Sustainability in livestock production systems: what are the options?

Prof. Jude Capper

5th December 2023

Healthy and sustainable diets

Source: Jude L. Capper, 2023

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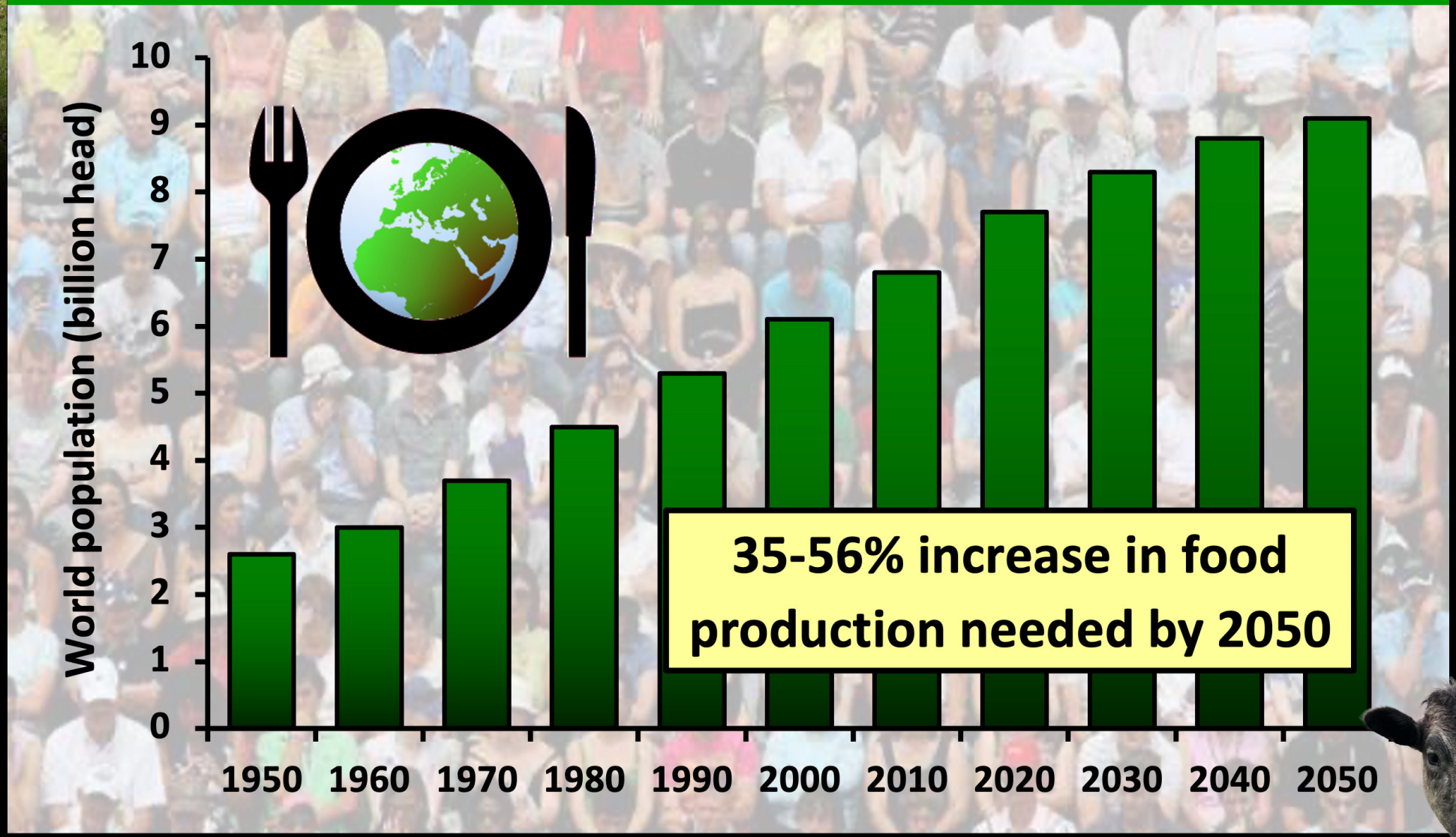
More people means we need to produce more food with fewer resources



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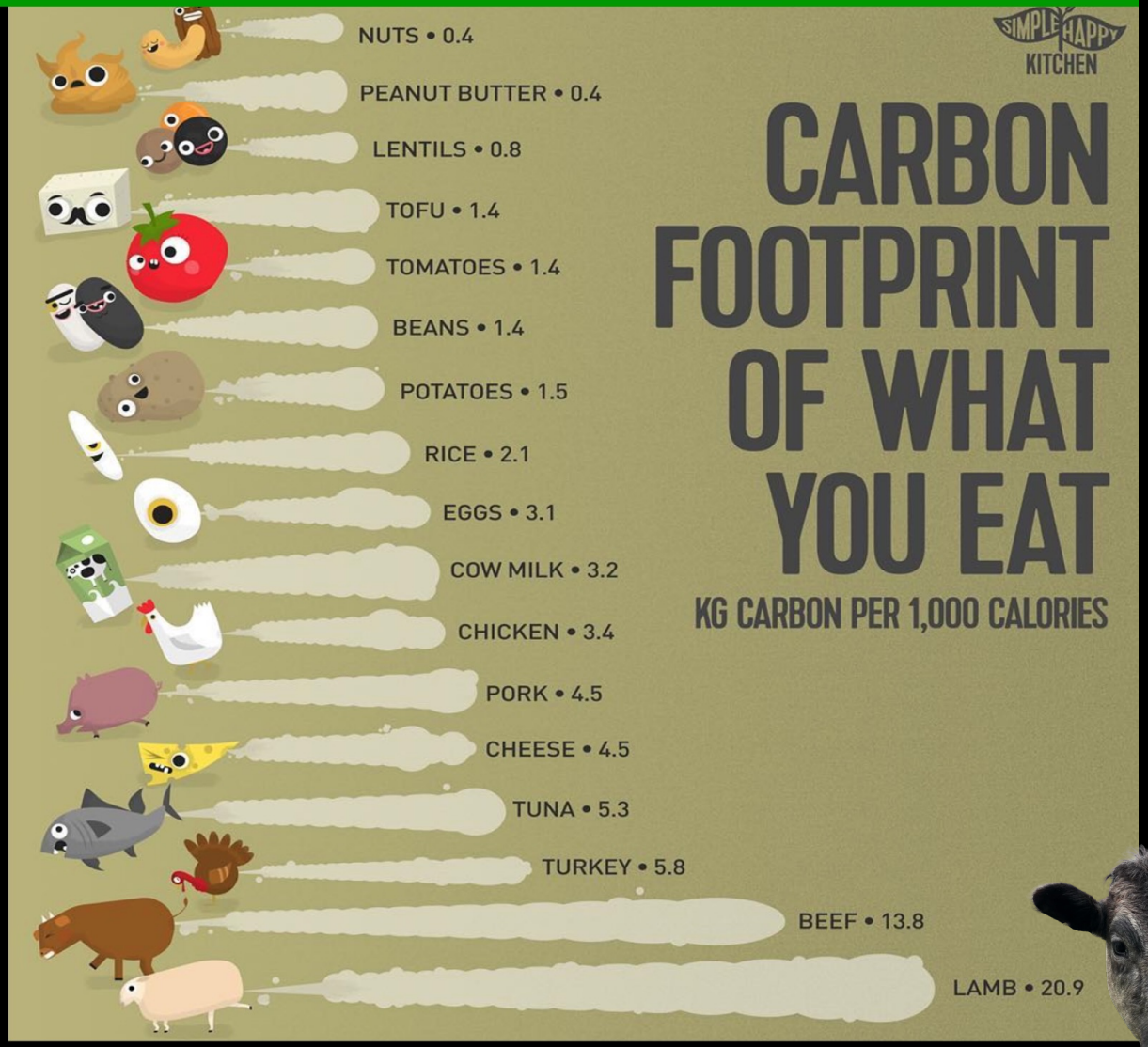
Source: Created by Jude L. Capper, 2023. Data from: van Dijk et al. (2021) https://doi.org/10.1038/s43016-021-00322-9

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



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Source: Created by Jude L. Capper, 2023. Infographic from https://www.instagram.com/simple_happy_kitchen/

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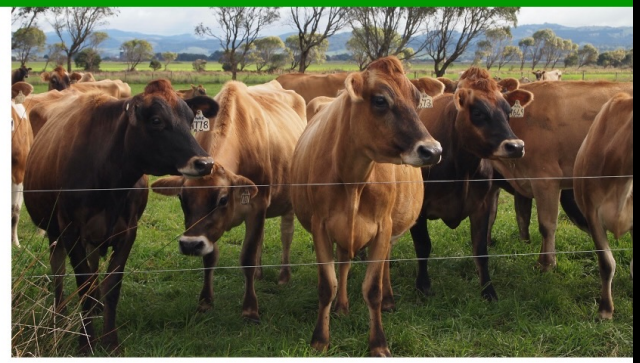
There is no definitive sustainable protein system – but every system can be sustainable









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Source: Created and photos by Jude L. Capper, 2023.

B

Improving key performance indicators reduces environmental impacts

Feed efficiency

Pasture quality

Growth

Health

Meat yield

Longevity

Fertility

Maternal traits

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Source: Created by Jude L. Capper, 2023

B

Finishing cattle earlier improves profit and cuts the carbon footprint

Modelling study involving 777 Angus cattle finished at ABP research farm.

Finishing at ideal time (not heaviest weight) improved profit by 45% and cut carbon footprints by 32%

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Source: Created by Jude L. Capper, 2023. Data from: Capper et al. 2023. Helping farmers navigate the green economy: A data-driven blueprint for net zero beef. British Society of Animal Science Annual Meeting. https://doi.org/10.1016/j.anscip.2023.01.515

HfA

“Real life” application – African swine fever

The recent African swine fever outbreak, in which 100-150 million pigs died, led to:

17-38% increase in global pork prices

Pigmeat losses would have fed 550-824 million people

Greenhouse gases invested in animals that died or were culled were equal to annual emissions of 16.7-25.1 million cars

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Source: Created by Jude L. Capper, 2023. Economic data from Mason-D’Croz et al. (2020) https://doi.org/10.1038/s43016-020-0057-2. Other data – J. Capper – *submitted*.

D

What could global dairying look like if we improved health, nutrition and genetics?

Global average yield	UK average yield	Dairy cows
2,577 kg	8,140 kg	-181 million

If all dairy cattle had UK yields, global milk supply could be maintained using 181 million fewer cows (69%).

At US average yields, 200 million fewer cows (75%)

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Source: Created by Jude L. Capper, 2023. Data from FAOSTAT (2020) http://www.fao.org/faostat/en/

D

What about smallholders?

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Source: Created by Jude L. Capper, 2023. Photo attribution: Mullookkaaran, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons

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How do we account for myriad livestock benefits in sustainability metrics?


Nutrition


Income


Fertiliser


Draught power


Cultural status


Education


Female emancipation

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Source: Created by Jude L. Capper, 2023.

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Suckler cows must demonstrate ecosystem services to justify environmental impacts

Annual requirements of one suckler cow:

- **3,954 kg feed DM**
- **20,047 litres water**
- **2,459 kg CO_2**

Need to justify these impacts *vs.* beef from dairy.

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Source: Created by Jude L. Capper, 2023. 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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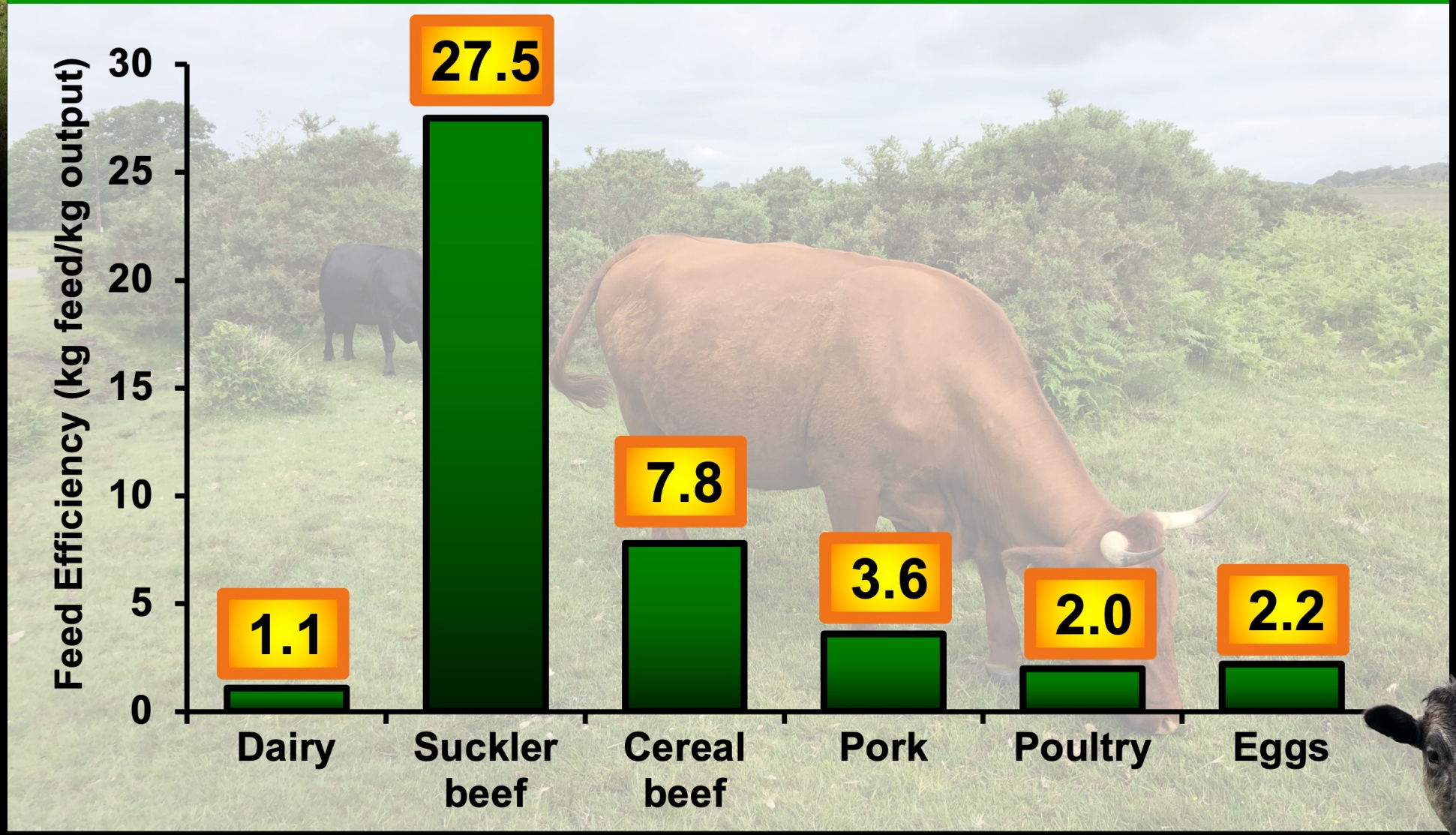
Feed efficiency ratios vary between systems and species



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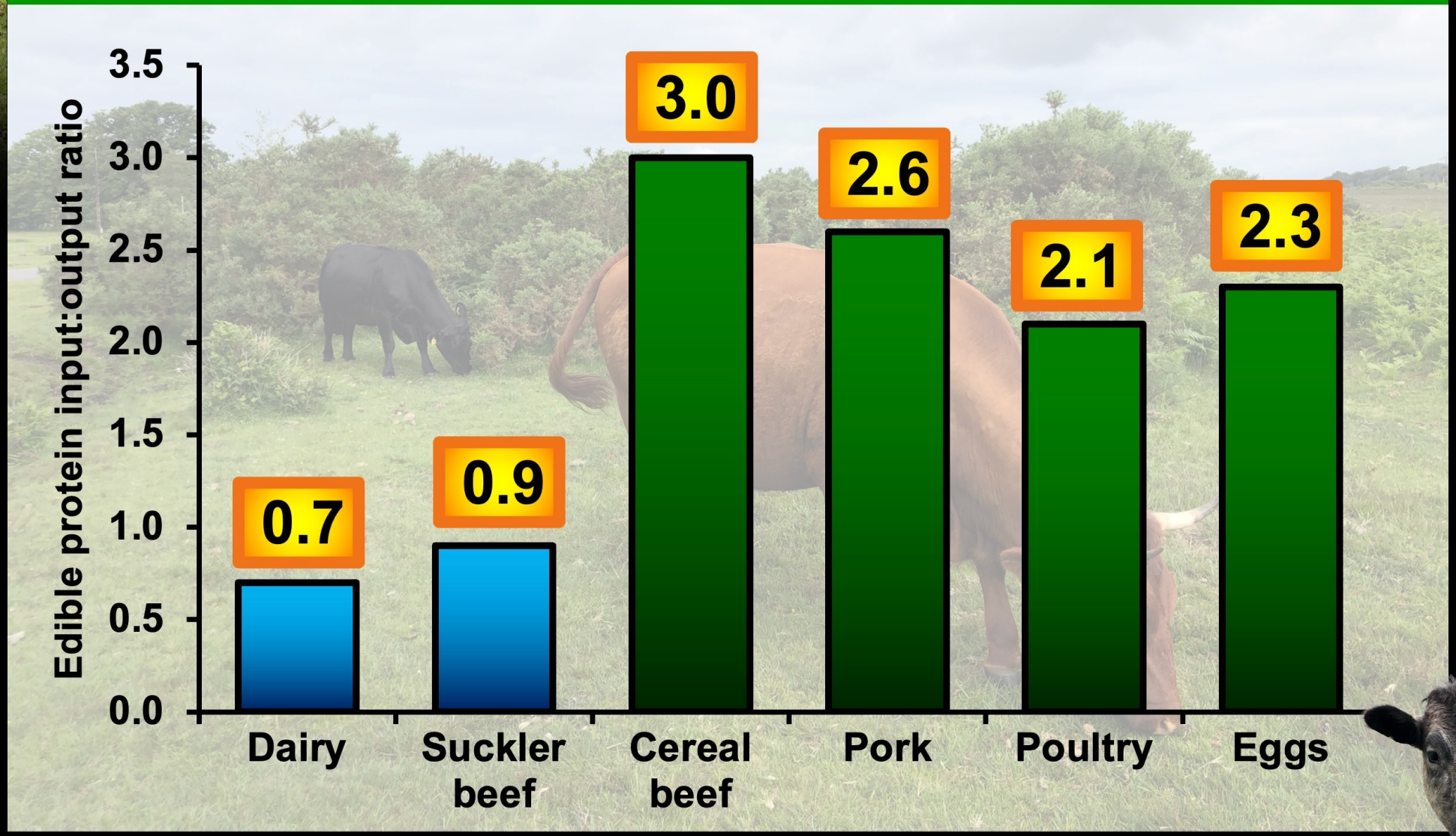
Source: Created by Jude L. Capper, 2023; data from Wilkinson (2011) https://doi.org/10.1017/S175173111100005X

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



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Source: Created by Jude L. Capper, 2023; data from Wilkinson (2011) https://doi.org/10.1017/S175173111100005X

S

Can we grow human food crops everywhere?

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Source: Created by Jude L. Capper, 2023

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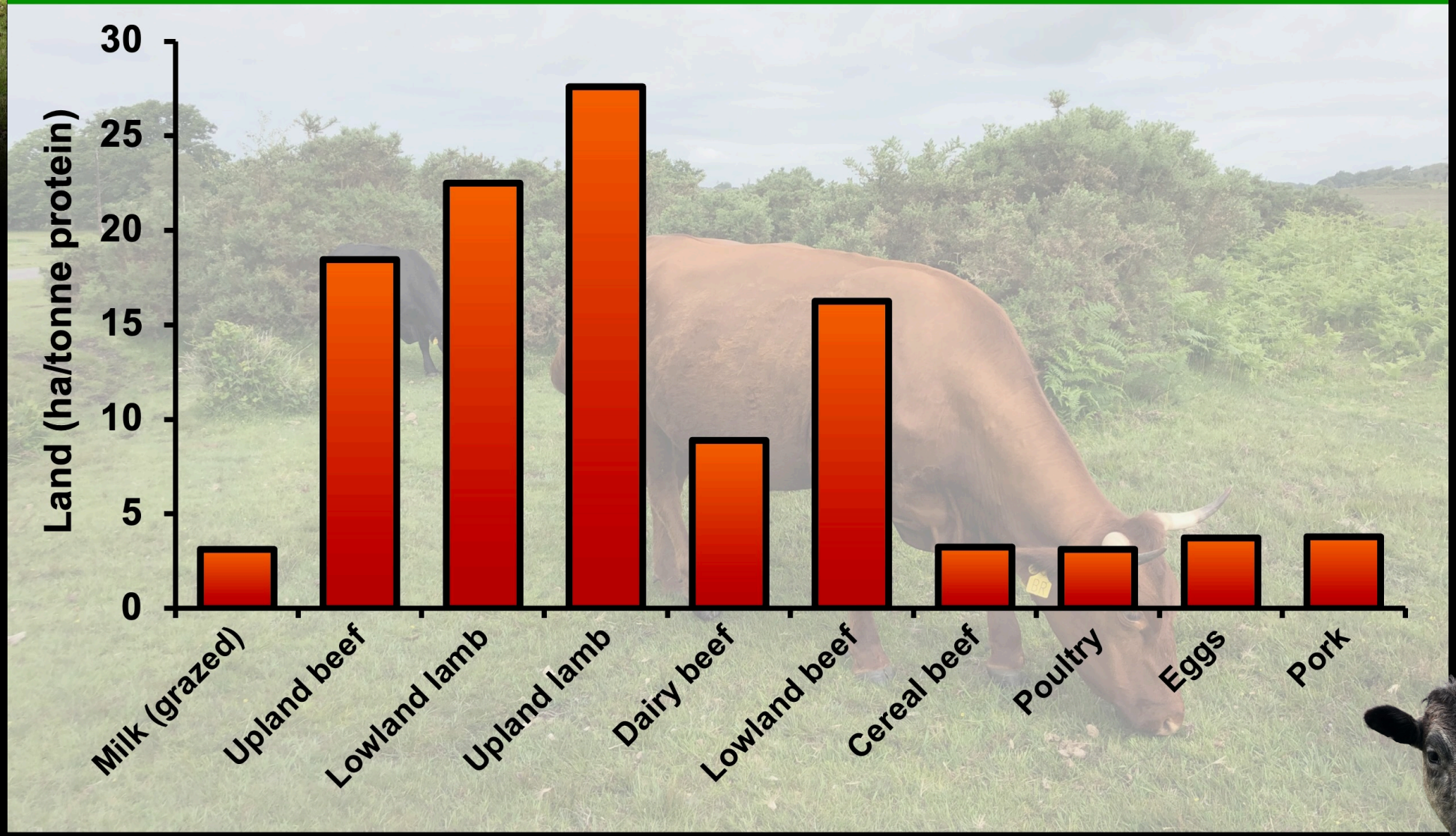
Livestock systems vary widely in land use



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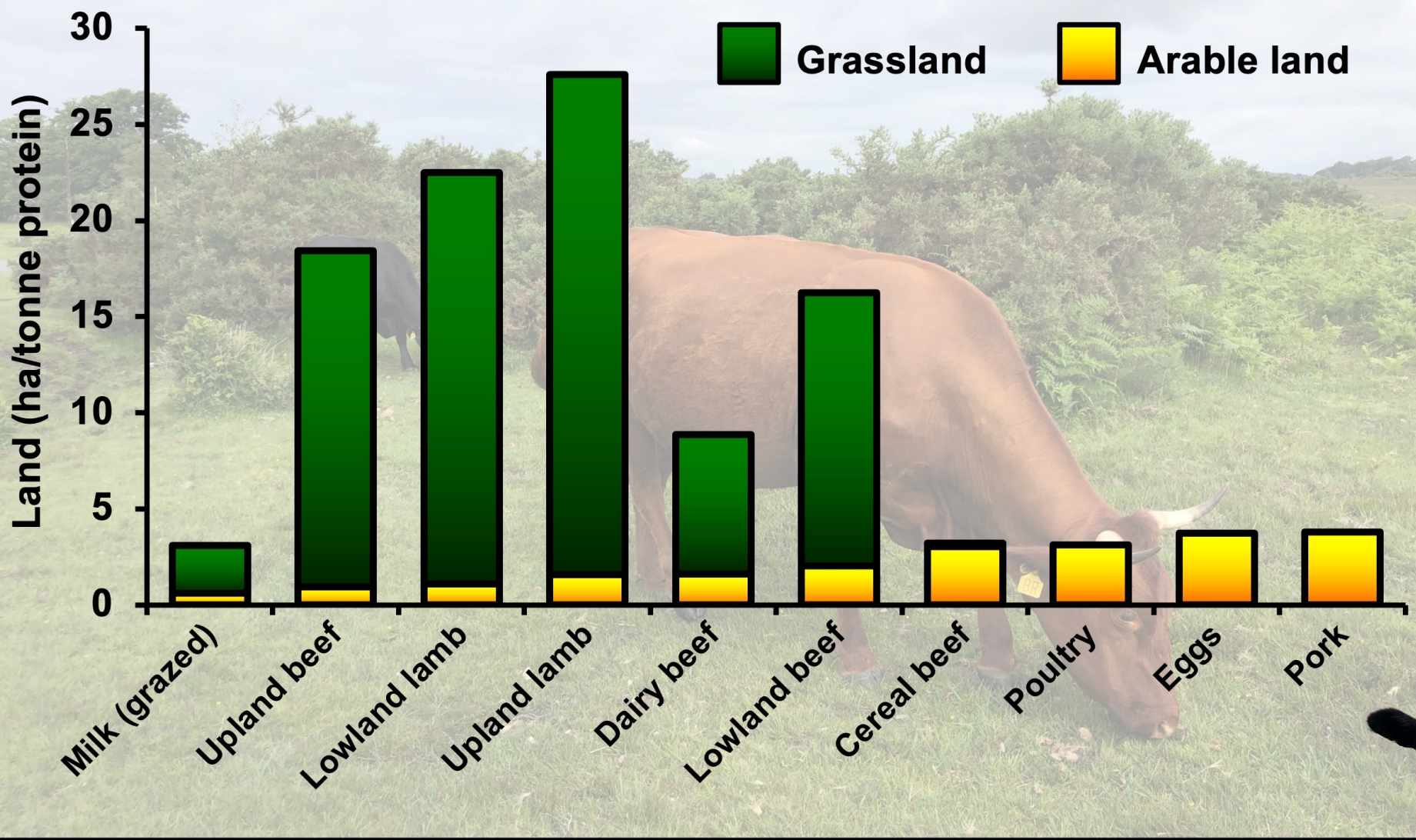
Source: Created by Jude L. Capper, 2023; data from Wilkinson and Lee (2018) https://doi.org/10.1017/S175173111700218X

Livestock systems vary widely in arable and grassland use



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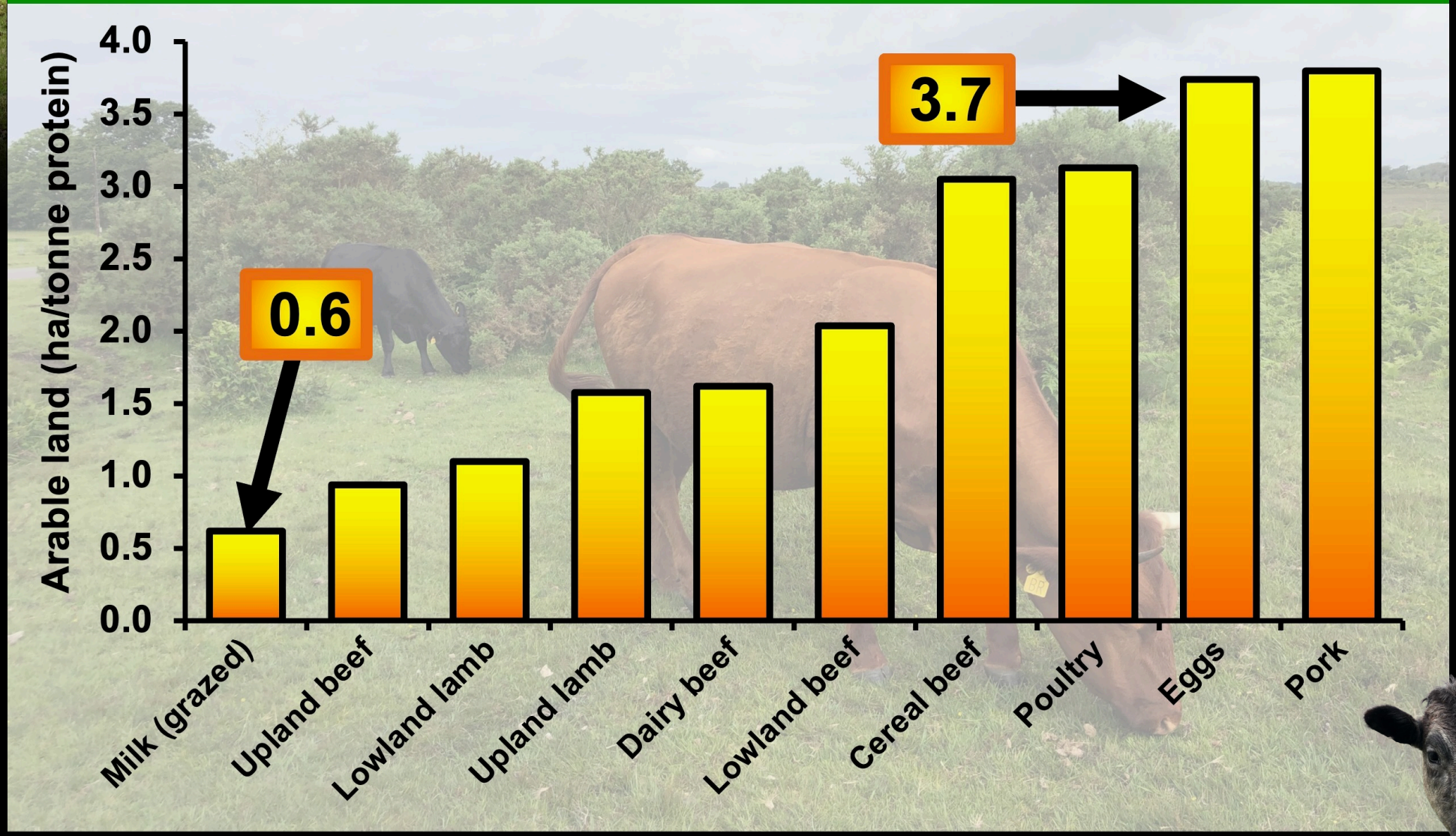
Source: Created by Jude L. Capper, 2023; data from Wilkinson and Lee (2018) https://doi.org/10.1017/S175173111700218X

Livestock systems vary widely in arable land use



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Source: Created by Jude L. Capper, 2023; data from Wilkinson and Lee (2018) https://doi.org/10.1017/S175173111700218X

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Removing cattle from pasture disadvantages ground-nesting birds

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Source: Created by Jude L. Capper, 2023. Photo from Odd Falch https://www.pexels.com/photo/brown-bird-on-brown-grass-12084162/

S

Dung beetles have myriad ecosystem benefits

Source: Created by Jude L. Capper, 2023.

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(Almost) all of our food comes from the soil








Source: Created by Jude L. Capper, 2023.

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Thank you!

JCapper@Harper-Adams.ac.uk

"No more bean dip for me, dear. I'm trying to reduce my carbon footprint."

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Questions?

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