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Strategic Programme

‘Livestock & Climate Change: implications for animal health’

Philip J Skuce

Moredun Research Institute

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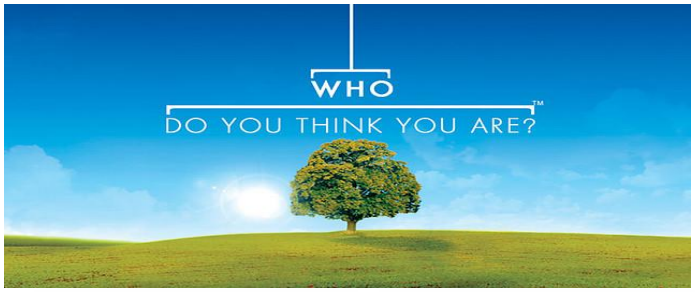
Michael Cooper, CAP Director, and I met on the internet!…

Despite appearances, it turns out, we're related!…we share a Great-Uncle…

Lance Corporal William Valentine Cooper, DCM



- Served in Royal Irish Constabulary (RIC), volunteered for 1st Battalion, Irish Guards in WW1, May 1917

- Received Distinguished Conduct Medal (DCM) on 27th August, for "conspicuous gallantry and devotion to duty"

- Killed in action, on 9th October, 1917 at Passchendaele in Flanders, aged 23

- Buried in Poelkapelle British Cemetery, nr Ypres, Belgium

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The importance of livestock & livestock farming

Globally:

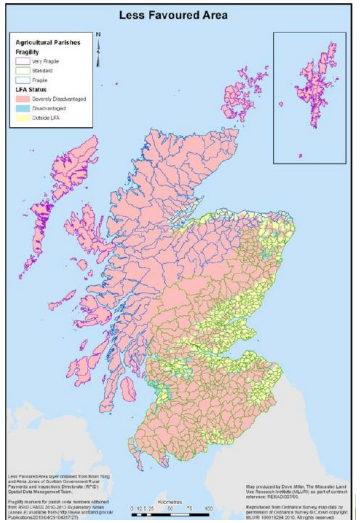
- Accounts for 70% of agricultural land, and 30% of the ice-free land surface of the planet
- Produces 40% of global agricultural GDP
- Employs 1.3bn people worldwide & creates livelihoods for 1bn of the world's poor

Locally:

- ~85% Scottish landscape classified as Less Favoured Area (LFA) – most suitable for grazing livestock

- 500,000 beef cattle
- 2.7M breeding sheep
- 200,000 dairy cows
- 38,000 breeding pigs

= £1.25 billion p.a. to Scottish economy



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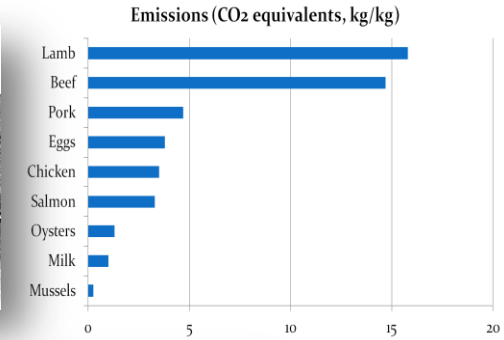
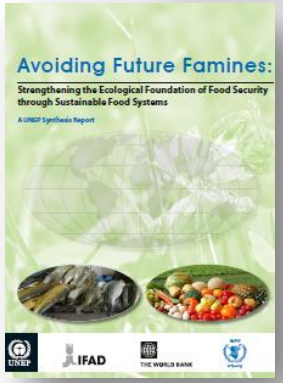
Policy context

- Livestock seen as major contributor to global environmental problems – estimated to contribute 18% of global GHGs; 8% of UK's
- Agriculture's legal obligations under SG Climate Change Act (2009) – reduce Carbon footprint of livestock farming
- Increasing global demand for food, inc. livestock products, meat & dairy – Food Security agenda, 'Feeding the 9 Billion' etc.
- Will require increased biological efficiency of livestock production and reduced waste in the system, so-called "Sustainable intensification"





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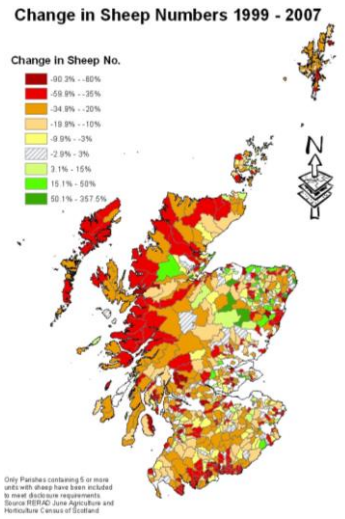
CAP reform and the livestock sector

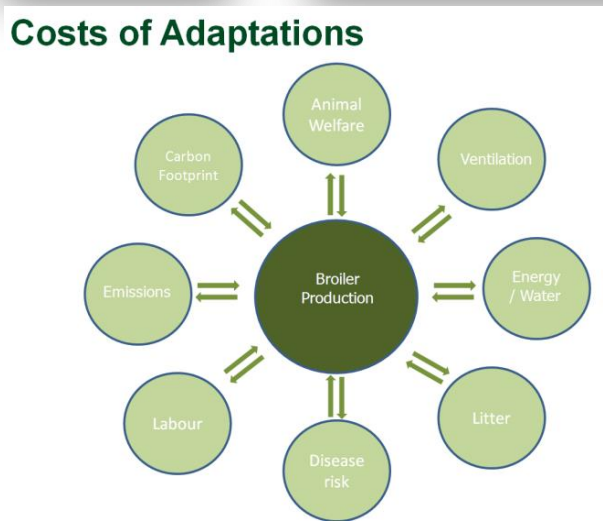
- Previous CAP reform significantly affected livestock numbers esp. sheep (e.g. down by 60% or abandoned; 'Farming's retreat from the Hills', 2008)
- Change in farm structure – fewer full-time staff, larger areas to cover etc. – implications for animal health & welfare (+/-)
- CAP 'pot' – Land Management Options (LMOs) – incentivise animal health plans & support for improved welfare
- New CAP: PILLAR 1 - changes in direct payments from production-based to land area-based likely to drive towards extensification *cf* intensification?

  e.g. payments for LFA sheep > lowland sheep & cattle? Scotland, like UK, very heterogeneous - difficult to predict outcomes
- PILLAR 2 – in Scotland, SRDP, voluntary but with financial incentives. 2014-2020 update still under discussion



‘Direct’ effects of Climate Change on Livestock

- Intensive production – pigs & poultry - cold stress/heat stress/extreme events, housing, ventilation, cooling, insulation, location
- Extensive production – sheep & cattle - cold stress/heat stress/extreme events e.g. flooding
- Animal transport – as above + journey strategies, vehicle design and operation, legislative framework
- Modeling impacts of appropriate scenarios on AH&W
- Identify and model efficacy and costs/benefits of appropriate adaptations available to producers/industry



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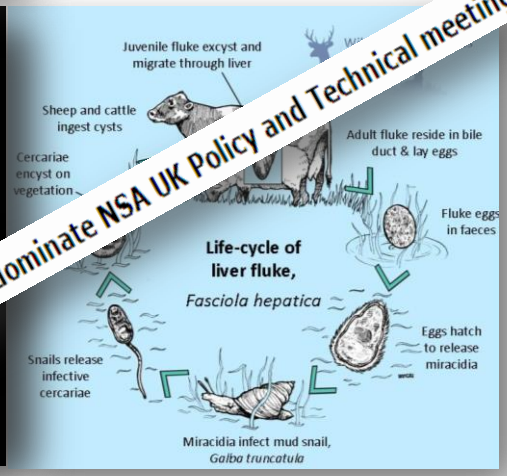
‘Indirect’ effects of Climate Change on Livestock – Animal health

- Have seen significant changes in weather patterns/climate in Scotland over past ~100 years
  - Increasing temperature (ave., max., min)
  - Increasing rainfall, more extreme events
  - Reduced groundfrost days
  - Longer growing/grazing season

- Incursion of ‘exotic’ vector-borne pathogens into UK e.g., Bluetongue virus, Schmallenberg virus; increased incidence of tick-borne diseases etc.

- Changes also have significant impact on ‘endemic’ disease; exemplified by parasitic worms e.g. liver fluke

  - spend much of their life-cycles outside the host on pasture, affected by temp, rainfall, evapotranspiration, UV etc…



Fluke and CAP reform dominate NSA UK Policy and Technical meeting.

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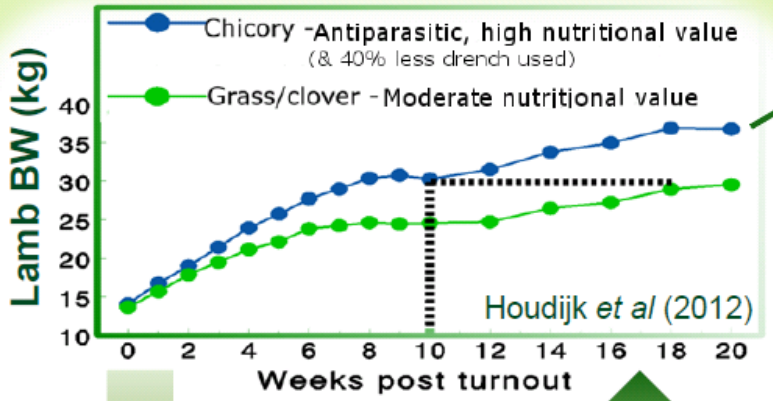


Parasites increase time spent on farm

→ Increases overall emissions

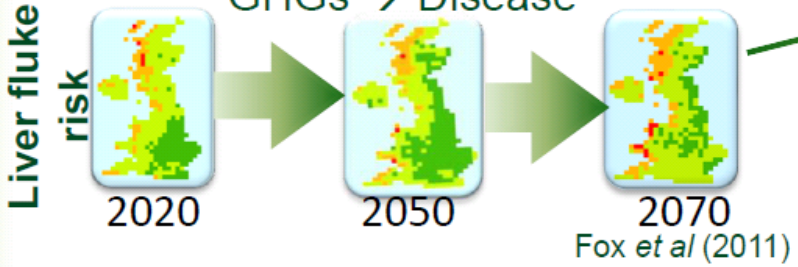
→ Accelerates climate change

GHG emissions & productivity are quantified using climate chambers and field studies

Disease → GHGs

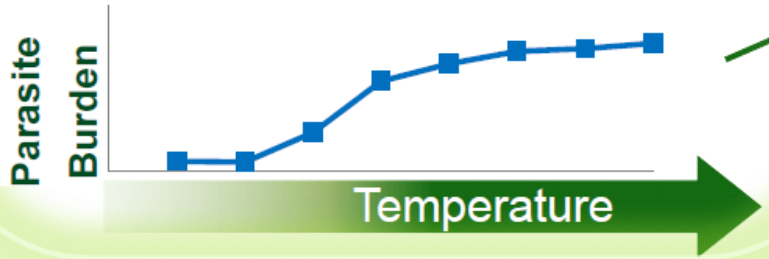
Breaking the cycle requires sustainable disease control……

GHGs → Disease



Our predictive models show climate change increases disease risk (e.g. liver fluke)

→ Decreases productivity and increases GHGs



Our process based parasite models predict climate change (CC) could lead to tipping points in parasite risk

CC→ Disease → Increased GHGs → CC

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Sustainable disease control - reducing the burden of endemic, production-limiting disease

Practical disease solutions:

Diagnostic tests e.g.

- BVDV – routine use
- CLA – on market
- Liver fluke – under evaluation
- Johne's Disease – in development

Vaccines e.g.

- *Toxoplasma* – routine use
- *Chlamydia* – in development
- CLA – in development
- *Haemonchus* – near market

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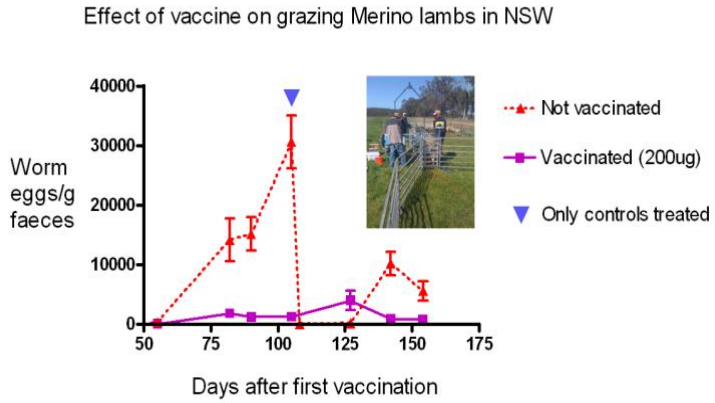
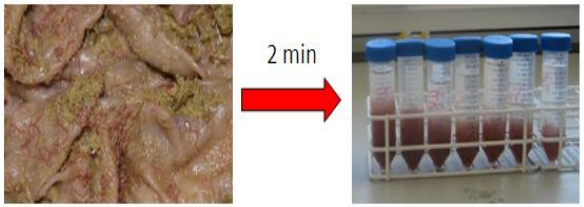
Sustainable disease control – a vaccine for *Haemonchus*?

- Most important GI nematode in the world; scourge of livestock industry in S. Hemisphere
- Vaccine derived from the parasite's own gut proteins , 'Trojan Horse' principle
- 'Nemesys' machine for rapid recovery of adult *Haemonchus* on the line at an abattoir
- One person can purify ~1.5 million doses (@2μg) of vaccine in <2 weeks
- This represents the first vaccine for any gut worm in any host, including man!



Trialled in calves, grazing lambs & goats in S. Africa, Australia & Brazil



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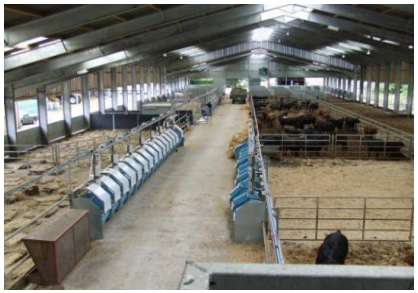
Livestock & GHGs

- Generating baseline data on UK animal types in UK systems on UK diets – evaluate mitigation measures
- DEFRA & Devolved Administrations - UK Agricultural GHG platform project (£12m) - measuring GHGs:

  - SRUC GreenCow facility – ~250 individual animal measurements; climate chambers for cattle & sheep – investigate effect of breed, diet, health status etc. – big KTE event there tomorrow!

  - Grazing animals (lowland & hill) – large scale field experiments - alternative methods for measuring/modelling CH_4
- Improved understanding of rumen micro-organisms (with Rowett Institute, Aberdeen) and CH_4 outputs linked to animal/grazing behaviour e.g. 'RoboCow'
- Mitigation options – breeding improvements & dietary change, also new grant from EBLEX investigating dietary additives that reduce CH_4



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Livestock health & GHGs

- Field Study, 2005-present; Monitoring performance of fattening lambs under 4 different anthelmintic (drug) treatment regimes:

- Preferred option - Targeted selective treatment **(TST)** – based on calculated need to treat (using electronic weighcrate/EID system)…

✓ Use less drug (~50%)
✓ Maintain productivity
✓ Finish animals earlier
✓ Preserve drug efficacy

- Used an IPCC-compliant model to calculate GHGs associated with respective treatment groups:

'Clinical signs' (MT) group had ~10% higher GHG per unit LWG than all other groups, mainly due to reduced % reaching target market weight by end of experiment

- Effective disease control can help reduced GHG emissions

Table 1. Percentage lambs reaching target weight (38kg)

Treatment	2006	2007	2008	2009	2010	Overall Treatment
MT	12.5	16.7	3.1	25.0	60.0	23.6***
NST	62.5	43.7	21.9	40.0	82.5	51.4
SPT	33.3	33.3	32.3	50.0	70.0	43.5
TST	36.2	33.3	28.1	45.0	80.0	44.4

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Conclusions

- Changes in EU farming practices as a result of CAP reform will have implications for livestock health & welfare - always have in the past, often with unforeseen consequences
- Allied to changes brought about as direct/indirect effect of climate change itself
- Need improved disease surveillance and forecasting, coupled with sustainable disease control strategies
- The carbon footprint of livestock farming can be reduced through effective control of production-limiting disease – EIDs/TST/GHG - move towards 'Precision Livestock Farming'
- Animal health and welfare implications need to be taken into consideration in developing agricultural and land-use policy designed to mitigate climate change e.g. Environmentally Sensitive Areas (ESAs)

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Acknowledgements

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MRP colleagues

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