



Sustainable beef production – challenges and opportunities

2nd December 2022

Source: Jude L. Capper, 2022

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There is no definitive sustainable protein system – but every system can be sustainable



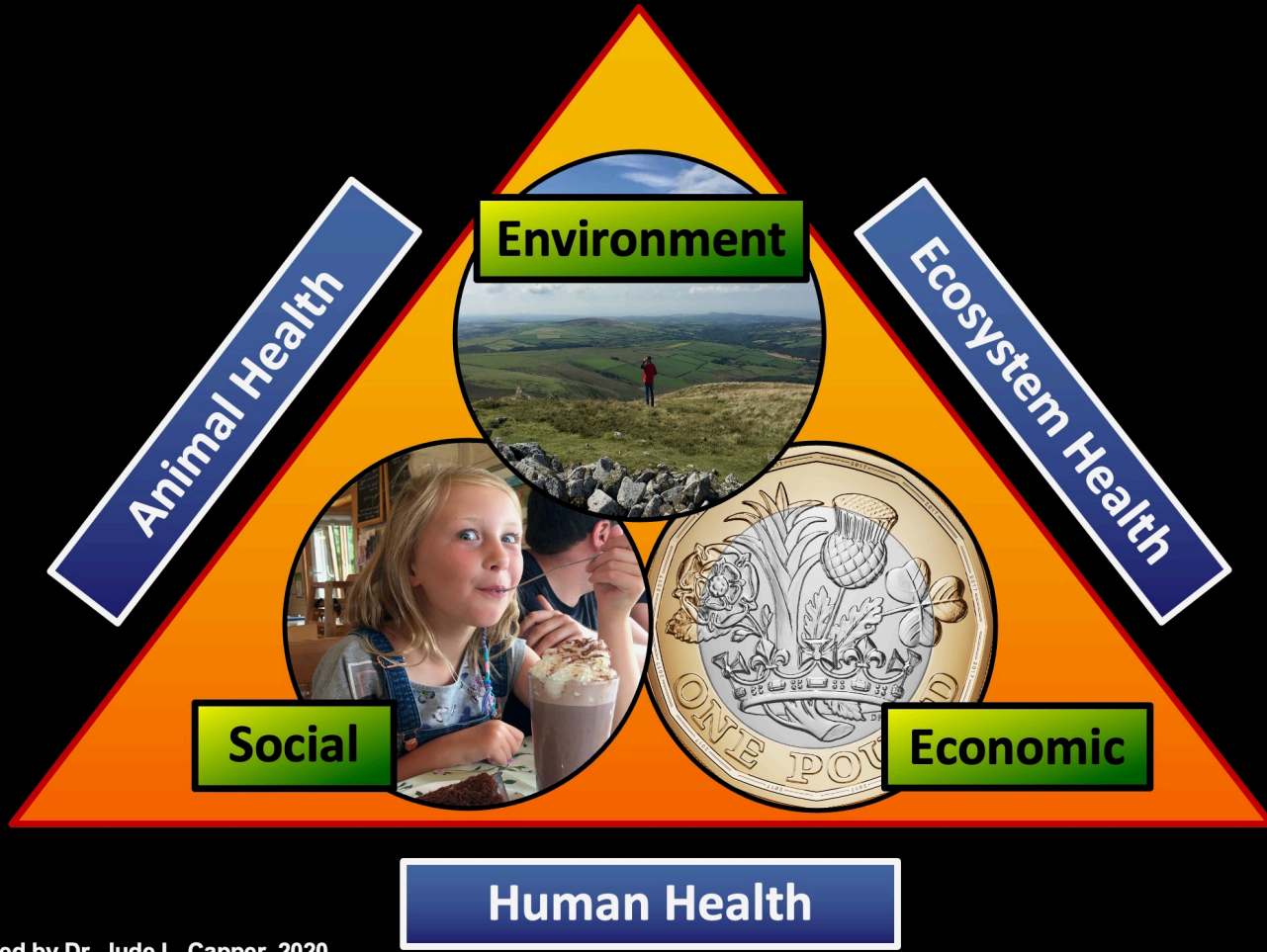
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Source: Created and photos by Dr. Jude L. Cappier, 2020

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Sustainability comprises three pillars, all under the umbrella of One Health



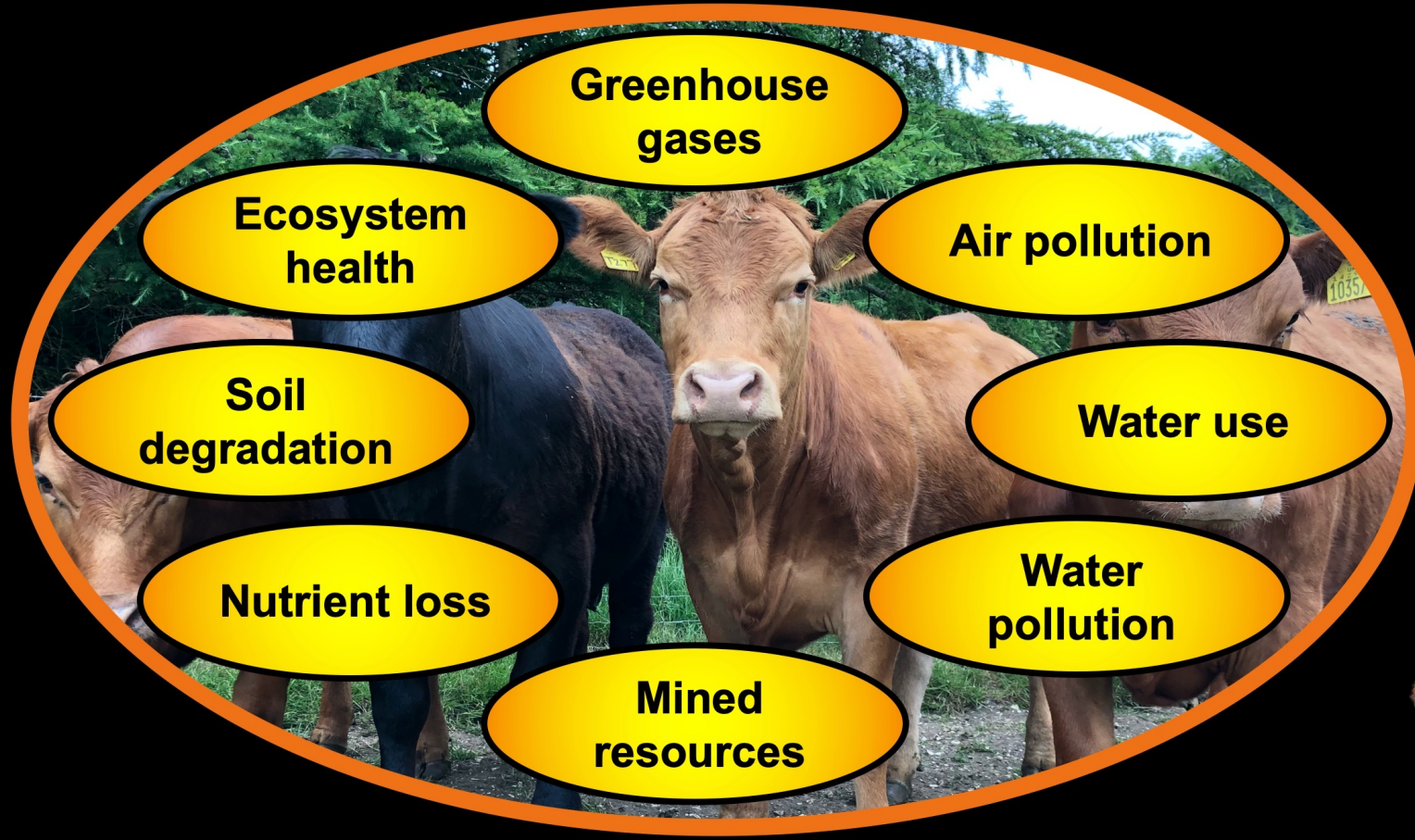
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Source: Created by Dr. Jude L. Capper, 2020.

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Environmental impacts are not limited to greenhouse gas emissions



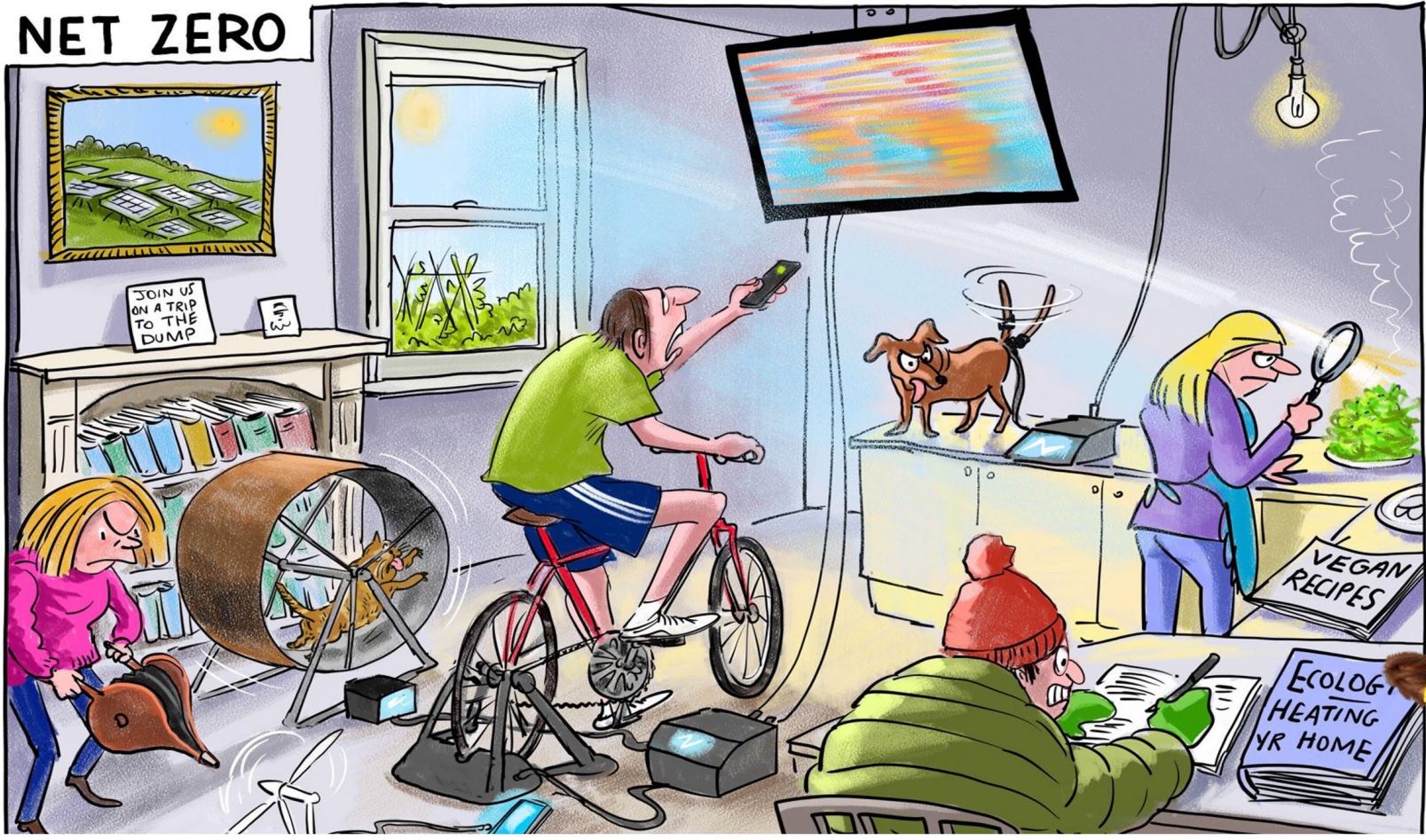
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Source: Created by Dr. Jude L. Capper, 2020



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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Retailers face challenge of meeting net zero commitments

50% reduction in food-related GHG emissions by 2030 is possible, but only if we take

URGENT
ACTION

wrap.org.uk/GHGPathway



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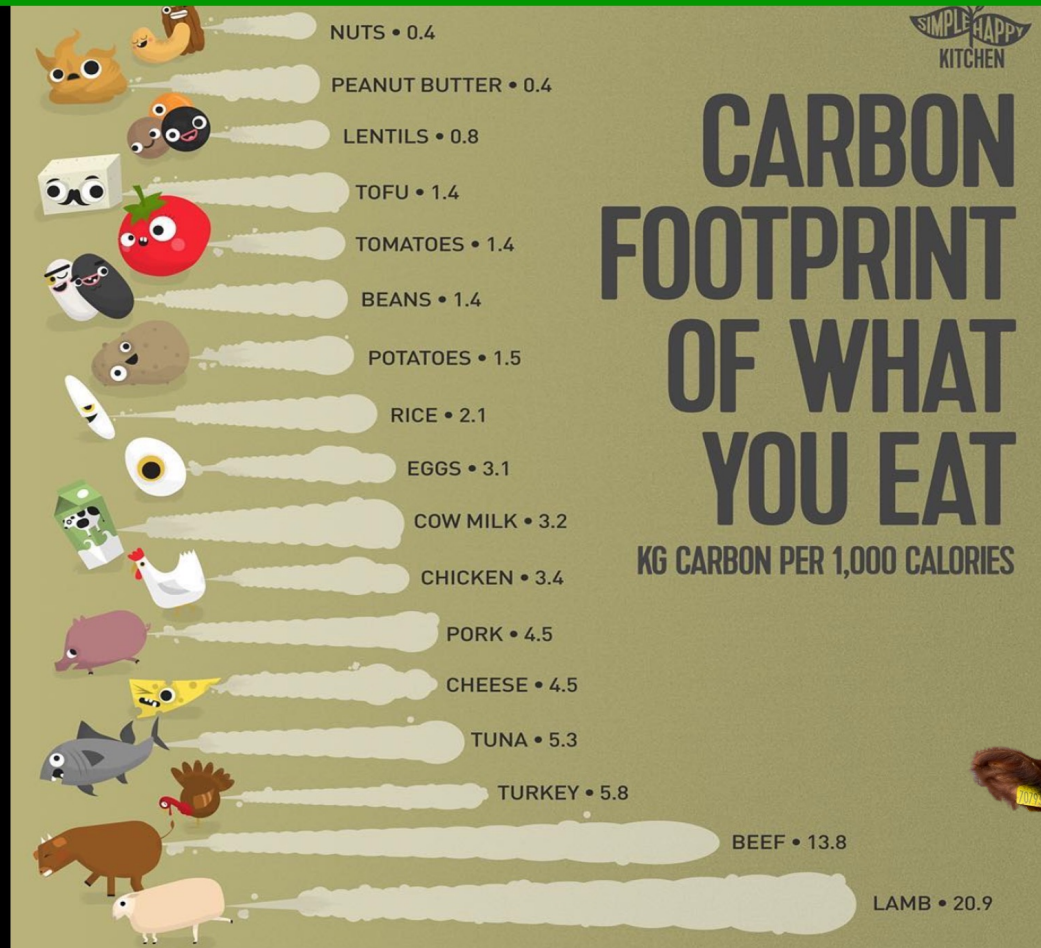


Source: Created by Dr. Jude L. Capper, 2021. Infographic from: https://wrap.org.uk/sites/default/files/2021-10/WRAP_UK_food%20systems_GHG_Report_TWITTER_Urgent%20action.jpg?itok=8txblEnz

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Global averages are meaningless

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



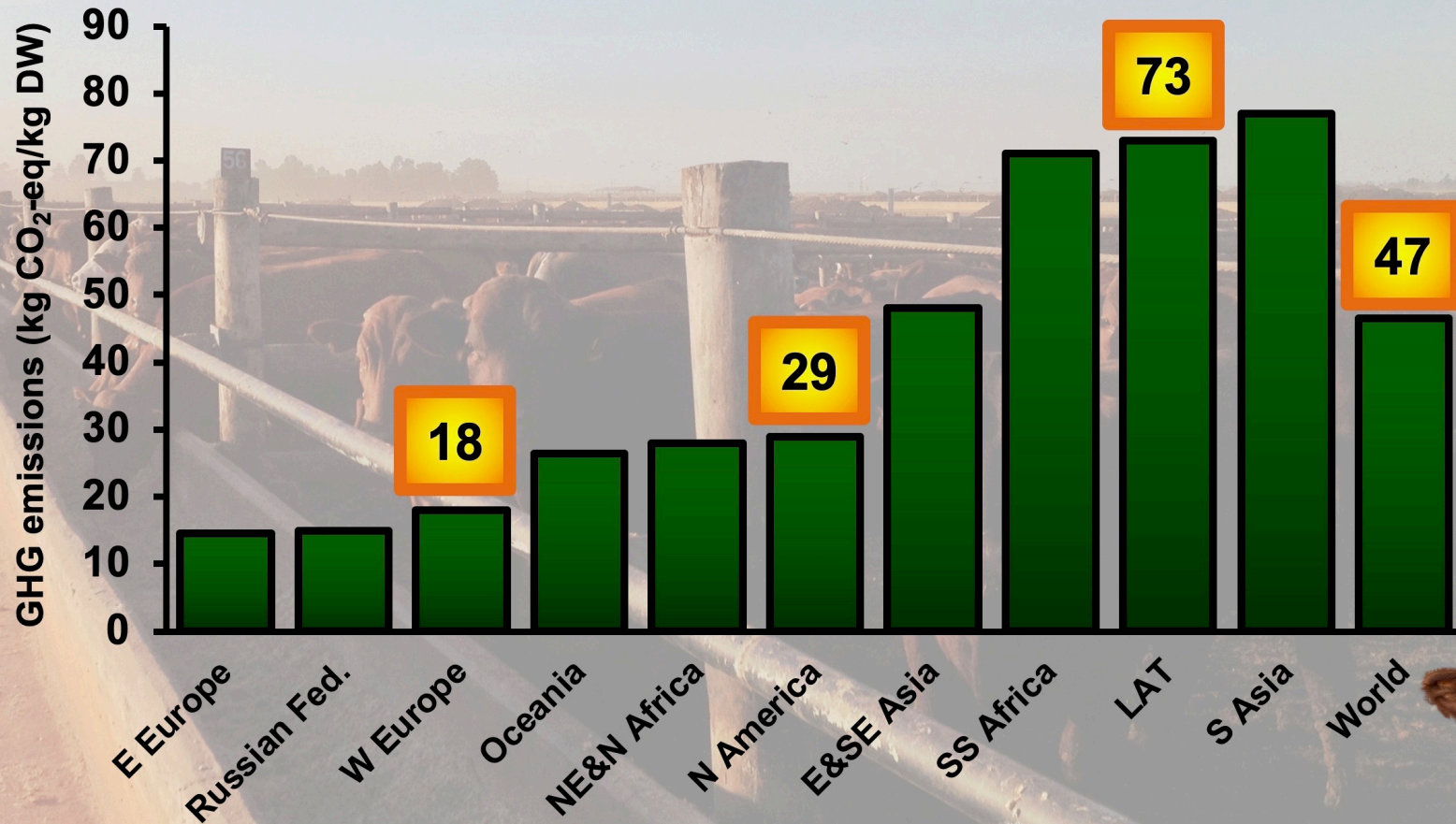
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Source: Created by Dr. Jude L. Capper, 2020, infographic from: https://www.instagram.com/simple_happy_kitchen/

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The carbon footprint of beef production varies across the globe

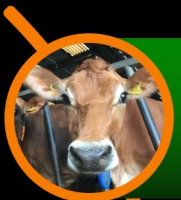


Source: Created by Dr. Jude L. Capper, 2020; data from Gerber et al. (2013) Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. FAO, Rome, Italy.



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Improved efficiency has reduced GHG emissions from U.S. livestock production



19% decrease in GHG emissions per litre of ECM between 2007 and 2017



18% decrease in GHG emissions per kg of HCW beef between 1977 and 2007



35% decrease in GHG emissions per kg of pork between 1959 and 2009



63% decrease in GHG emissions per ton of eggs between 1960 and 2010

Source: Created by Dr. Jude L. Capper, 2020. Data from: Capper and Cady (2019) The effects of improved performance in the U.S. dairy cattle industry on environmental impacts between 2007 and 2017. *J. Anim. Sci.* and Capper (2011). The environmental impact of U.S. beef production: 1977 compared with 2007. *J. Anim. Sci.* and Cady et al. (2013) A 50-year comparison of the environmental impact and resource use of the US swine herd: 1959 vs. 2009. ADSA-ASAS Annual Meeting, 2013, Indianapolis, IN and Pelletier et al. (2014) Comparison of the environmental footprint of the egg industry in the United States in 1960 and 2010. *Poult. Sci.*

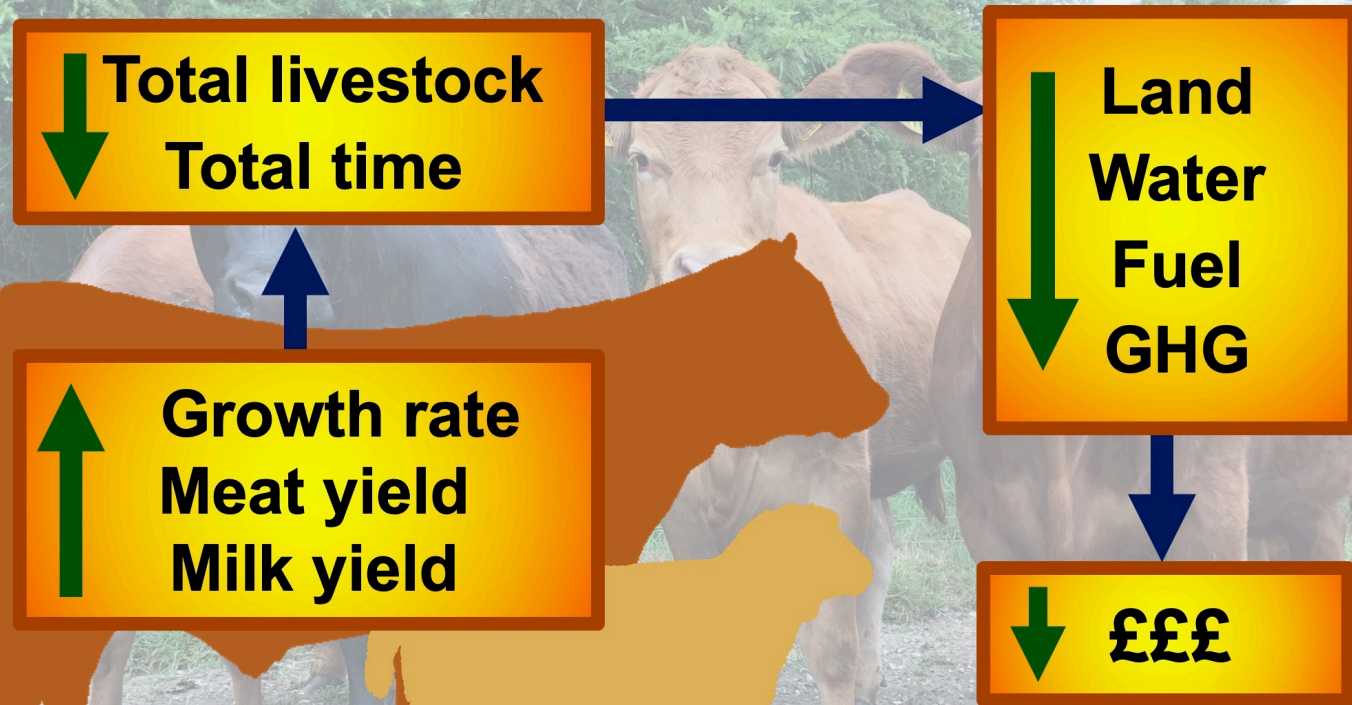


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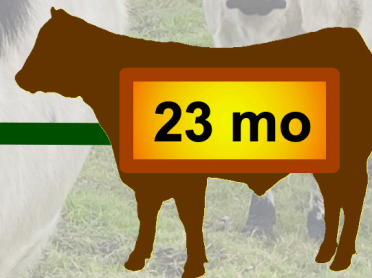
Improving animal productivity reduces the environmental impact of milk and meat



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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
23 months
0.90 kg/d
702 days

40 kg
670 kg
630 kg
26 months
0.80 kg/d
793 days

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

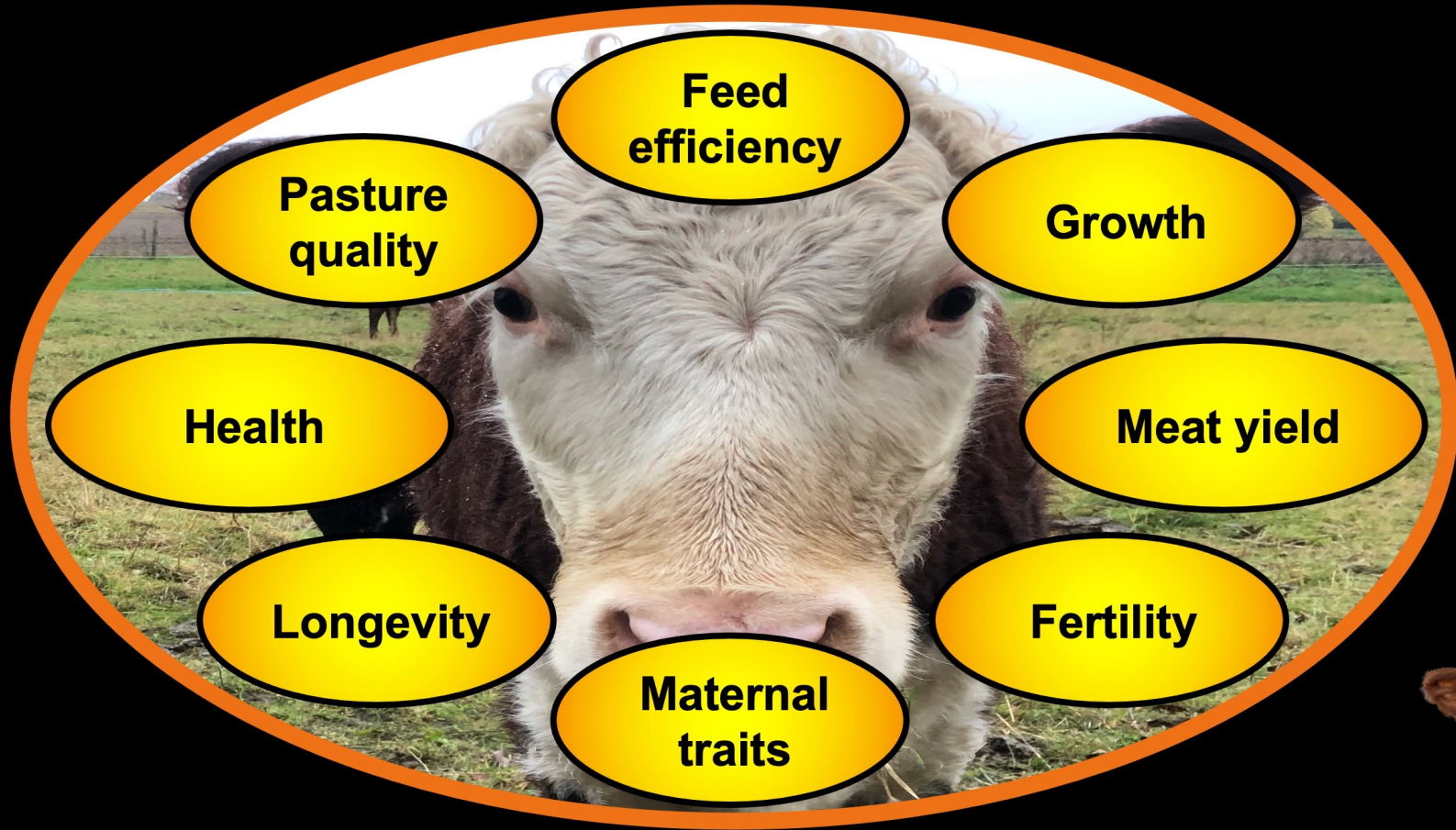


Source: Created by Dr. Jude L. Capper, 2022. Data from Quinton et al. (2018) Predicted economic and greenhouse gas benefits from using improved maternal genetics in UK beef cattle. Proceedings of the World Congress on Genetics Applied to Livestock Production, 11.364



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Doing everything better on-farm improves economic and environmental sustainability



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

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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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Can we grow human food crops everywhere?



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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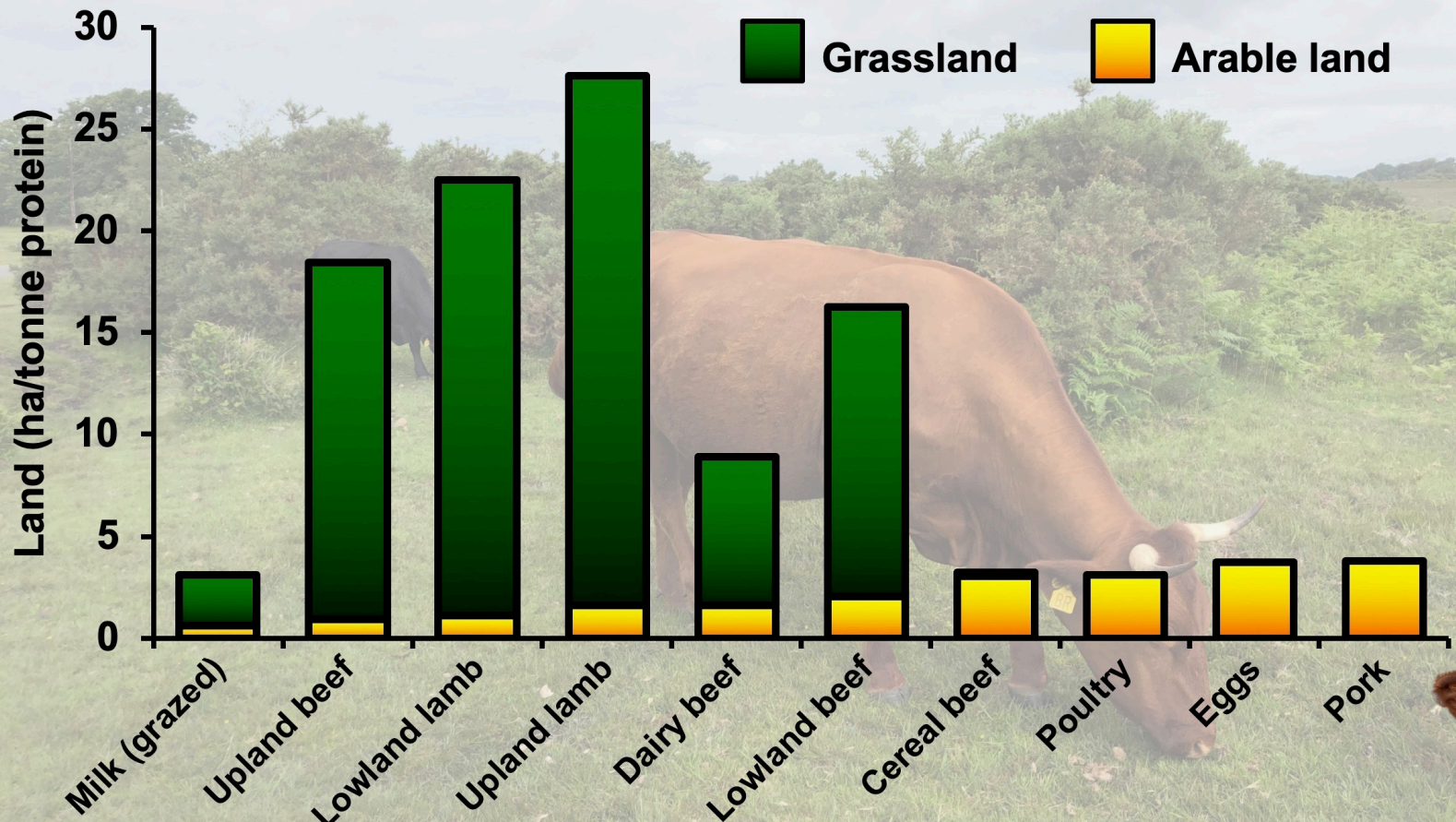


Source: Created by Dr. Jude L. Capper, 2020. Grazing land includes temporary grass on arable land (6% of total), land used for outdoor pigs or non-agricultural purposes not shown (1.7% of total). Data from DEFRA. 2019. Farming statistics - provisional crop areas, yields and livestock populations at 1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

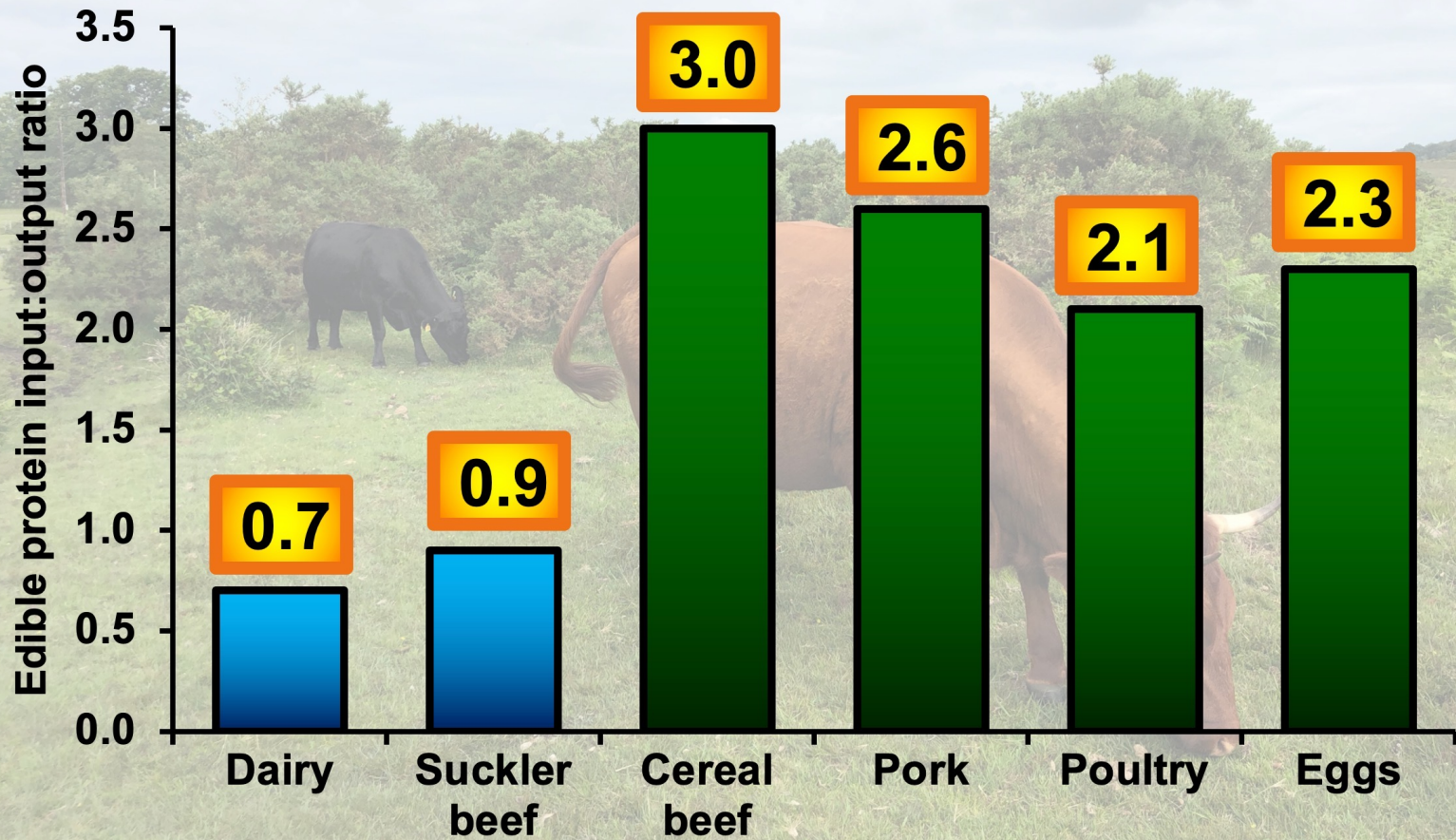


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Grazing cattle systems produce more human-edible protein than they consume



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



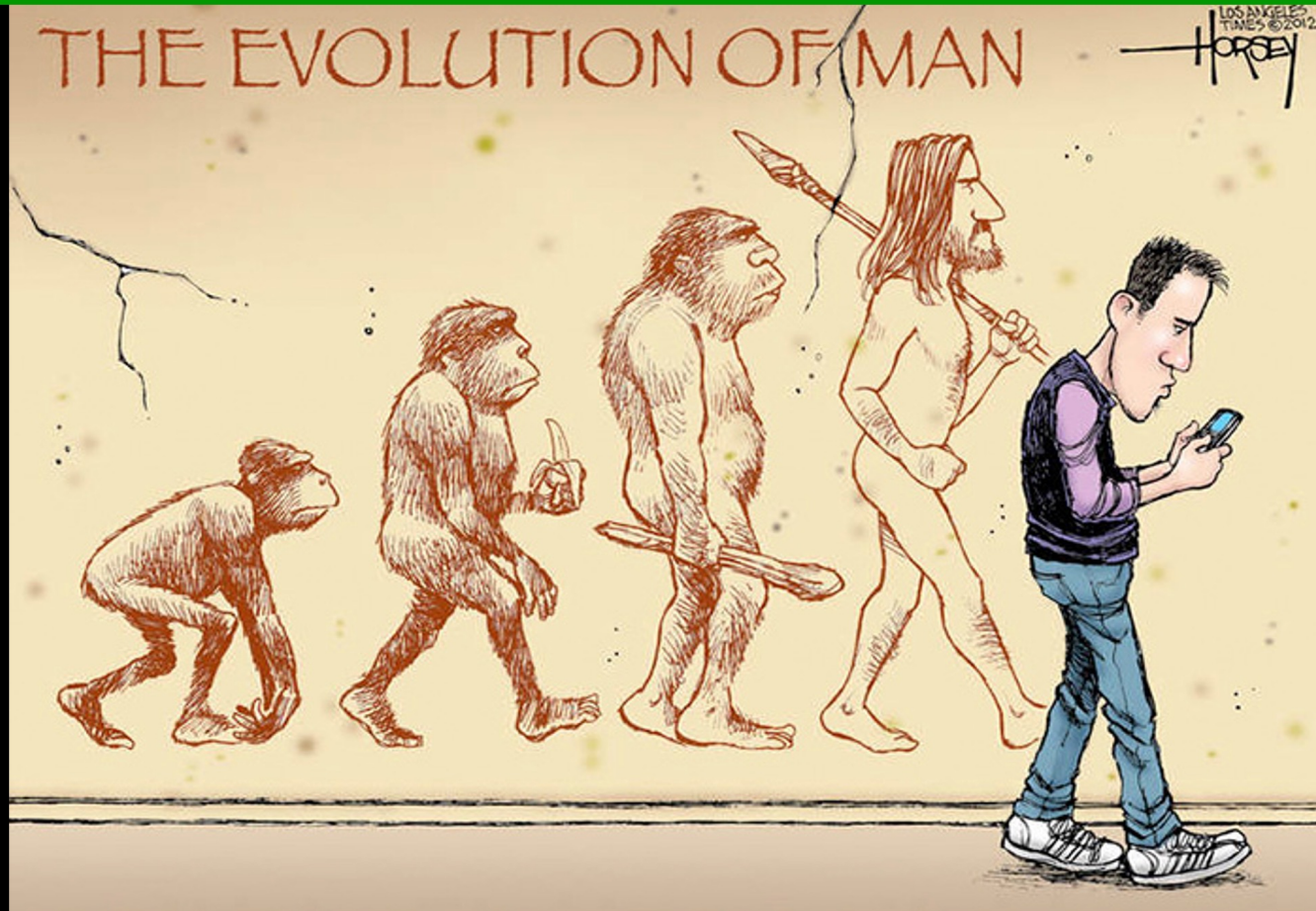
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Source: Created by Dr. Jude L. Capper, 2020.

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We've got the technology –
now we need to use it to its potential



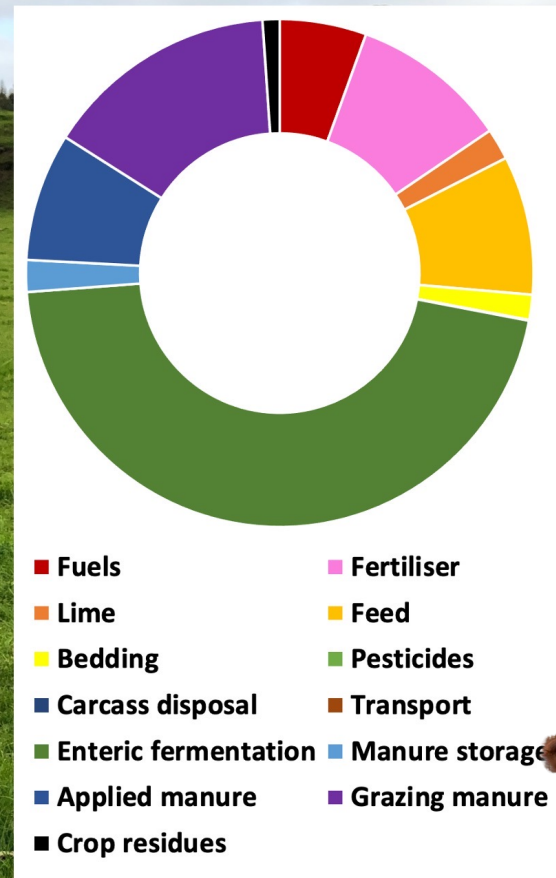
Source: Created by Dr. Jude L. Capper, 2021. Cartoon from: https://static.boredpanda.com/blog/wp-content/uploads/2016/02/funny-satirical-evolution-charles-darwin-day-251_700.jpg

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Standard footprinting tool urgently needed across the industry



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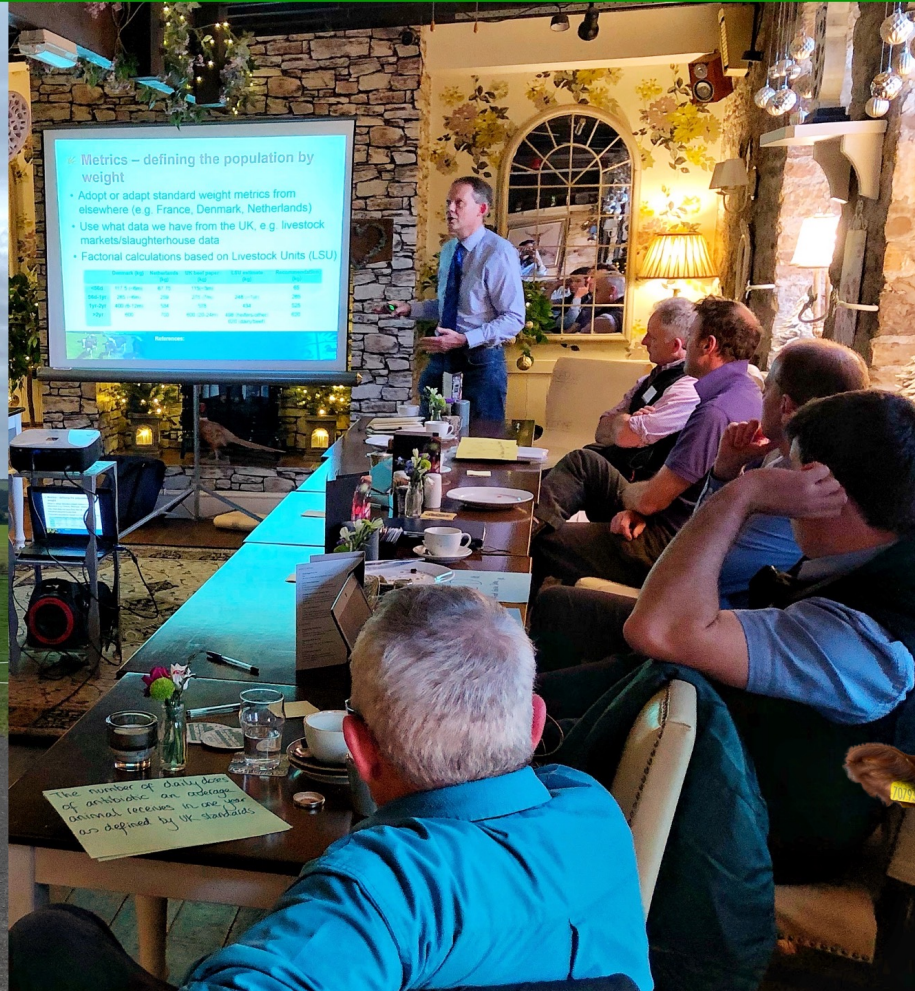


Source: Created by Dr. Jude L. Capper, 2021. Example carbon footprint results based on a beef finishing farm.



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



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
Goats	45	1.0
Cattle	450	10.0
Horses	450	10.0
Pigs	225	5.0

The number of daily doses of antibiotics an average animal receives in the UK as defined by the standards.



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

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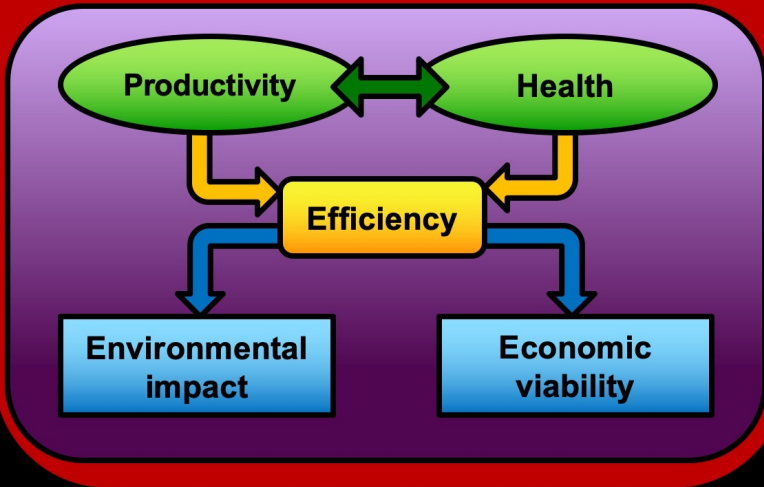


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Social acceptability and consumer trust are vital for sustainable livestock production



Social Acceptability



Sustainability



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

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

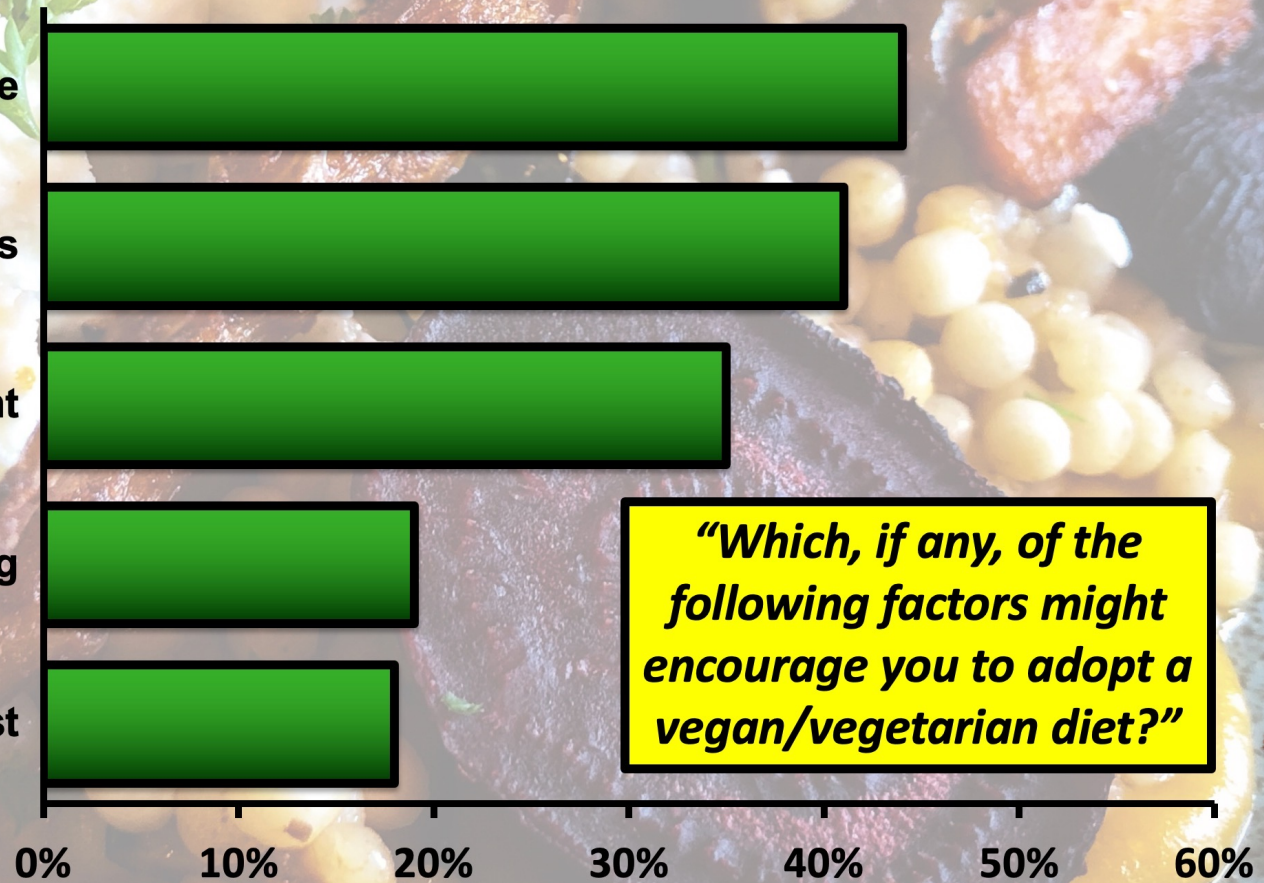
Animal welfare

Healthiness

Environment

Labelling

Economic cost

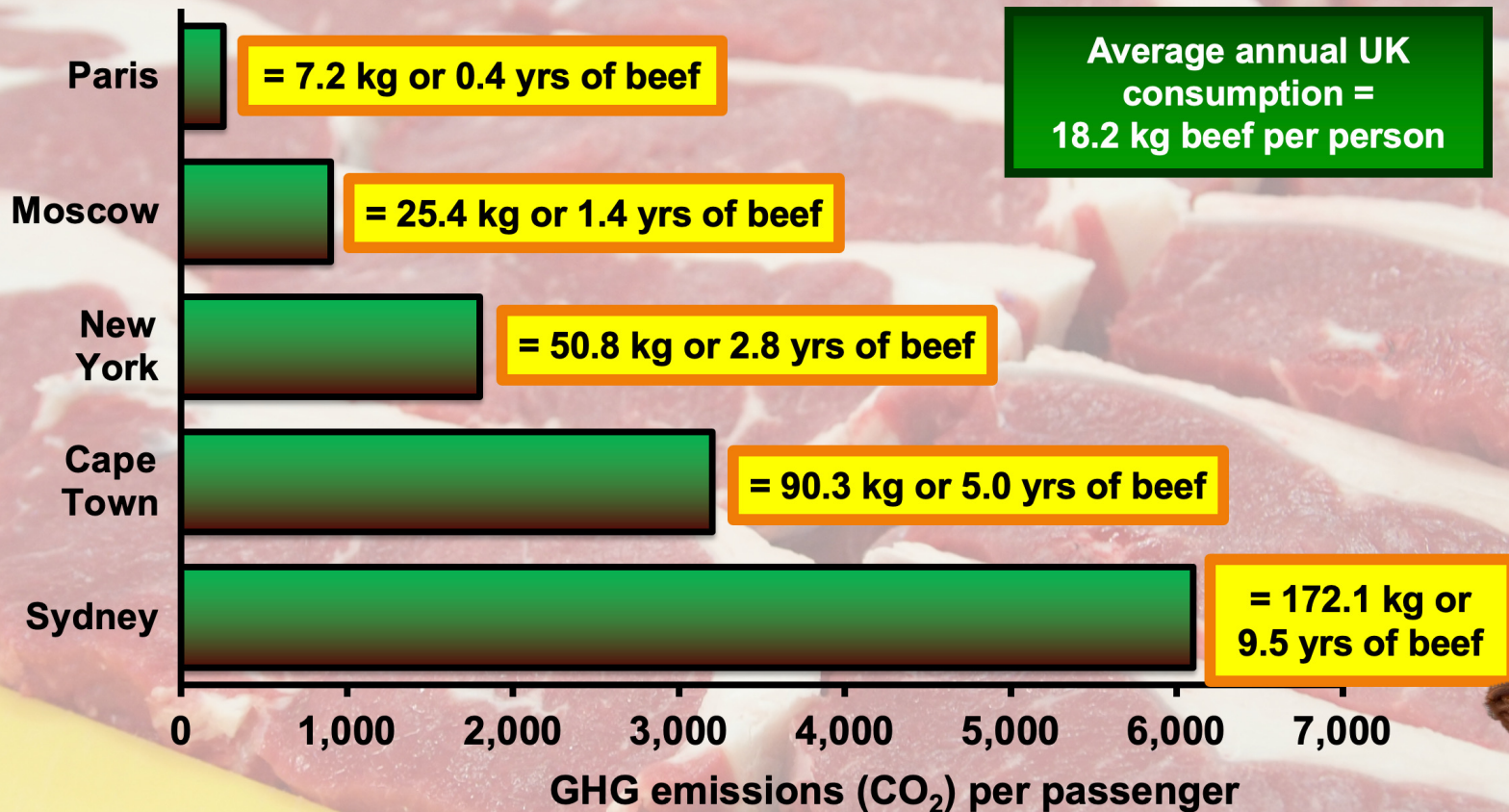


Source: Created by Dr. Jude L. Capper, 2020. Information from: YouGov (2019) Is the future of food flexitarian?
<https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian>



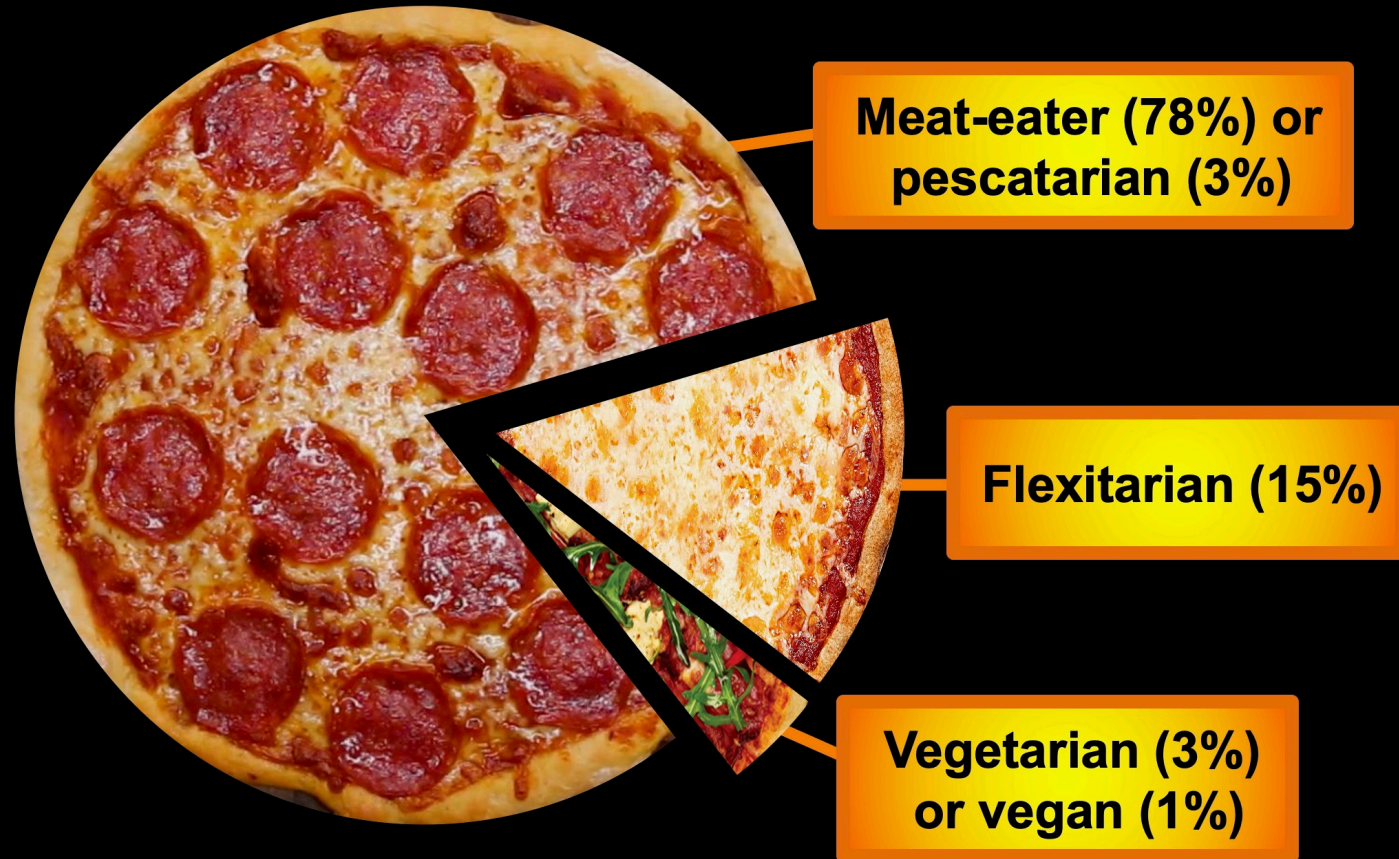
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International flights emit considerable quantities of carbon compared to beef production



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The future probably isn't vegan, but it may be flexitarian?



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Source: Created by Dr. Jude L. Capper, 2020. Data from: YouGov (2019) Is the future of food flexitarian?
<https://yougov.co.uk/topics/resources/articles-reports/2019/03/18/future-food-flexitarian> Question: "Which, if any, of these best describes your usual eating habits?" Results adjusted for people who answered "don't know" (3%) or "other" (3%).

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How do we make meat sexy?



Source: Created by Dr. Jude L. Capper, 2022.



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How do we make meat sexy?



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Source: Created by Dr. Jude L. Capper, 2022.



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How do we make meat sexy?



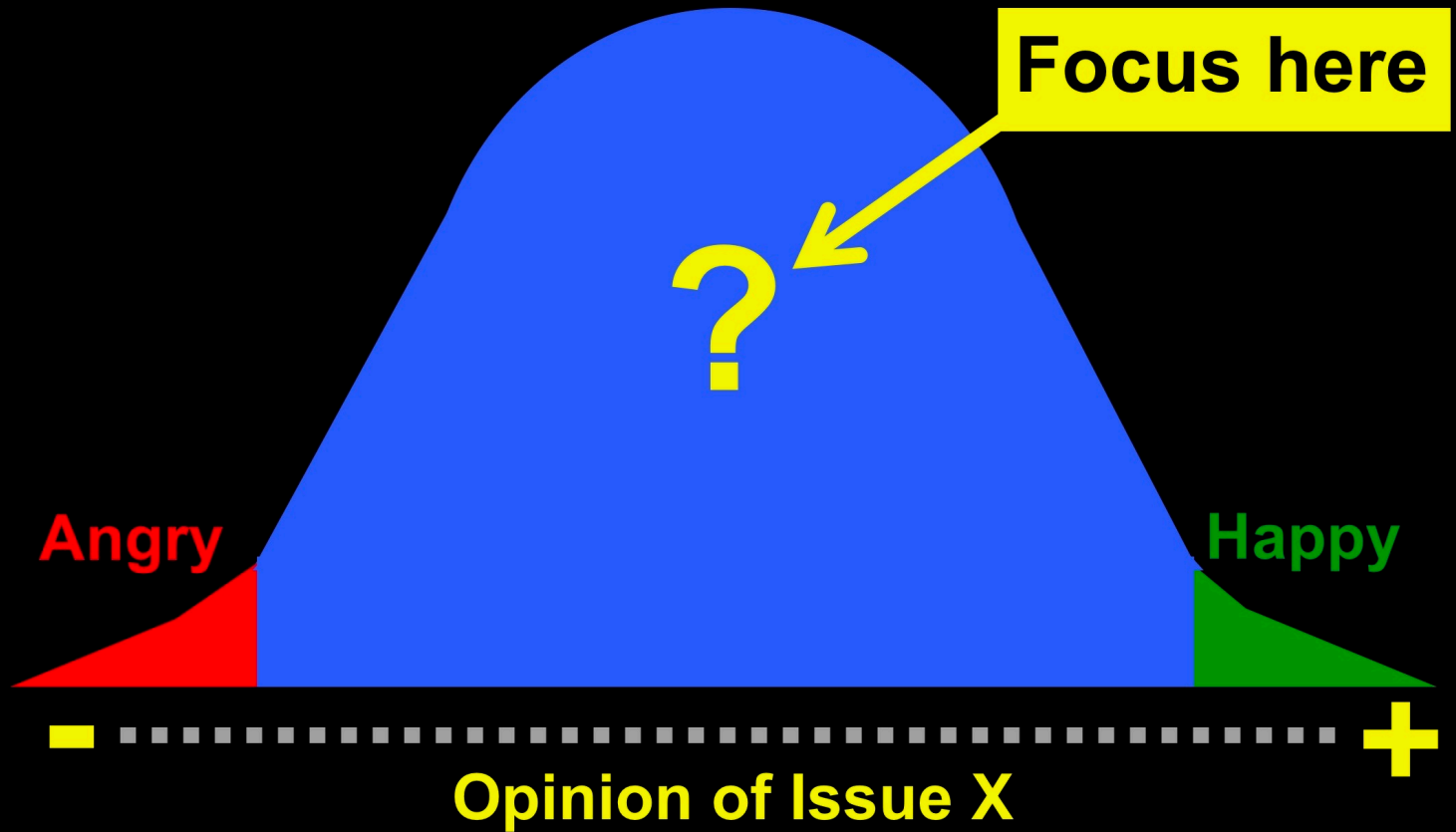
Source: Created by Dr. Jude L. Capper, 2022.

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We need to communicate with consumers who don't yet have fixed opinions of agriculture



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Source: Created by Dr. Jude L. Capper, 2017



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5 easy tips for positive communication

Share your values

Stay positive, polite and personal

Keep it short, simple and see-through

Focus on the important

Know when to walk away

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Source: Created by Dr. Jude L. Capper, 2019. Adapted from: Capper and Yancey. 2015. Communicating Animal Science to the General Public. *Animal Frontiers*.

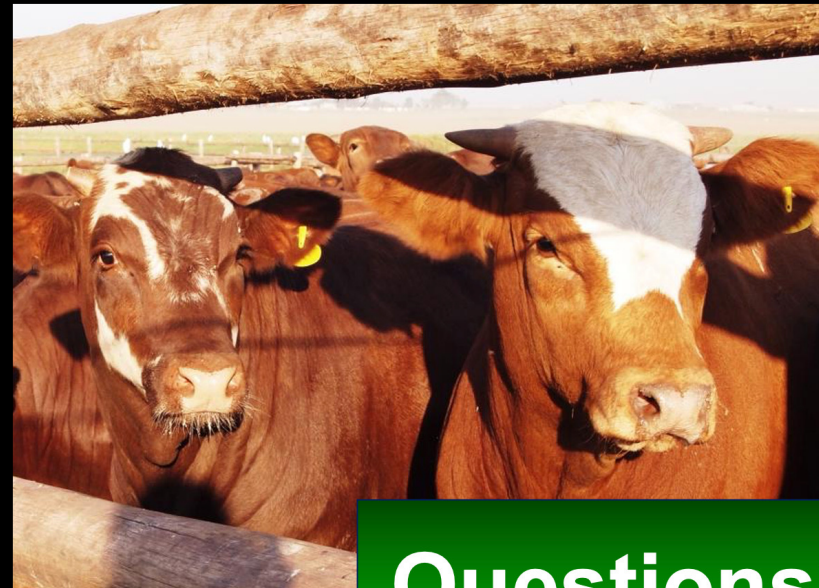


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Thank you!

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<http://bovidiva.com/presentationlinks>

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Questions?



Source: Created by Dr. Jude L. Capper, 2021. Cartoon from: <http://RubesCartoons.com>