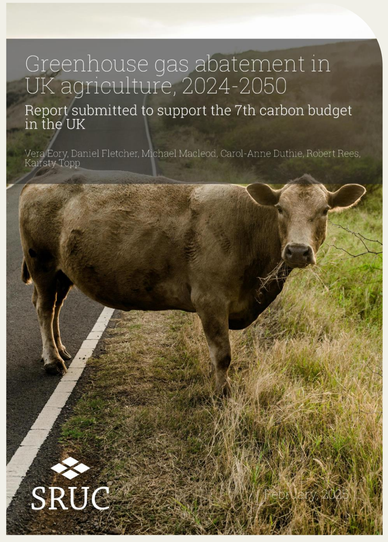
Environmental Trade-offs in UK Beef Production

Methane and Agriculture

- ✓ Methane is a short-lived climate pollutant which will not accumulate in the atmosphere over longer periods of time (>20 years). Therefore, 0.3% reduction of methane emissions per year will result in no further warming from it. Reductions further than that will result in a relative cooling effect, which can be used as a lever to reduce global warming.
- ✓ Ruminants in agriculture are one of the main sources of anthropogenic methane. The UK beef sector is facing mounting pressure to reduce GHG emissions.
- ✓ CCC's 7th carbon budget projection for agriculture is based on the adoption of 61 abatement strategies produced by SRUC.
- ✓ A key abatement strategy is improved nutrition and faster finishing for cattle. It indicates a potential in reducing emissions from beef farming by approximately 0.7 $MtCO_2eq$ (approximately 4%) by 2050.
- ✓ Faster finishing of cattle reduces methane emissions through reduced lifespan.
- ✓ However, in some scenarios, this results an increase of emissions of CO_2 and N_2O (Long-lived GHGs).
- ✓ This project explores the trade-offs inherent in such changes from a temperature response perspective.



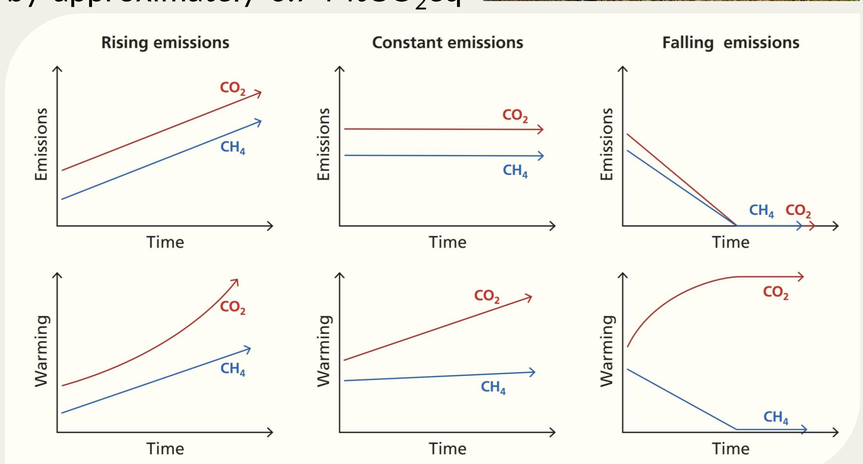


Figure 1: Illustration of how temperature responds to long-lived (CO_2) and short-lived (methane) greenhouse gases (Adapted from Allen, M., et al., (2022). Climate metrics for ruminant livestock.)

Preliminary Results

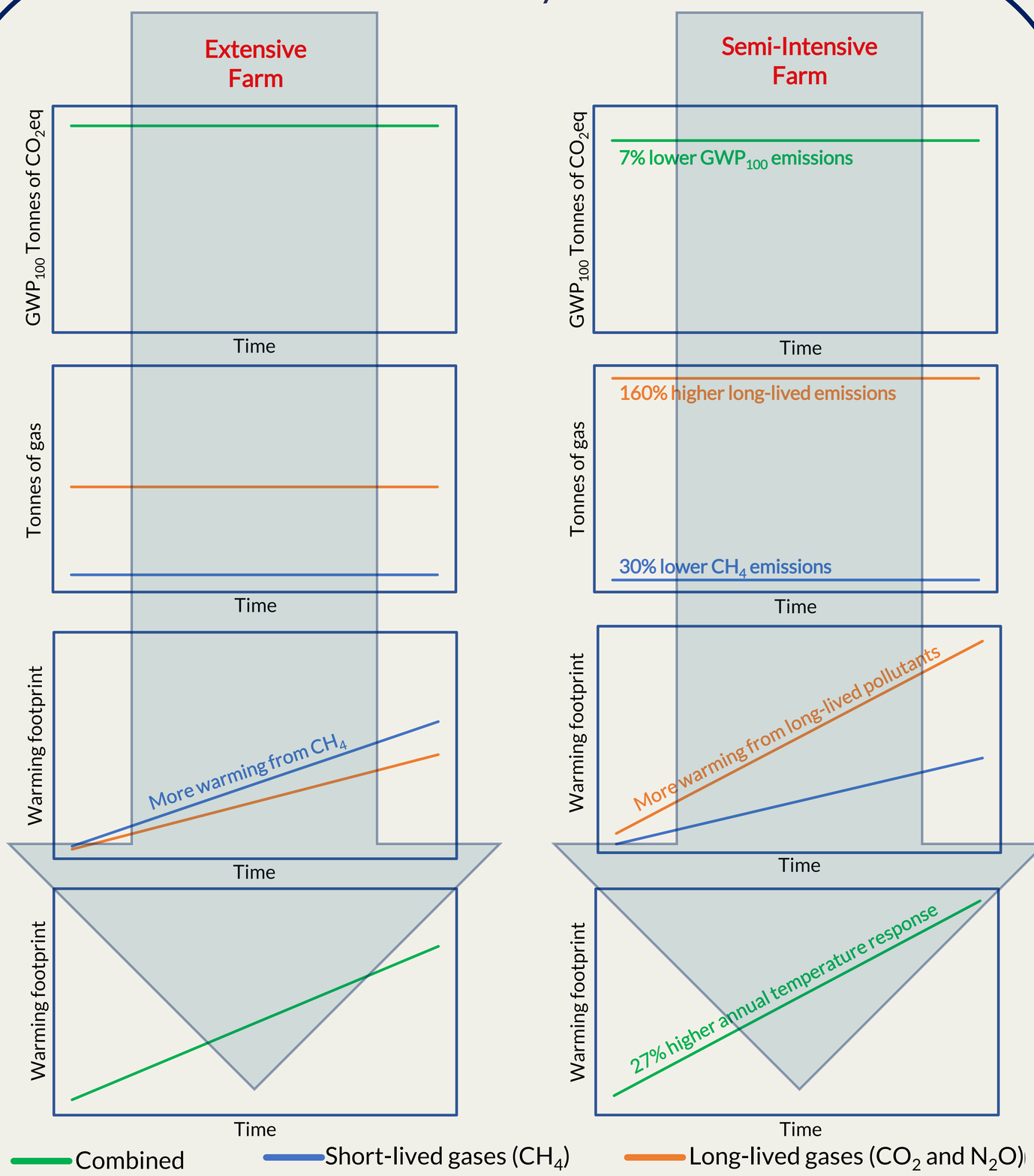


Figure 2: Comparison of greenhouse gas emissions and warming from two farms (extensive and semi-intensive) which produce the same amount of beef. Emissions have been calculated using Agrecalc Cloud. AR6 conversion factors were used for conversion from CO_2eq to tonnes of gases. The warming footprints shown are based on cumulative warming-equivalent emissions calculated using GWP* and IPCC AR6 TCRE (The Transient Climate Response to Cumulative CO_2 Emissions) values. Systems are compared in a constant state.

Beef Production Systems

Extensive

- ➢ Grazing outdoors to the maximum extent.
- ➢ Minimal use of non-forage feeds.
- ➢ Slaughter age: between 20 to 24 month
- ➢ Methane is by far the dominant GHG in these systems.

Semi-Intensive

- ➢ More often housed.
- ➢ Increased use of concentrates/hard feeds.
- ➢ Slaughter age: between 16 to 20 months
- ➢ CO_2 and N_2O from fertilisers and concentrate/hard feed production are far more significant in these systems.

What is the potential cost of reducing methane?

Reducing methane emissions through faster finishing/improved nutrition can considerably reduce methane emissions. However, in some cases, the trade-off can be a hefty increase in long-lived climate pollutants (CO_2 and N_2O). In the example shown in this poster, methane emissions were 30% lower in the more intensive system, but the emissions of long-lived climate pollutants were 160% higher. Over time, the long-lived GHGs will accumulate in the atmosphere and continue to cause warming.

In other words, transition from an extensive system to an intensive one will induce a relative cooling effect by reducing methane emissions; but over time, the long-lived gases will override this effect.

Authors
Amirali Zolghadri[1], Andrew Loftus[2], and Michelle Cain[1]
1. Cranfield University
2. Loftus Farms
Correspondence
michelle.cain@cranfield.ac.uk

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