Estimated Suckler Beef Climate Scheme implications for cattle numbers

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Andrew Moxey (Pareto Consulting)

and

Steven Thomson (SRUC)

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Key Points

- Emissions registered against beef production in the Scottish 'Smart' National Inventory could be eliminated by eliminating all Scottish beef production
- However, this would forgo the benefits of domestic beef production and (assuming unchanged consumption patterns) could simply change which countries' National Inventory beef emissions are registered within without necessarily reducing global emission levels
- Actions proposed under the Suckler Beef Climate Scheme seek to balance domestic production benefits with the need to reduce emissions to meet both local Inventory targets and global aspirations
- Nonetheless, registering the effects of some actions in the National Inventory does imply reductions in the size of the national suckler herd in terms of cows and replacement heifers
- Achieving upper-bound mitigation potential through improved calving and on-farm mortality rates implies culling c.111k unproductive cows and c.37k replacement heifers
- Similarly, achieving upper-bound mitigation potential through lowering the age of first calving for replacement heifers implies reducing total replacement heifer numbers (split across multiple year-cohorts) by between c.33k (if unproductive cows have already been culled) and c.47k (if not)
- However, due to the biological nature of production and other constraints, upper-bound technical potentials are unattainable in practice
- 50% of the overall upper-bound potential could be achieved through different combinations of individual mitigation actions. Hence, depending on the combination considered, estimated reductions in the national beef herd range between 0 and c.181k.
- Herd reductions in excess of c.181k would deliver additional registered emission savings, but would also result in lower beef production levels and hence lower associated benefits
- All estimated effects are first approximations, based on incomplete data and a number of assumptions, and should be treated as indicative rather than definitive guides to impacts
- Additional savings may also arise from actions not considered explicitly here, including as-yet undiscovered innovations and improved pasture management.

Contents

Introduction

1. Mitigation of emissions associated with Scottish beef production can be attempted in a number of ways. One solution would be cessation of some or all beef production, eliminating some or all beef cattle and thereby eliminating some or all beef-related emissions. However, this would be highly disruptive to domestic patterns of resource usage and the livelihoods, communities and semi-natural habitats associated with current production levels.

2. Moreover, the net effect on overall beef emissions would almost certainly be reduced by consumers – whether in Scotland or elsewhere – switching to beef sourced from outwith Scotland. Hence, whilst domestic cessation of some or all beef production would help to attain local emission reduction targets, it would actually merely shunt registered beef emissions between different National Inventories without necessarily reducing UK or global emissions.

3. The proposed Suckler Beef Climate Scheme seeks to mitigate beef emissions more subtly than by simply reducing Scottish beef production levels by some arbitrary amount. This recognises the need to balance competing policy objectives, but also the limitations of focusing solely on domestic emissions. Hence the Scheme offers a range of mitigation actions intended to lower the emission-intensity of Scottish beef in ways that allow retention of current domestic prime beef production levels and its associated socio-economic and environmental benefits.[1]

4. However, retention of current production levels does not necessarily mean retention of current beef cattle numbers. Specifically, to avoid the risk of aggregate Scottish beef emissions increasing, some (but not all) actions to improve production efficiency need to be accompanied by reductions in cattle numbers.

5. Estimates of the implied reductions are presented below, drawing on the previous analysis of potential emission savings reported by Moxey & Thomson (Oct 2020).2 As stated in that previous analysis, all estimates are first approximations based on incomplete data, partial activity coverage and a number of simplifying assumptions.

6. Moreover, because the Inventory uses dynamic monthly headcounts and numerous age categories, care has to be taken in combining stock and flow measures when summarising total cattle numbers. Similarly, the Inventory is itself a model of emissions and – whilst being important in terms of how mitigation efforts are officially registered - does not necessarily accurately reflect practical changes on the ground. As such, estimates presented here are sufficient to indicate orders of magnitude but should not be treated as offering any definitive precision.

Estimated upper-bound implications for cattle numbers

7. The main mitigation actions with implications for cattle numbers are improvements to registered calving rates and on-farm mortality rates. Currently, a proportion of suckler cows are unproductive in the sense that they either fail to produce a registered calf in a given year or that calf subsequently dies prior to entering the food-chain. In both cases, emissions are incurred without any prime beef

[1] Indeed, if the emissions-intensity of Scottish beef is (or can be made to be) lower than that of production in other jurisdictions, reducing Scottish production would lead to higher global emissions if overall beef consumption remains the same or increases. Such an outcome is not considered further here, other than to note that most Scottish beef production is consumed outwith Scotland.

[2] Moxey, A. & Thomson, S. (Oct 2020) Estimated SBCS effects within the National GHG 'Smart' Inventory. SRUC Report.

actually being produced. Hence, emissions could be reduced and prime beef production maintained by culling unproductive cows and minimising calf mortality.[3]

8.

9. Registered calving rates are estimated to be c.80%, implying that c.20% of cows fail to produce a registered calf. This equates to c.85.2k cows that could, in theory, be culled with no impact on calf production or subsequent prime beef production. In addition, assuming that all such unproductive cows are part of the normal replacement cycle, if they were not replaced then the number of replacement heifers required would also fall by c.20%. This equates to a further reduction of c.28.4k animals (split across three different year-age cohorts, averaging c.9.5k per cohort).[4] All other cattle headcounts are assumed to be unaffected.

10. On-farm calf mortality rates are estimated to be c.6%. This implies that c.25.6k cows producing calves are nonetheless effectively unproductive and could theoretically be removed with no impact on beef production. Similarly, c.8.5k replacement heifers (c.2.8k per year cohort) would no longer be required. Again, all other cattle headcounts are assumed to be unaffected. Reduced cow mortality rates would also be beneficial, but are not considered here due to a lack of data on the precise timing of deaths within production cycles (i.e. before or after calving).

11. Removing unproductive cows and their replacement heifers would increase registered calving rates and decrease on-farm mortality rates. Rates could also be improved by replacing unproductive cows with productive animals. However, this would increase the number of calves successfully entering the food-chain, increasing levels of both beef production and emissions recorded domestically (but not necessarily at UK or global level, see footnote 1).

12. Cattle numbers may also be reduced by changes in the age profile of some animals. For example, lowering the age at first calving for replacement heifers will reduce the total number of heifers present in the system by allowing replacements to be drawn from a younger cohort, thereby avoiding the need for the older cohort at all. Similarly, earlier finishing of prime animals for slaughter at a younger age will reduce the number of older prime animals.

13. Estimation of the overall headcount effect of changing the age profile of animals flowing through the system is less straightforward than for changes to the stock of actual breeding animals. For example, it is necessary to distinguish between different age categories of animal and to make some further assumptions, including regarding the calving rate of younger heifers and the slaughter weight of younger finished animals, to maintain beef production levels.

14. Nevertheless, earlier calving at no later than 24 months could potentially reduce total heifer numbers by up to c.44.7k, or up to c33.1k if culling of all unproductive cows has already occurred, through removing the need for the oldest year-cohort of heifers.

15. Similarly, earlier finishing at no later than 24 months could reduce the number of prime animals reaching older ages in a given year by c.39.8k, although these animals would still be in the system, merely slaughtered earlier (which highlights difficulties of using monthly flow headcounts as a guide

[3] A smaller breeding herd would, however, eventually mean fewer cull cows and hence a reduction in cow-beef production over the longer-term. In the short-term, however, culling of unproductive cows would create a pulse of additional cull-beef.

[4] These no-longer-needed breeding replacements will be finished for slaughter, meaning there will be a short-term increase in prime beef production for a few years.

to annual snapshot summaries, and of mixing input stocks with output flows – changes in prime animal numbers should not be simply added to changes in breeding animal numbers).

16. Other mitigation actions suggested by the Suckler Beef Climate Scheme have no direct implications for cattle numbers. For example, although there may be some potential effects on rates of growth and carcass yields, methane inhibitors and other dietary changes primarily affect enteric emissions per animal without necessarily altering the number of animals. Similarly, improved manure handling will lower manure-related emissions per animal but would not be expected to affect animal numbers.

17. Consequently, if all mitigation actions were adopted completely and simultaneously, the upper-bound estimate for reductions in cattle numbers consistent with maintaining current prime beef production levels would be c.181k (out of a baseline of c.568k).

18. This comprises c.85k plus c.26k cows (out of a baseline of c.426k) and c.28k plus c.9k (out of a baseline of c.142k, split across three year-age cohorts of c.47k each) replacement heifers via improved calving and on-farm mortality rates, with a further c.33k (or c.45k, depending on action sequencing) replacement heifers from younger age at first calving.

19. In addition, c.40k (out of c.538k, split across three year-age cohorts of c.179k per cohort) prime animals would be slaughtered at a younger age, which might (depending on timings) appear as perhaps c.20k fewer animals in a given annual National Inventory summary.

Estimated implications for cattle numbers at 50% mitigation

20. The estimates presented above are upper-bounds which will not be realised for a number of reasons. For example, less than 100% enrolment of beef farms into the scheme, market requirement constraints for year-round throughput and, most importantly, the biological nature of farm production. That is, for example, sustaining 100% calving rates and 0% mortality rates year-on-year is impossible given factors outwith managerial control.

21. Moxey & Thomson (Oct 2020) acknowledge this but make the observation that 50% mitigation achievement could deliver up to c.20% (0.52 Mt CO_2e) of emission savings. However, they offered no commentary on what 50% achievement might comprise. This is because whereas 100% mitigation can only be realised in one way (i.e. the complete and simultaneous achievement of all mitigation options), 50% mitigation can be realised in a variety of ways.

22. For example, it could be achieved solely through the use of methane inhibitors and faster finishing times – in which case there would be no implications for the size of the breeding herd. Or it could be achieved solely through improvements to calving and on-farm mortality rates plus younger first calving ages, in which case the implications for size of the breeding herd are the same as if for 100% mitigation. Hence changes in breeding beef cattle numbers could range between 0 and c.181k (out of c.568k currently).[5]

23.

24. In practice, it is likely that 50% (or any other level of partial) mitigation would probably be delivered by some mix of uptake of most if not all of the suggested management actions. That is, some combination of a smaller breeding herd arising from improved calving and mortality rates plus some

[5] Direct comparison of this figure with (e.g.) values from the June Agricultural Census are hampered by the Inventory's use of dynamic, monthly headcounts rather than a snapshot at a single point in time.

younger first-calving, alongside faster finishing and the use of methane inhibitors or other dietary improvements. Table 1 below illustrates this for three different example combinations.

Table 1 : CO2e mitigation options – examples of possible CO2e and herd reduction mixes associated with 100% and 50% mitigation achievement

Mitigation level	**100%**		**c.50%a**		**c.50%b**		**c.50%c**	
Achieved reduction	**CO2e**	**Cattle**	**CO2e**	**Cattle**	**CO2e**	**Cattle**	**CO2e**	**Cattle**
Calving rate	11.4%	114k	11.4%	114k	5.7%	57k	0%	0
On-farm mortality	3.4%	34k	3.4%	34k	1.7%	17k	0%	0
Younger calving age	3.5%	33k	3.5%	33k	1.8%	17k	0%	0
Faster finishing	6.1%	0	0%	0	1.5%	0	6.1%	0
Methane inhibitors	14.9%	0	0%	0	7.4%	0	14.9%	0
Total	39.3%	181k	18.3%	181k	19.7%	91k	21.0%	0

Notes: percentage emission savings are relative to an estimated c.2.6 Mt CO2e attributed to suckler beef production in Scotland. This excludes emissions from dairy calves reared for beef, but also emissions associated with feed and fodder production (see Moxey & Thomson, Oct 2020). Herd reductions are relative to baseline numbers of c.426k cows and c.142k replacement heifers.

Other considerations

25. Herd reductions in excess of the estimated upper-bound would deliver further emissions savings, but would also reduce beef production levels and therefore its associated socio-economic and environmental benefits.

26. For example, if unproductive cows and their replacement heifers have already been removed, a further 10% reduction in cow numbers (c.43k) and their replacement heifers (c.14k) would yield additional emission savings of c.9% to c.11%. This comprises emissions associated with the cows and heifers themselves, but also (unlike for the unproductive cows) with the offspring that they would have had. It is this reduction in offspring that would (all other things being equal) also lead to a reduction in beef output, of c.10%.

27. It should also be noted that additional savings may also arise from actions not considered explicitly here, including as-yet undiscovered innovations and improved pasture management.

28. The initial list of suggested entry requirements and management options for the Suckler Beef Climate Scheme runs to almost 50 separate elements, many of which are not currently supported by easily verifiable quantitative data.

29. However, the task of scheme implementation can perhaps be simplified by distinguishing between scheme elements that could be monitored simply in terms of their presence or absence, and other elements that need to be monitored in some detail as the basis for payments. This approach is outlined below.

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