Poultry Welfare and Sustainability

Dr Sarah Lambton

Lecturer in Livestock Welfare and Innovation

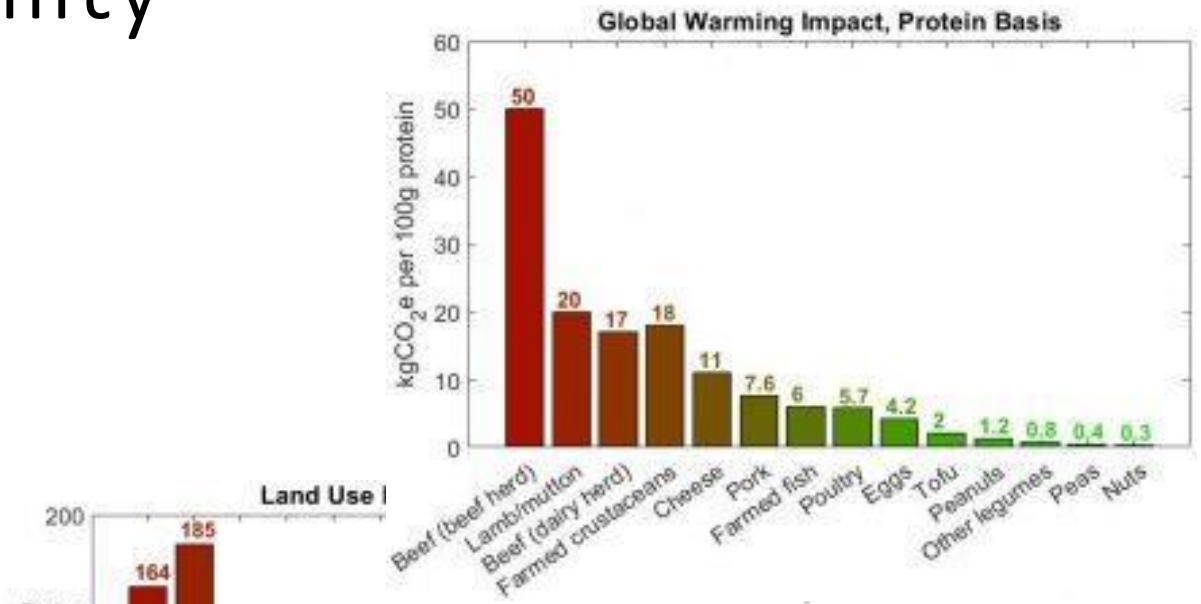
Bristol Veterinary School, University of Bristol

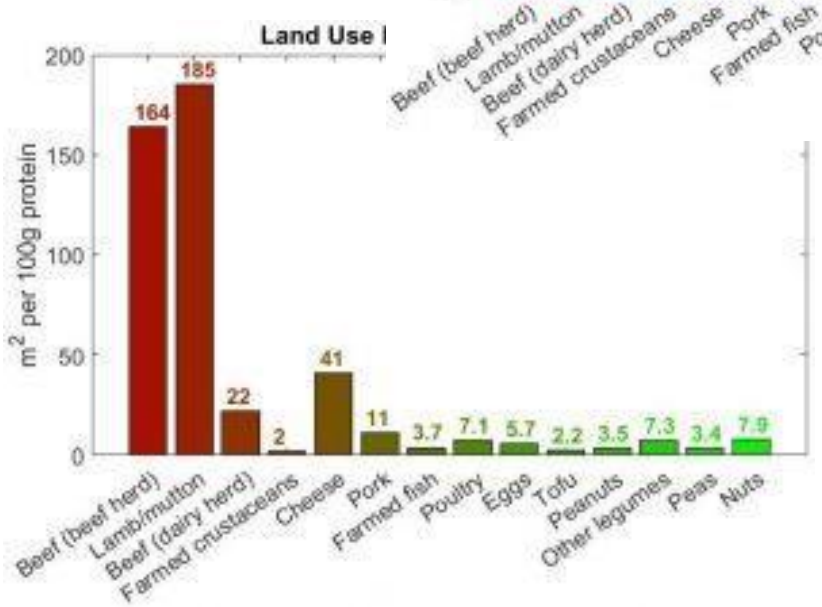
Sustainable development goals

- Poultry farming can have impacts for a number of the sustainable development goals listed
- Sustainable poultry production
  - Combat hunger
- Potential impacts for
  - Climate
  - Life below water
  - Life on land
- *No explicit mention of animal welfare*

Poultry and sustainability

- Production of poultry meat, and eggs has lower environmental burdens than many other farming systems
- Intensive system
- Welfare implications





Animal welfare and sustainability

- Farm Animal Welfare Council report
  - Sustainable agriculture and farm animal welfare 2016
- Animal welfare is integral to sustainable agriculture
  1. Agriculture cannot be considered sustainable if it is achieved at an unacceptable cost to animal welfare.
  2. Sustainable agriculture must take account of the fact that farmed animals are sentient individuals
  3. Sustainable agriculture must include a duty of care for the physical and mental needs and natures of farmed animals, and should not depend on prolonged or routine use of pharmaceuticals, or on mutilations.

Challenge

- Balance farming efficiency, competitiveness, food security, environmental impact, and animal welfare
- Produce more eggs/meat with fewer animals, a smaller carbon footprint, less pollution/waste
- More intensive farming systems
  - ➢ Generally associated with poorer welfare
- Welfare challenges:
  - Higher stocking densities;
  - Higher rates of growth and production;
  - Less opportunities to perform normal/natural behaviour

FAWC
Farm Animal Welfare Committee

Integration of welfare into sustainability assessment

- Simplified animal welfare metric
- Inclusion in LCA models
- Accounting for
  - Life quality
  - Slaughter age
  - Number of animals affected
- A more comprehensive assessment is necessary for this to be meaningful

Int J Life Cycle Assess (2018) 23:1476–1490
https://doi.org/10.1007/s11367-017-1420-x

CrossMark

LIFE CYCLE SUSTAINABILITY ASSESSMENT

Framework for integrating animal welfare into life cycle sustainability assessment

Laura Scherer[1] · Brian Tomasik[2] · Oscar Rueda[3] · Stephan Pfister[4]

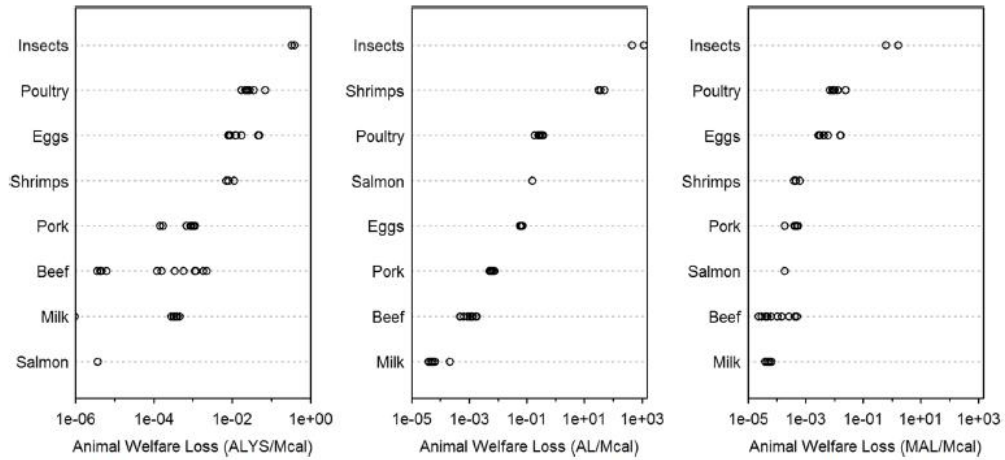


Fig. 1 Animal welfare loss of various food products using three alternative indicators. Different estimates (circles) for the same animal product represent different production systems and/or countries

External pressure

Meat

- Better Chicken Commitment / European broiler ‘ask’
  - >200 food companies across Europe
- Requires those signed up to improve conditions by 2026
  - Lower stocking densities
  - Slower growing birds

Eggs

- Cage-free systems
- Reduce beak-trimming

BETTER CHICKEN COMMITMENT

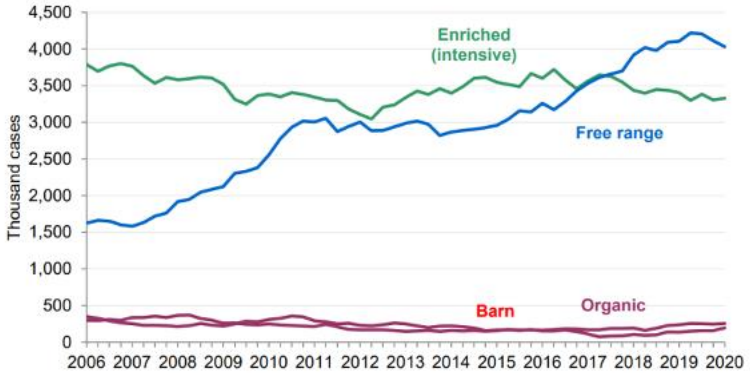
ACCOR HOTELS Feel Welcome · COMPASS GROUP · KraftHeinz

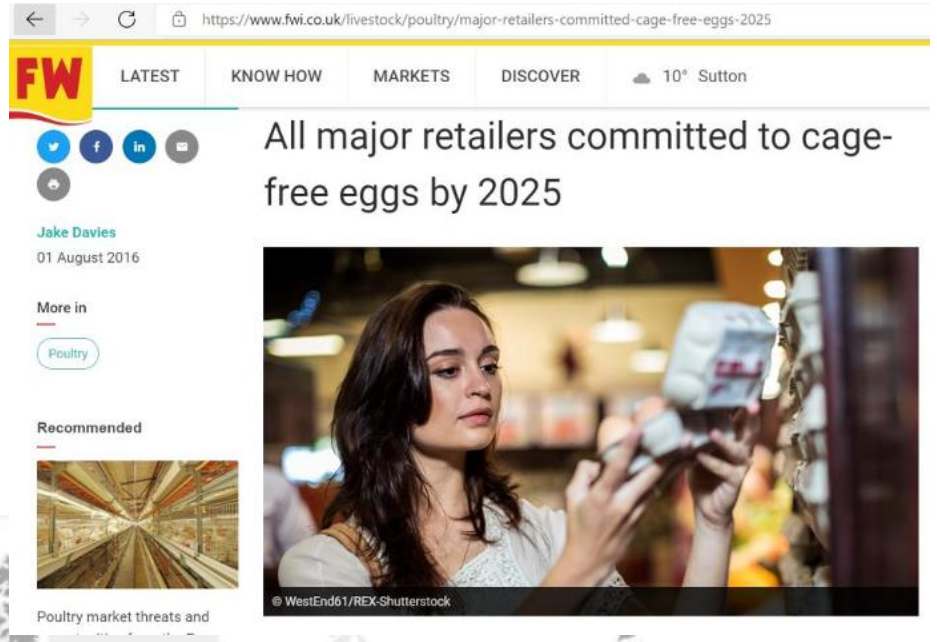
MARKS & SPENCER · Nestlé · KFC

Cage-free eggs?

- Cage-free systems increasing market share in Europe and the west
- Cages are still the dominant system worldwide
- Mollenhurst et al (2006): cage-free aviary systems score better in terms of animal welfare and economics, but worse environmentally

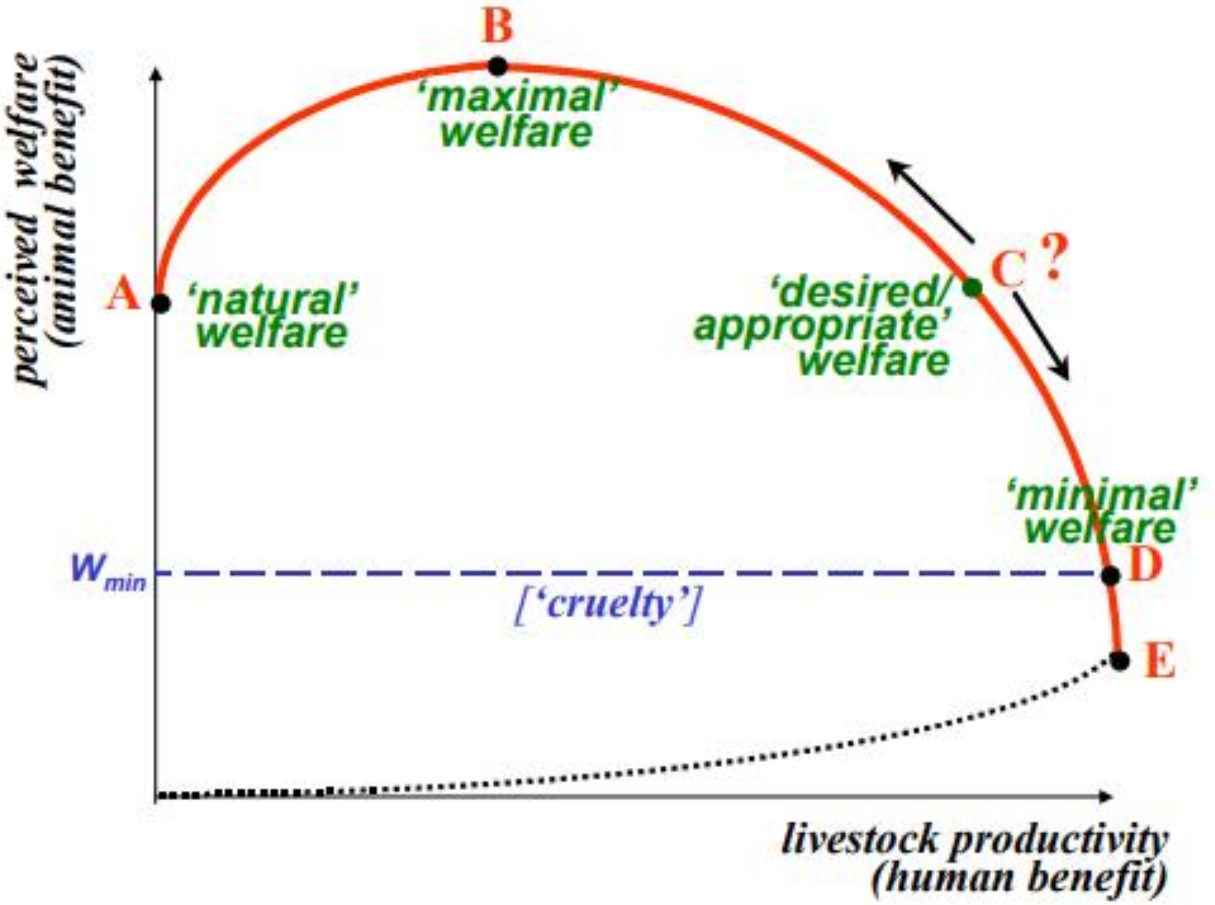
Figure 2: UK egg throughput by production method





Improving sustainability in current systems

- Win-wins for sustainability and welfare
- Improving the health and welfare of poultry can result in improvements in productivity
- Unhealthy animals simply are not as productive
  - Resources are not available for growth/egg production



Comparison of environmental burdens in broiler production systems

- Assumptions…
- Slower growing birds
  - ❖ Take longer to get to slaughter weight
    - ➢ Land occupied longer
    - ➢ More feed and energy consumed
    - ➢ More GHG and nitrogenous emissions
  - ❖ But, are these animals healthier, therefore more productive?
  - ❖ Are some of the negatives offset?

Environmental impacts of broiler production systems

- Free range and conventional systems in the UK modelled
  - LCA
- Free range
  - Higher GWP
  - Eutrophication potential
- Feed the main driver

Predicting the environmental impacts of chicken systems in the United Kingdom through a life cycle assessment: Broiler production systems

I. Leinonen,*[1] A. G. Williams,† J. Wiseman,‡ J. Guy,* and I. Kyriazakis*

2012 Poultry Science 91:8–25
doi:10.3382/ps.2011-01634

Table 7. Global warming potential (1,000 kg of CO_2e, on a 100-yr timescale) for the 3 different systems considered per 1,000 kg of expected edible carcass weight

Material or activity	Standard	Free range	Organic
Feed + water	3.14	3.69	4.08
Electricity	0.16	0.15	0.17
Gas + oil	0.43	0.34	0.31
Housing + land	0.53	0.78	1.03
Manure + bedding	0.14	0.16	0.08
Breeder	0.35	0.33	0.25
Broiler	4.06	4.80	5.41
Total[1]	4.41[b] (0.44)	5.13[ab] (0.52)	5.66[a] (0.62)

[a,b]Different superscripts indicate statistical difference ($P < 0.05$) between systems based only on A uncertainties, which were considered to vary between systems.

Table 8. Eutrophication potential (kg of PO_4 equivalent) for the 3 different systems considered per 1,000 kg of expected edible carcass weight

Material or activity	Standard	Free range	Organic
Feed + water	10.53	11.81	33.62
Electricity	0.00	0.00	0.00
Gas + oil	0.04	0.03	0.03
Housing + land	1.04	2.16	3.48
Manure + bedding	8.71	10.27	11.69
Breeder	1.67	1.61	1.16
Broiler	18.64	22.66	47.66
Total[1]	20.31[b] (2.12)	24.26[b] (2.51)	48.82[a] (6.69)

[a,b]Different superscripts indicate statistical difference ($P < 0.05$) between systems only based on A uncertainties, which were considered to vary between systems.

Slower growing broilers are healthier

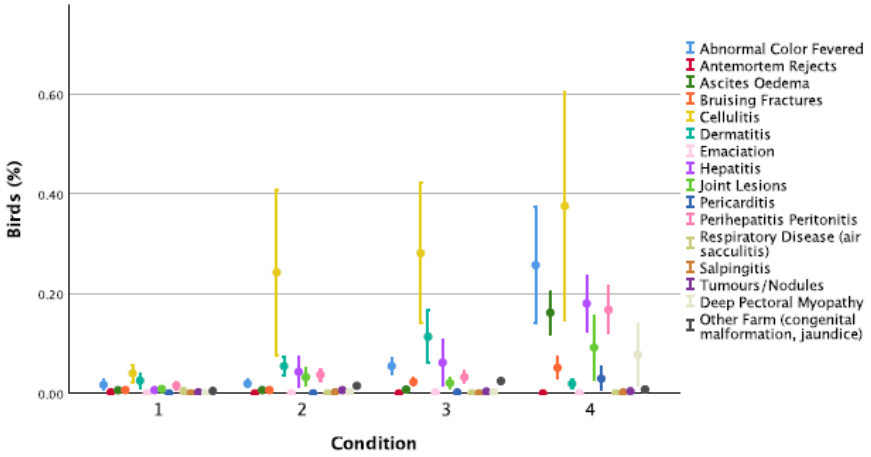


Figure 1. Mean percentage (±SE) Post-mortem Inspection Rejection reasons across Condition (n = 4 production cycles). Figure created in IBM SPSS version 25 (https://www.ibm.com/analytics/spss-statistics-software).

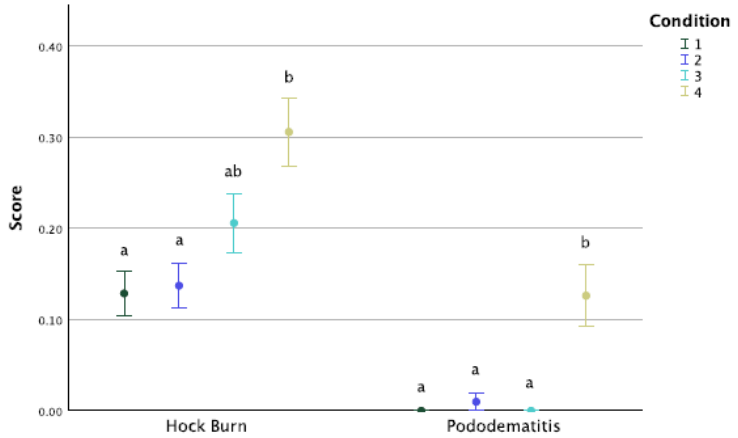


Figure 3. Mean (±SE) Hock Burn and Pododermatitis score (ranging from 0, no evidence of lesion, to 4, severe lesions) by Condition (n = 202, n = 204, n = 204, n = 206 birds scored in Conditions 1–4, respectively) 2d before processing of Production Cycles 3 and 4. Different letters indicate differences in score distribution within each variable, between conditions as identified by pairwise comparisons of medians using Dunn's[52] procedure ($p < 0.0083$). Figure created in IBM SPSS version 25 (https://www.ibm.com/analytics/spss-statistics-software).

- Comparison of slow growing breeds at lower stocking densities with conventional breeds at standard stocking density
- Slower growing breeds were healthier
- Total post mortem rejections more than 9x higher in conventional system
- How much does this mitigate the increased burdens of keeping hens longer?

SCIENTIFIC REPORTS
nature research
Check for updates
OPEN

Slow-growing broilers are healthier and express more behavioural indicators of positive welfare

Ann C. Rayner[1,2✉], Ruth C. Newberry[3], Judit Vas[3] & Siobhan Mullan[2]

Broiler lameness

- Lameness linked with productivity
- Lame birds more likely to be culled/condemned at slaughter (Granquist et al, 2019)
- Decreased slaughter weight and increased mortality
- Difficulties reaching food and water
- Solution:
  - Reduce stocking density
  - Improve litter quality

Win-win:

- Reduce lameness
  - ➢ Increased productivity
- Better litter management
- Feed additives?
  - ➢ Decreased eutrophication potential

Comparison of environmental burdens in laying hen production systems

- Assumptions….
- Free range systems
  - ❖Fewer animals, and therefore egg output, per unit land area
  - ❖Escape of more nitrogenous emissions
  - ❖Higher mortality, more wastage?
- But what of barn or wintergarden systems?

Figure 1: Layout of the Rondeel™

System comparison

- Cage, barn, free range, and organic systems modelled
  - LCA
- Little difference in GWP
  - Barn and free range higher than cage, but NS
- Barn and free range higher eutrophication potential
- Again, feed the main driver

Predicting the environmental impacts of chicken systems in the United Kingdom through a life cycle assessment: Egg production systems

I. Leinonen,*[1] A. G. Williams,† J. Wiseman,‡ J. Guy,* and I. Kyriazakis*

2012 Poultry Science 91:26–40
doi:10.3382/ps.2011-01635

Table 7. Global warming potential (1,000 kg of CO_2, 100-yr timescale) for the 4 different systems considered per 1,000 kg of eggs[1]

Material or activity	Cage	Barn	Free range	Organic
Feed + water	2.10	2.22	2.36	2.41
Electricity	0.24	0.48	0.20	0.24
Gas + oil	0.09	0.14	0.18	0.18
Housing + land	0.38	0.48	0.50	0.54
Manure + bedding	0.11	0.13	0.14	0.06
Breeder	0.05	0.04	0.03	0.04
Pullet	0.51	0.55	0.57	0.60
Layer	2.36	2.86	2.78	2.78
Total	2.92^{c} (0.21)	3.45^{b} (0.26)	3.38^{abc} (0.27)	3.42^{ab} (0.34)

[a–c]Different superscripts indicate statistical difference ($P < 0.05$) between systems as based only on A uncertainties, which were considered to vary between systems.

[1]The SD (in parentheses) were based on A and B uncertainties. The B uncertainties were considered to be similar between the systems.

Table 8. Eutrophication potential (kg of PO_4 equivalent) for the 4 different systems considered per 1,000 kg of eggs[1]

Material or activity	Cage	Barn	Free range	Organic
Feed + water	7.80	8.23	8.76	21.90
Electricity	0.00	0.00	0.00	0.00
Gas + oil	0.01	0.01	0.02	0.02
Housing + land	3.43	3.83	4.20	4.84
Manure + bedding	7.23	8.24	9.05	10.84
Breeder	0.29	0.21	0.21	0.22
Pullet	2.67	2.62	2.68	7.63
Layer	15.51	17.49	19.13	29.76
Total	18.47^{c} (1.57)	20.32^{b} (1.78)	22.03^{b} (2.01)	37.61^{a} (4.21)

[a–c]Different superscripts indicate statistical difference ($P < 0.05$) between systems as based only on A uncertainties, which were considered to vary between systems.

Mitigation

- Within the high welfare system there are win-wins
- Mortality
- Injurious pecking
- Keel damage?

Mortality in cage-free systems

- High mortality means more chicks have to be placed for the same number of eggs
- Weeks et al. 2016 found predicted cumulative mortality was >4x higher in free range systems, and much more variable
- Improved with better understanding!

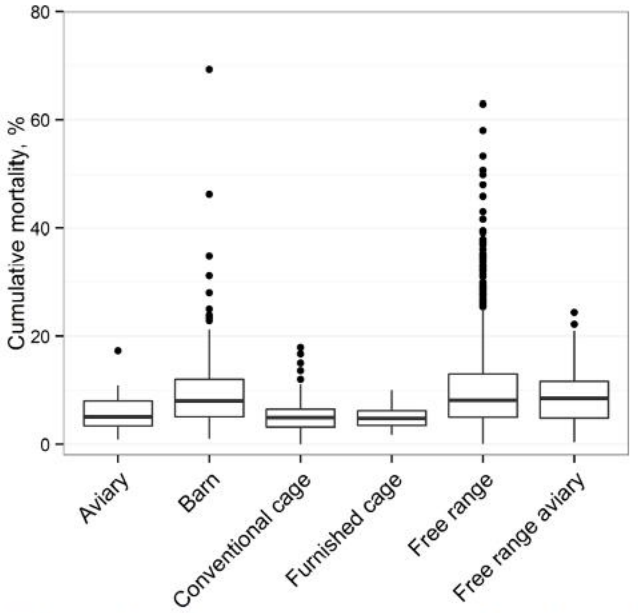


Fig 1. Box plots for mortality in each housing system between 60 and 80 weeks of age using the full data set from 10 studies (3,851 flocks).

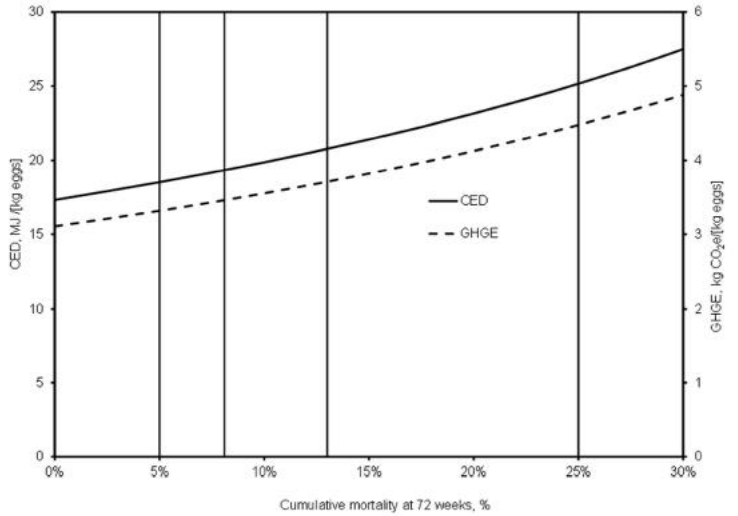
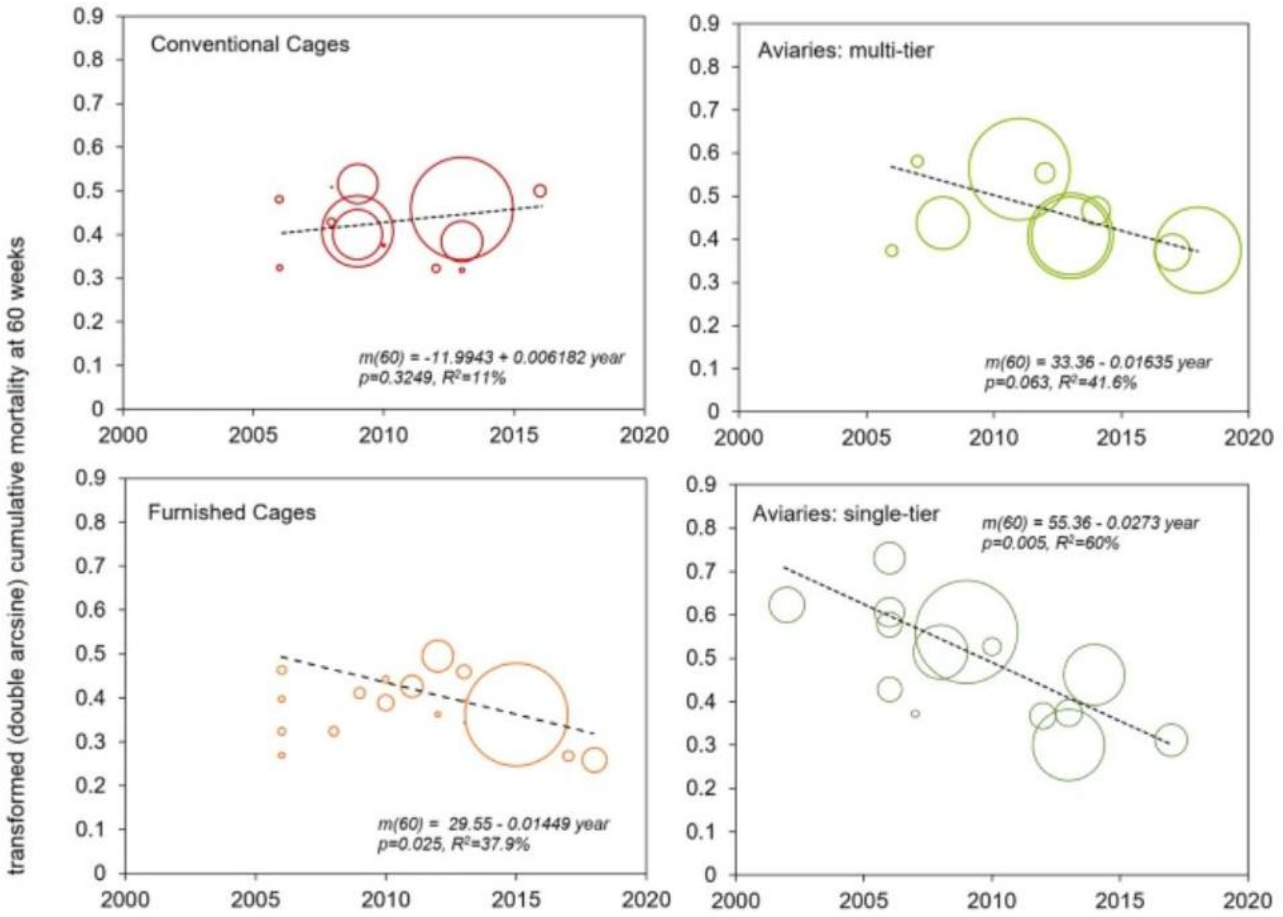


Fig 4. Effects of increasing levels of cumulative mortality at 72 weeks on cumulative energy demanc (CED) and greenhouse gas emissions (GHGE) for free range egg production. Levels of up to 30% are

Mortality

- Schuck-Paim et al, 2021
  - Meta-analysis of mortality of da countries
  - Differences in mortality reduce



Injurious pecking

- Associated with:
  - Increased mortality
  - Decreased productivity
  - Increased FCR
- Win-win:
  - Reduction in injurious pecking should result in decreased environmental burdens
  - Feeding insect protein?
    - Microbiome?
  - Range cultivation?

Keel damage

- Painful
- Reluctance to access resources such as feed and water
- Increased FCR
- Reducing keel damage could reduce environmental burdens

Production of male chicks

- Hatching male chicks
  - Impact on resource use?
- Identifying males before incubation & hatch could improve both

The future…

- So, there is hope!
- Work within the systems we have, as well as trying to understand differences in the sustainability of different systems
- Interactions between improving welfare challenges and decreasing environmental burdens
- **Alternative protein sources!**
- Welfare of the insects?