CAN GRAZING LIVESTOCK BE NET CARBON NEGATIVE?

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I am writing this because it’s an important question. I need to explain a few other matters first, then I’ll get down to question of grazing livestock.

We probably all accept now that there is some kind of ‘climate emergency’, compounded by potential collapse of some natural systems on which we depend. There is a sustainability crisis that requires some major changes in the next 20 years or so. That sentence probably needs to be in caps with exclamation marks.

I have been working on these matters for a long time and I have been obliged to change my ‘recipe’ somewhat as urgency mounts. Back in the 80s it was possible to believe that gradual lifestyle changes would become widespread, bringing both greater well-being and reduced physical environmental impacts. But these lifestyle changes have not occurred. The physical threats are now so great that we must deploy physical responses, largely of a technical nature, rather than appeal for changes in aspirations or lifestyles. I am aware that this puts me at odds with much of the green movement, but this is what I now think.

Let’s put a few ballpark numbers in. Climate change is mostly down to greenhouse gas emissions, and at a world scale these can be handily grouped into three classes:

* Energy/fossil fuels: about 65% of the total
* Non-energy industrial processes such as cement and waste: about 10% of the total.
* Agriculture and other land use practices: About 25% of the total

Left to their own devices, these are all likely to increase by around 20% as the population grows and people demand more energy, food and materials. However, the technologies now exist to reduce them if we decide to do so, as follows

* Energy emissions could go down to 10%
* Industrial non-energy could go down to 5%.
* Agriculture emissions could also go down to 5%

That leaves about 20% of the present level, and to reduce this further would require a range of so-called Negative Emission Technologies (NETs) which I won’t go into right now.

This at least is the orthodox view. I am setting it down to assert that I believe there *are* solutions to the climate change problem if we want to adopt them. They are mostly of a technical nature, such as rapid deployment of renewable energies, refitting buildings, improved waste handling, alternatives to cement, electric vehicles etc. It’s emergency stuff, like A&E is different from physiotherapy. It can be done without triggering vast waves of *gilets jaunes* protests from the 90% non-green part of the population who hate change more than anything, and personally I am in favour of this because it is the only plausible route. To put it metaphorically, the socio-political milk is easily curdled and we have to avoid this at all costs.

Good, but there’s a problem: agriculture is different. A significant fraction of the emissions, about 10% of the total, perhaps more, appear to come from grazing livestock, and so far, we have found no magic bullet technical fix to stop the methane emissions generated by turning grass into meat and milk.

This means either:

* That we live with this, press harder on other sectors and use more NETs (technically difficult); or
* Tolerate higher risks from climate change (which ethically speaking we should not); or
* Reduce the grazing livestock to a small fraction of the present level and deal with the knock-on effects in diet, land-use etc (socially difficult and risks curdling the milk).

Very tricky! The big blockage would be a substantial rise in the price of meat, milk and dairy products. My preferred solution to avoid riots in the streets is for the food industry to develop plant-based simulacra of meat and milk (and cheese) that most people would adopt as being (eventually) cheaper, healthier and more readily available. Let me hasten to add that I am fully aware this would be anathema to most greenies, and indeed to readers of *The Land* and especially its editor. Yes yes, Frankenstein foods, for which I can argue the toss on another occasion. Without them you are going to lose the lot. Suffice it to say that this part of the food industry is developing at an astounding pace and with a healthy diversity of approaches. Meanwhile dietary opinion is converging on the view that meat is not an essential part of human diets, and is indeed a ‘benign extravagance’.

OK, so the orthodox view is that grazing livestock are high net emitters of greenhouse gases and their numbers need to be reduced. Is there another view? Yes, there is: the opposite, that grazing livestock are **net sinks**, so perhaps their numbers can be maintained, even increased. The effect of grazers in stimulating carbon incorporation into soil is greater than the effect of their methane emissions, giving overall net-negative emissions. I shall call this idea the ‘Net Sequestration Thesis’ or NST.

The NST is often yoked to another meme regarding methane that goes like this: because methane has a short half-life, it does not accumulate in the atmosphere; therefore it does not contribute to long-term ‘carbon budgets’; therefore it is unimportant in global warming. In addition, it is argued that before mainstream agriculture there were large herds of wild ungulates also emitting methane, so the process is ‘natural’ and can be discounted. We might call this the ‘methane revisionist thesis’ or MRT.

(If anyone is in any doubt, the orthodox view is that methane *is* a significant greenhouse gas wherever it comes from, and that reducing it would be the quickest way to lengthen the window within which CO2 could be reduced. Farm livestock now weigh ten times more than all other wild mammals, so they are a major source).

The two memes are widely taken as a pair (NST/MRT?) to support the use of grazing livestock.

The NST/MRT is strongly established in the farming community, especially the organic sector. Indeed, for many people it is simply a Fact that grazing livestock are net sinks. For example, at the Oxford Real Farming Conference, the premier event for small-scale mixed farming, it is not deemed worthy of discussion: it is simply taken for granted.

How did the NST/MRT come about?

It seems to go back largely to the claims of a farmer called Allan Savory. He developed a system of grazing management that he claimed increased the amount of carbon in the soil. Potentially this is very significant because soils can potentially contain a lot of carbon, and an increase of only a few percent in the soil represents a huge reduction in the atmosphere. Savory was so confident in his system that he claimed that more grazing livestock could solve the climate change problem all on their own, and he gave a TED Talk to publicise his ideas.

This talk went viral, along with the basic NST meme. It was just what meat-eaters and stock farmers wanted to hear, and they bolted it to their brains. Meanwhile others took notice. Of course they did: this was potentially very important. Many studies have since been conducted, and indeed it does sometimes happen: that grasslands accumulate carbon, and that grazing can increase uptake. Sometimes, under some conditions. But very rarely are these effects enough to offset methane emissions, which remain especially high with rough forage rather than feed concentrates.

It is also a problem to work out mechanisms through which sequestration could happen. Perhaps manure is more easily incorporated than solid leaf litter. Stock might trample litter and perhaps push it into the soil. Grazed shoots might shed roots deep underground, which then decompose into stable humus. We don’t really know: it’s mostly just empirical: measuring soil carbon under various grazing regimes.

Savory’s results proved very difficult to replicate and careful study of his data showed that he cherry-picked high values of carbon storage in soils and low values of methane emissions from gastric fermentation. In the orthodox world, Savory is discredited and there is no need to revisit the issue. But the NST is just too good to give up without a fight, so has led to a continued cultivation of anecdotal reports supporting it, which are unreliable but widely cited. It is a bubble.

I should say a bit about the argument for feeding ruminants on grass. The UK produces a lot of very good grass and humans can’t eat it. So, it seems to make sense to hand it over to organisms that can convert it into delicious products. Magic! The alternative is to feed ruminants with ‘concentrates’ made up from food waste and soya meal imported from places like Brazil and Malaysia. This is thought to be less ‘natural’; to produce inferior meat; and to indirectly generate climate change problems overseas. It is essentially treating cattle like pigs: in which case, why not use pigs?

Which brings us to another part of the argument: whether grass-fed ruminants are ‘better’ than concentrate-fed livestock like pigs and poultry. Devotees of the NST/MRT insist they are, and that we should eat less pork and chicken, not less beef and cheese. The orthodox view is the other way round: that ruminants are far worse in terms of emissions per kg of meat, and grass-fed ruminants are worst of all. So if we are going to eat meat at all, it should be pork and chicken (and eggs). That’s what the extensive research literature says without much ambiguity.

Let me move on now to examining my own biases. I have somewhat mocked the grass-fed ruminant community for adopting a self-serving belief with weak evidence. But what about me? What do I want to be The Case? Well, I was involved in a team developing a physically-realistic scenario to decarbonise the UK in 20 years, reported in a previous issue of *The Land*. We found ways to reduce the energy and non-energy industrial emissions to about 6%. Easy! But that left the agriculture sector with about 20%, half of it coming from ruminants. Had we adopted the NST/MRT we could perhaps have wrapped it up there and then, perhaps even increasing the stocking rates to boost sequestration.

Perhaps we missed a trick, but we stuck to orthodoxy, accepting that grazing ruminants were strong net emitters. Clearly, we were not going to get to zero with all those cows and sheep, so most them had to go (only in the scenario of course: no livestock were actually harmed in the course of the exercise). Then the miracle started. We could hardly believe it. Suddenly we had about ten million hectares of pasture available for other uses, for the sacrifice of just 5% of the food, and about 23% of the protein, which was easily replaced by arable land no longer needed to provide supplementary feeds.

In the scenario, this released land could now be partially used

* for energy crops to fill the occasional shortfalls due to a high proportion of renewables in the energy mix;
* for biomass crops for low-carbon materials to replace imports;
* for sequestration crops and processes to balance off the irreducible emission residuals; and
* for habitat creation and biodiversity.

It gave us

* improved energy security,
* improved food security;
* improved materials security;
* a better diet;
* zero indirect land-use change overseas;
* reduced emissions of excess nitrogen and phosphorus; and
* improved ecosystem services.

It was win-win-win all the way.

So…you can see that I have a strong ideological incentive to accept the orthodox view and to reject the NST/MRT. I ‘want’ cows to be a liability in many different dimensions: emissions, land-take, impact on ecosystem services, general inefficiency. If the NST/MRT is true, it spoils the story a bit, so I would be psychologically inclined to dismiss evidence in its favour.

For this reason, I have had to try hard to find respectable evidence on both sides. On the whole I find orthodoxy more or less correct, but of course I am open to contrary evidence. There is one possible fly in the ointment: erosion. For obvious reasons, tilled land is much more prone to erosion than grassland, and soil carbon could be lost at a greater rate. This effect is not normally included in measuring carbon intensity for crops, and it might be significant. More research needed.

So, in conclusion, I am firmly of the view that for climate-change reasons there are too many sheep and cows in Britain, and they have to be reduced by about 90%. But this reduction is not a cost or a penalty. On the contrary it releases a wealth of other benefits, and it’s time we got on with it.

APPENDIX I

Implications of some of the above arguments for land-use in a decarbonised Britain are shown in the figure below, UK acreage at left in 1 Mha squares, overseas acreage on right. Note that these areas are totals made up of thousands of small local cases.



APPENDIX II

The above argument emerged from the ZCB studies and other data, and is, I believe, strongly supported by the available evidence. It was agreeable, then, to read George Monbiot’s 2022 book *Regenesis* (Allen Lane). Monbiot’s argument is almost exactly the same, but backed up by a great deal more research and citation.