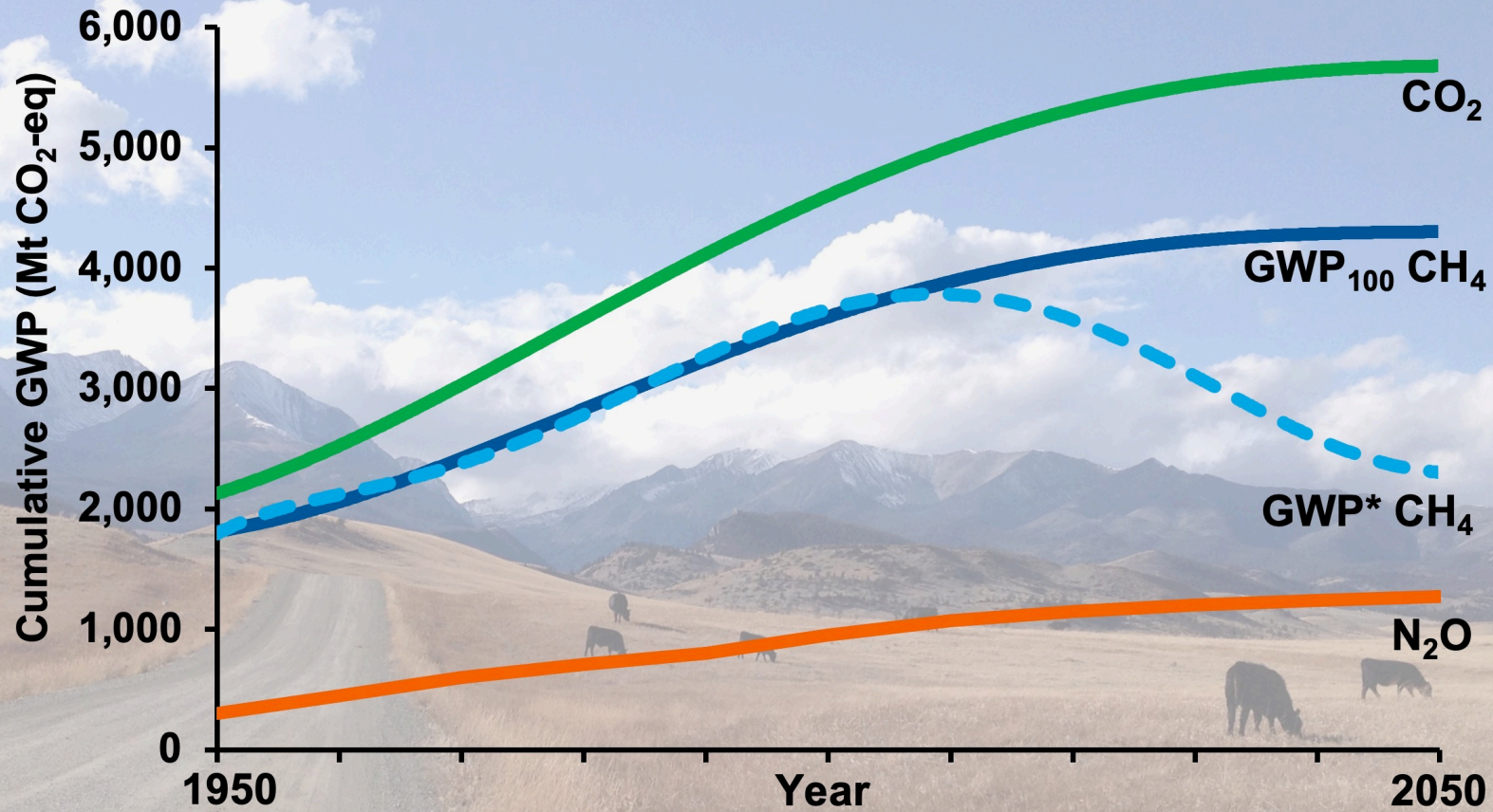
Source: Created by Dr. Jude L. Capper, 2020 as an example of soil carbon sequestration. Data from: Poulton et al. (2017) *Global Change Biology*.



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Under GWP*, methane may contribute to global cooling



Source: Created by Dr. Jude L. Capper, 2022. Graph adapted from Allen et al. (2019) Agricultural Emissions on a Path to Net Zero. Available at: <https://www.slideshare.net/Sustainablefoodtrust/myles-allen-154983406>

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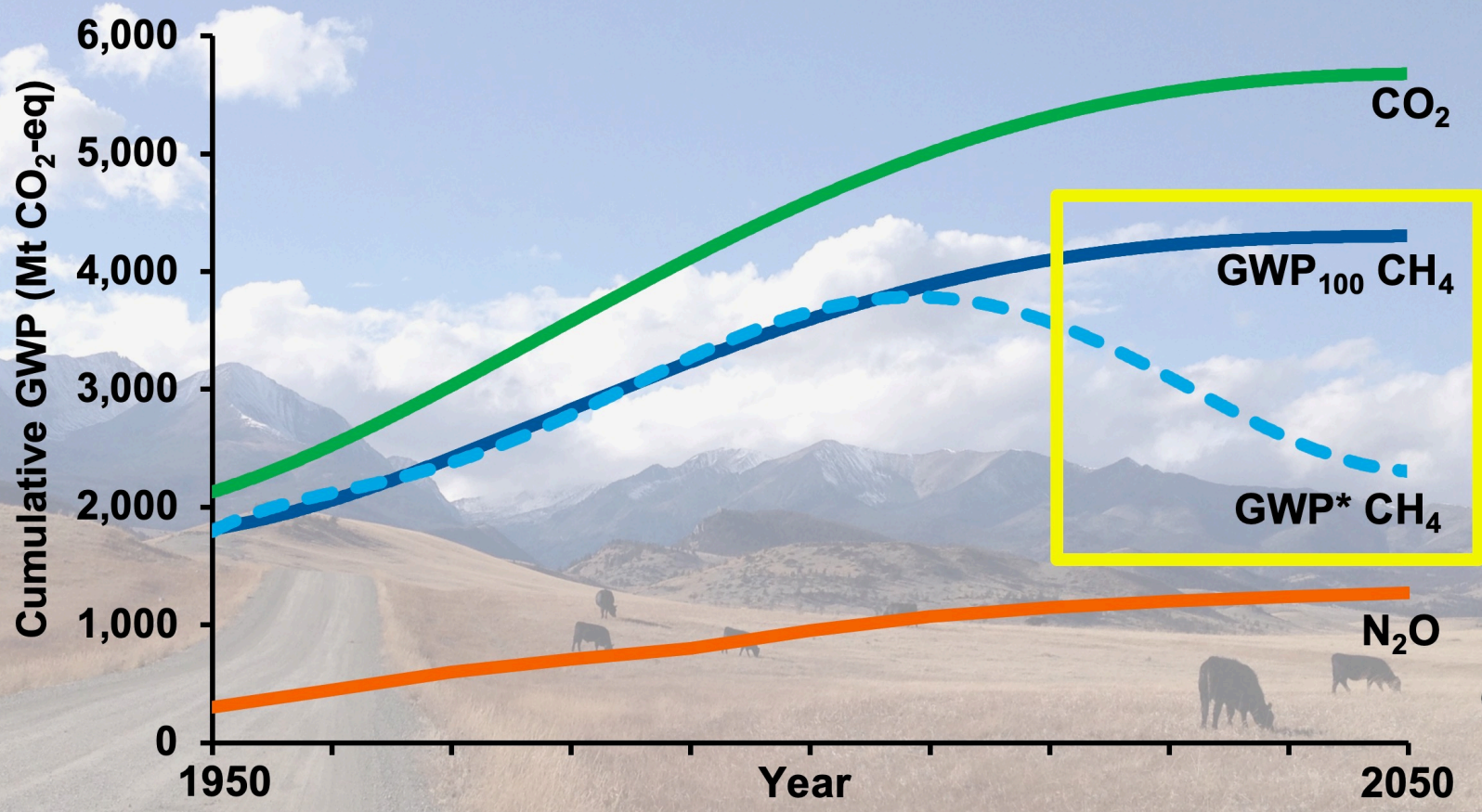


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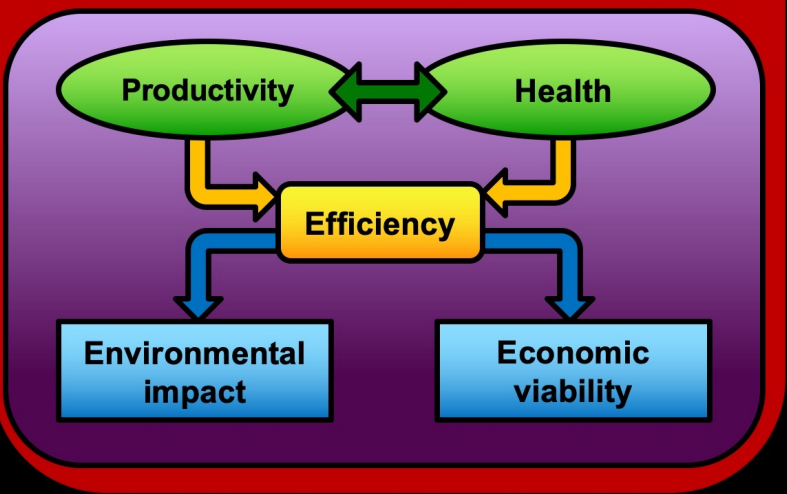
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Social acceptability and consumer trust are vital for sustainable livestock production

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Social Acceptability



Sustainability



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Source: Created by Dr. Jude L. Capper, 2020.

COM

Do 582,538 Veganuary participants amount to more than a hill of beans?

**JOIN THE
NEW YEAR'S
REVOLUTION**



- Slightly smaller than the population of Sheffield
- If all participants were UK-based they would comprise <1% of the UK population
- Average of 2,787 per participating country
- 62% of participants already vegan, vegetarian or pescatarian

Source: Created by Dr. Jude L. Capper, 2021. Information from: <https://veganuary.com/>

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Guilt is a primary motivator for people considering going vegetarian or vegan

"I sometimes feel guilty when consuming meat and dairy products"

66% of meat-eaters and flexitarians thinking of giving up meat said "yes" compared to 25% of national population

**No guilt
34%**

**Feel guilty
66%**



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Source: Created by Dr. Jude L. Capper, 2020. Information from: YouGov (2019) Is the future of food flexitarian?
<https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian>

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COM

Animal welfare and human health are major concerns for people giving up animal products

Animal welfare

Healthiness

Environment

Labelling

Economic cost

0% 10% 20% 30% 40% 50% 60%

“Which, if any, of the following factors might encourage you to adopt a vegan/vegetarian diet?”

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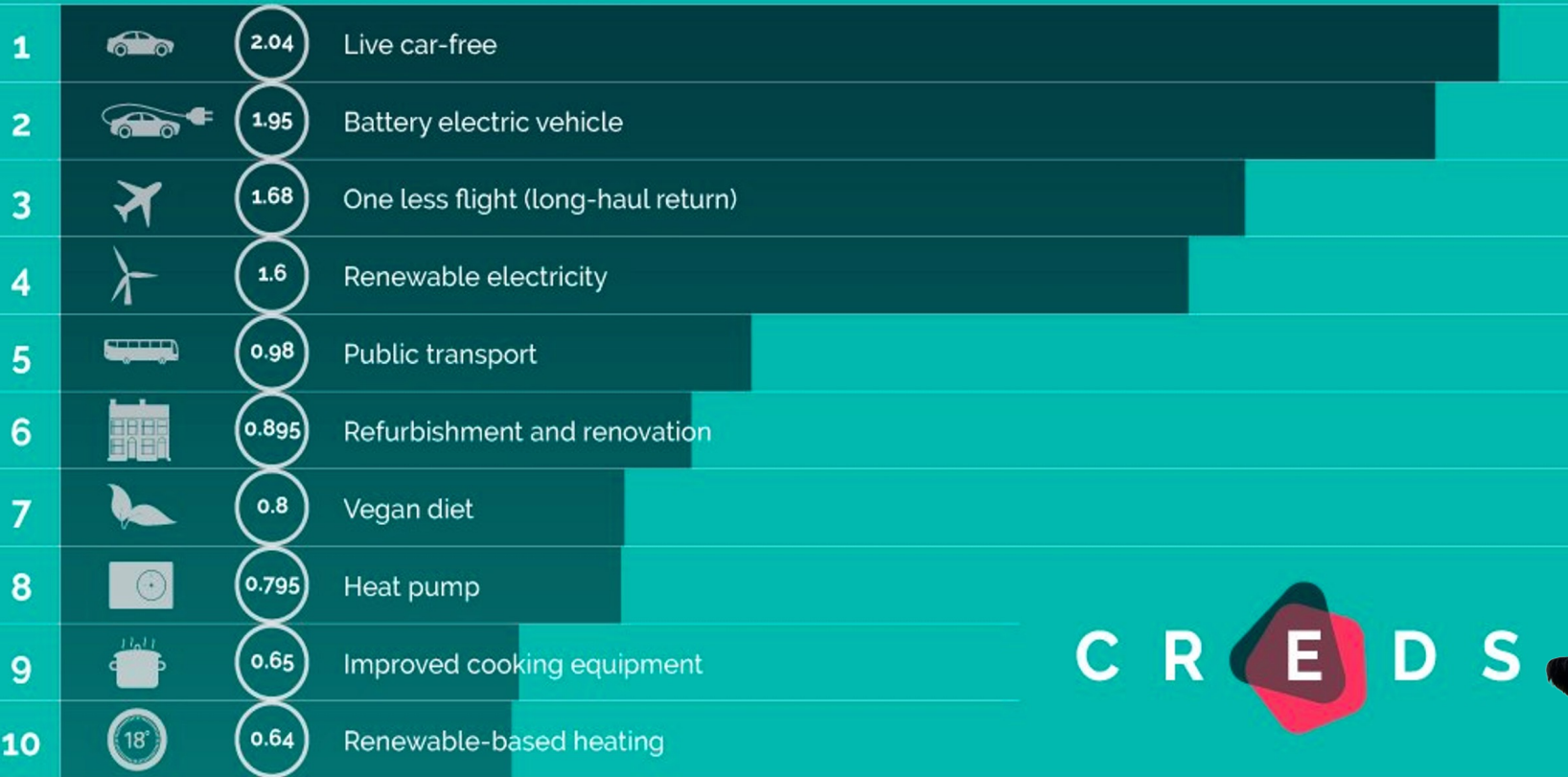


Source: Created by Dr. Jude L. Capper, 2020. Information from: YouGov (2019) Is the future of food flexitarian?
<https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian>

CV

New CREDS report puts transport, energy and food choices into context

Top 10 options for reducing your carbon footprint



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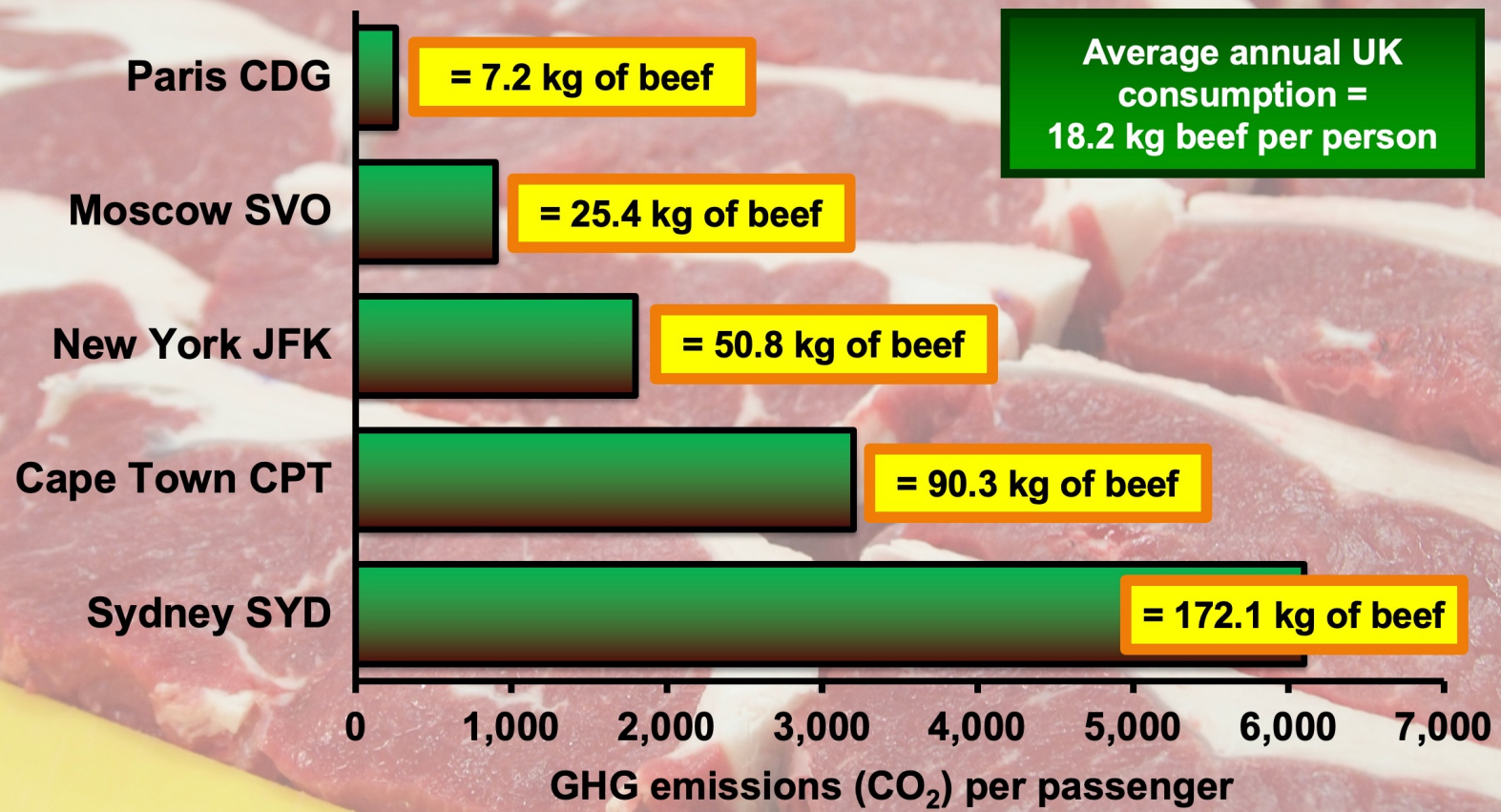


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Source: Created by Dr. Jude L. Capper, 2020. . Infographic adapted from Centre for Research into Energy Demand Solutions (2020). Available at: https://twitter.com/CREDS_UK/status/1262984570175176704?s=20

CV

International flights emit considerable quantities of carbon compared to beef production



Source: Created by Dr. Jude L. Capper, 2020. Calculations based on GHG emissions flight data from: https://co2.myclimate.org/en/flight_calculators/new, and on a carbon footprint per kg of boneless beef of 35.5 kg CO₂-eq (under GWP100) from AHDB: http://beefandlamb.ahdb.org.uk/wp-content/uploads/2013/05/p_cp_down_to_earth300112.pdf

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Can we grow human food crops everywhere?

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Source: Created by Dr. Jude L. Capper, 2021

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65% of UK land is not suitable for growing arable crops



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Source: Created by Dr. Jude L. Capper, 2020. Grazing land includes temporary grass on arable land (6% of total), land used for outdoor pigs or non-agricultural purposes not shown (1.7% of total). Data from DEFRA. 2019. Farming statistics - provisional crop areas, yields and livestock populations at 1 June 2019 – United Kingdom.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/837834/structure-jun2019prov-UK-10oct19.pdf

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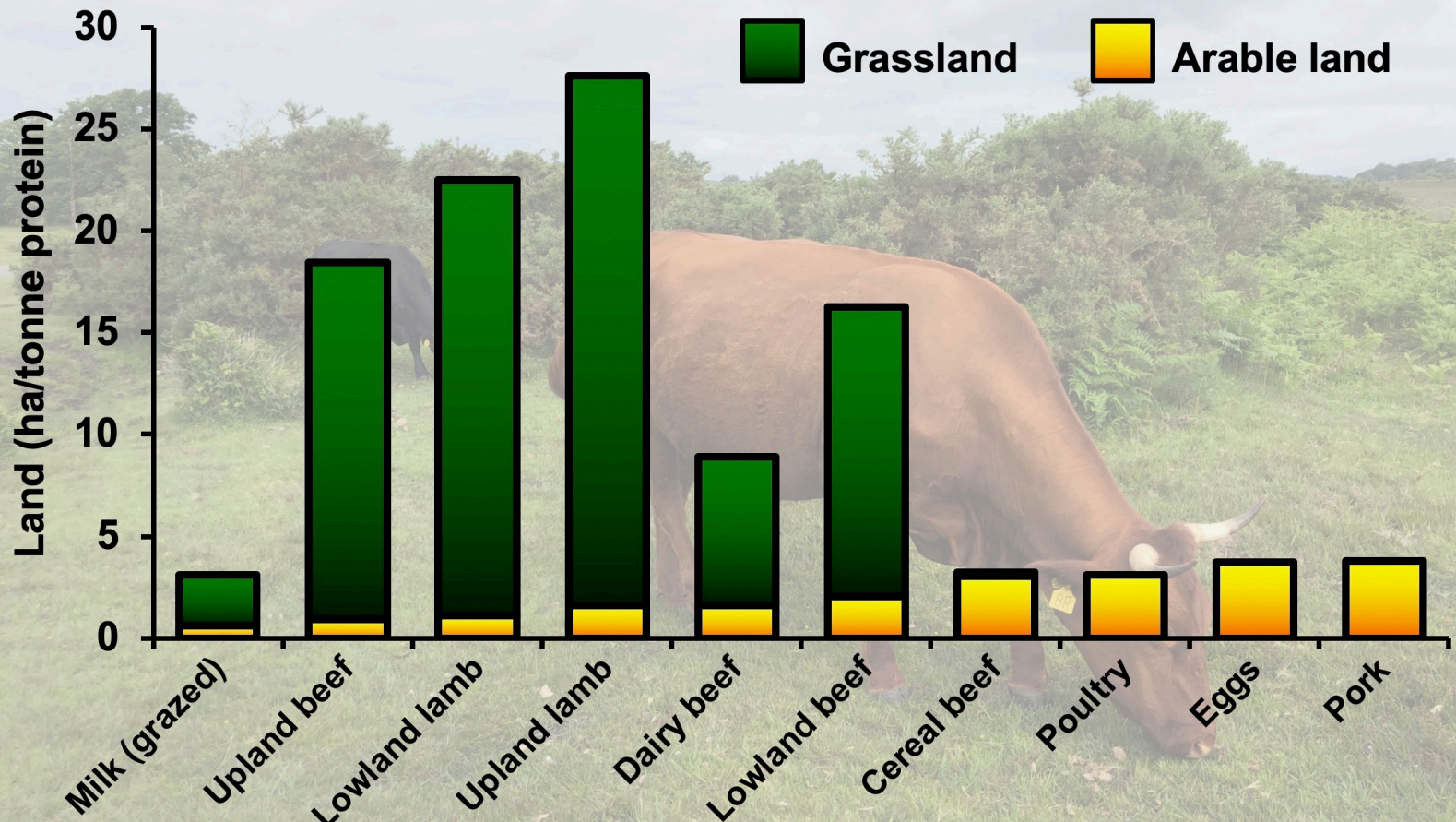
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Livestock systems vary widely in arable and grassland use



Source: Created by Dr. Jude L. Capper, 2020; data from Wilkinson and Lee (2018) Review: Use of human-edible animal feeds by ruminant livestock. *Animal*.

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What do these industries have in common? They all provide by-products fed to animals



Source: Created by Dr. Jude L. Capper, 2013

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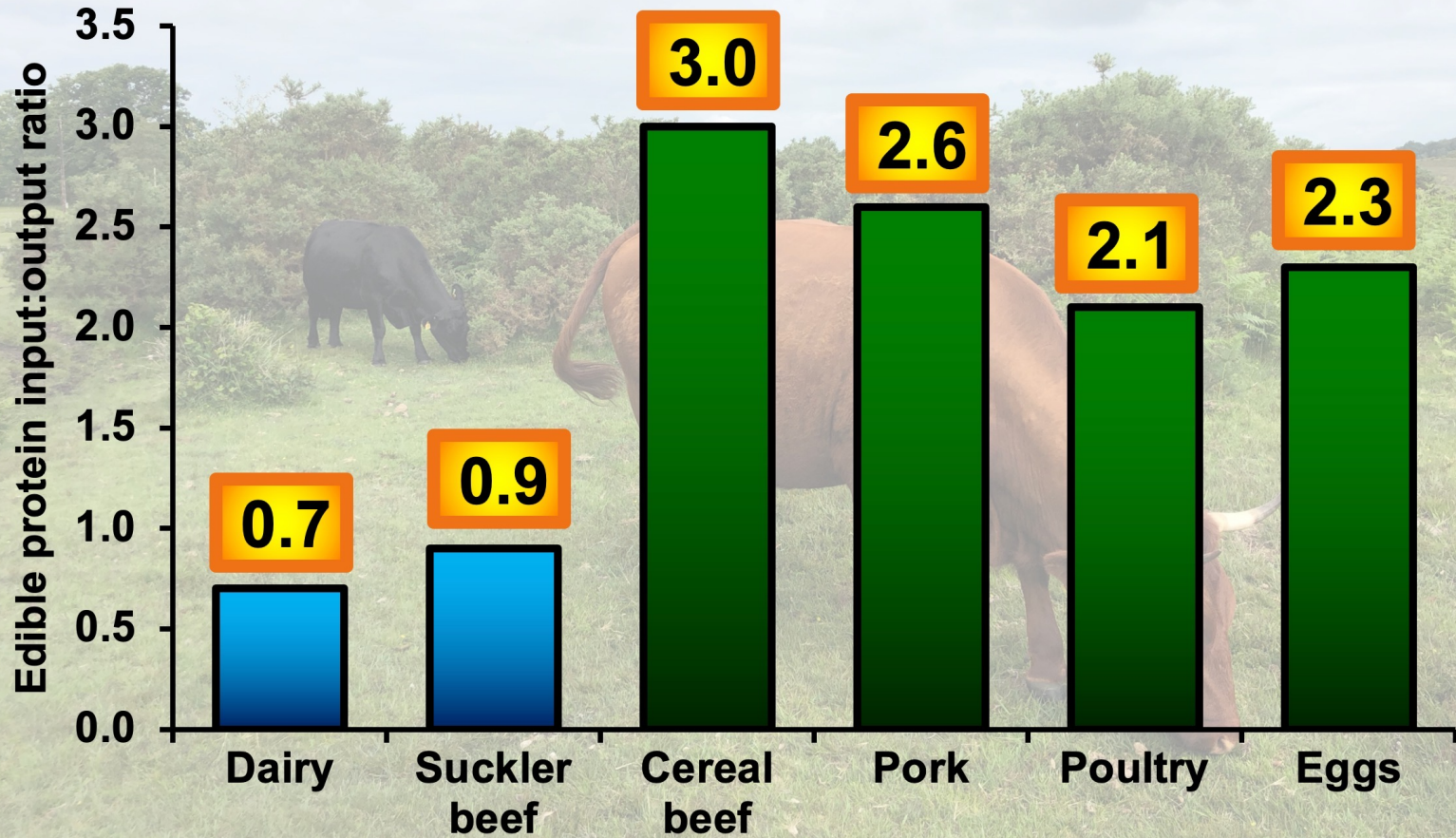


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Grazing cattle systems produce more human-edible protein than they consume



Source: Created by Dr. Jude L. Capper, 2020; data from Wilkinson (2011) Re-defining efficiency of feed use by livestock. *Animal*.

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Sustainability indices will be increasingly present on meat labels in future

Beef (animal-based) patty

Nutritional value*

Serving size: 227 g (8 oz) steak

78%

Pure beef protein
– contains no
lab-based
ingredients!

Sustainability index



Carbon footprint (under GWP*)



Water footprint



Antibiotic footprint



Community support rating



Farm webcam and sustainability assessment data



*compared to ideal protein



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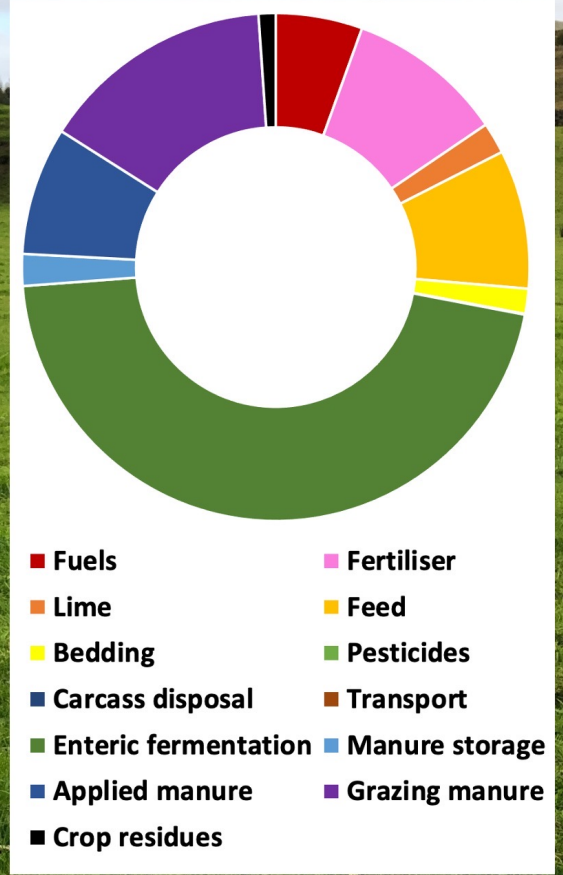
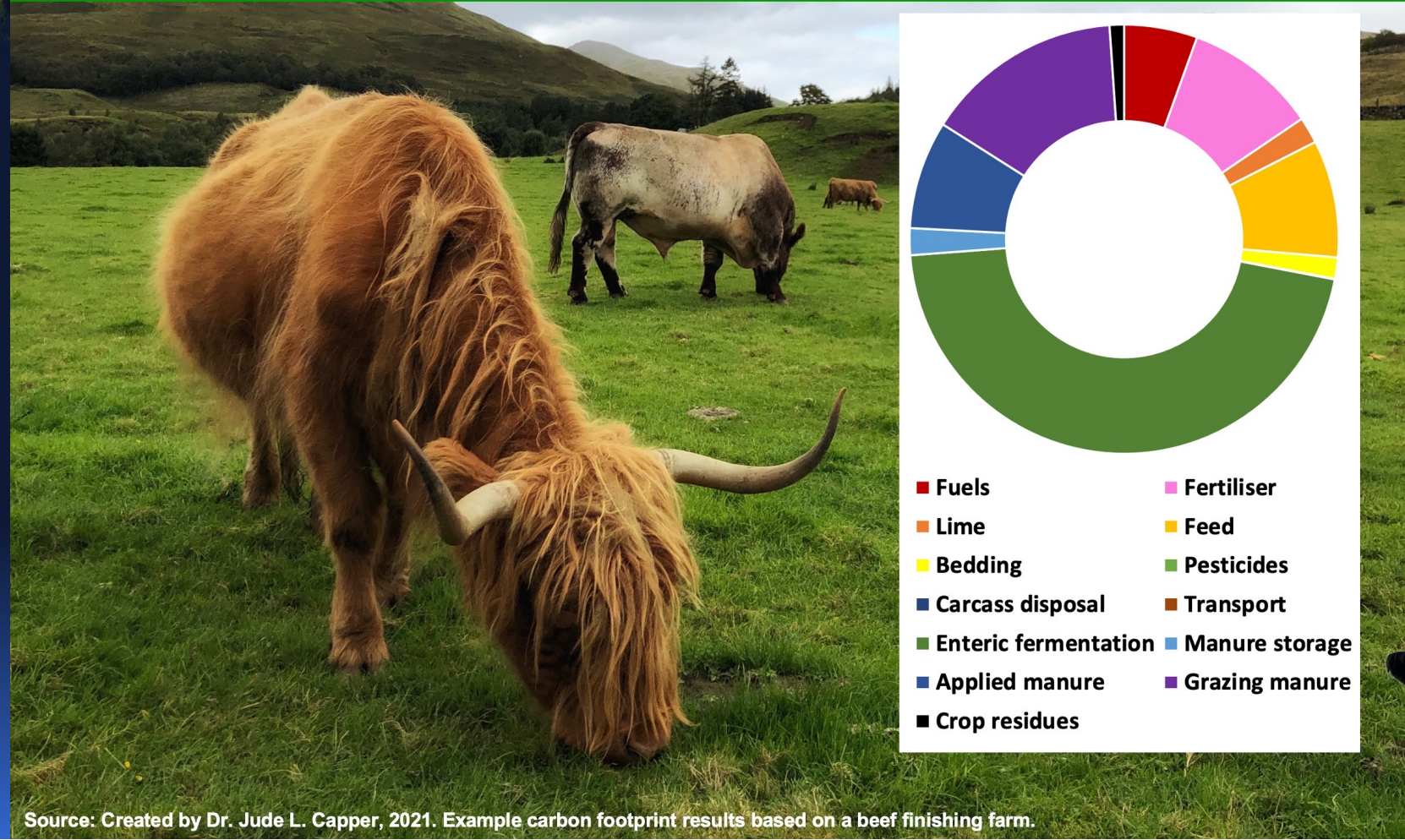
Source: Created by Dr. Jude L. Capper, 2020.

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Standard footprinting tool urgently needed across the industry

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Source: Created by Dr. Jude L. Capper, 2021. Example carbon footprint results based on a beef finishing farm.

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Peer-to-peer learning, discussion groups and farmer incentives aid behavioural change

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Source: Created by Dr. Jude L. Capper, 2021.



Metrics – defining the population by weight

- Adopt or adapt standard weight metrics from elsewhere (e.g. France, Denmark, Netherlands)
- Use what data we have from the UK, e.g. livestock markets/slaughterhouse data
- Factorial calculations based on Livestock Units (LSU)

Species	Weight (kg)	LSU
Sheep	45	1.0
Cattle	450	10.0
Pigs	250	5.0
Hens	4.5	0.1

The number of animals of a certain breed or variety of animal reared in one year as defined by the standards.

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Thank you!

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<http://bovidiva.com/presentationlinks>

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Questions?



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Source: Created by Dr. Jude L. Capper, 2020. Cartoon from: <http://snipurl.com/methanecartoon>