

CHARGE NO 3: LIVESTOCK CAUSE GLOBAL WARMING

A CONVENIENT UNTRUTH

Methane emissions from the UK's cattle herd are not causing global warming. Cattle are often blamed for more global warming than they cause because of a faulty methodology for equating methane emissions with carbon dioxide emissions.

Ruminants, and particularly cattle, are habitually cast as climate villains, responsible for large amount of greenhouse gas emissions. According to a much quoted United Nations Food and Agriculture Organisation (FAO) figure, livestock are responsible for 14.5 percent of human greenhouse gas emissions.¹ Eighty percent of these emissions come from ruminants, half being methane, and a quarter nitrous oxide.

As a result, there are innumerable scientific papers comparing the environmental impact of dairy and beef unfavourably with pork and poultry, with vegetarian diets, with milk substitutes, with test-tube meat and so on. Virtually all of these papers and the FAO's figure of 14.5 percent are flawed because they employ a formula for equating the climate impact of methane emissions with that of carbon dioxide — through the unit known as “CO₂ equivalent” — which is highly misleading.

This was explained in an article in *The Land* 22, entitled “Is Grass-Fed Guilt-Free?” However it is worth covering the matter again, because nearly all the media and the public remain unaware of what is in effect a calumny against ruminant livestock farmers. Myles Allen and colleagues at the Oxford Martin School at Oxford University, whose work was cited in our article, have since published further material designed to explain this dubious accounting to non-scientific readers.

Comparing Apples and Pears

Methane (CH₄) and Carbon Dioxide (CO₂) act upon the global temperature in very different ways. For the first few years after it has been released into the atmosphere, a given quantity of methane will have a much stronger global warming impact than the same amount of CO₂. The standard metric for equating the two gases, Global Warming Potential (GWP₁₀₀), currently estimates that over 100 years a kilo of methane has 28 times as much global warming effect as a kilo of CO₂, or 34 times as much if you take into account certain feedback mechanisms. The FAO's calculation that livestock cause 14.5 percent of all anthropogenic greenhouse gas emissions is based on the 34 figure.

However, methane degrades in the atmosphere relatively quickly — it has a half life of about ten years — whereas CO₂ is cumulative, that is to say a single emission of CO₂ will remain in the atmosphere for many hundreds of years, and a series of them will accumulate, continually increasing the amount of global warming.

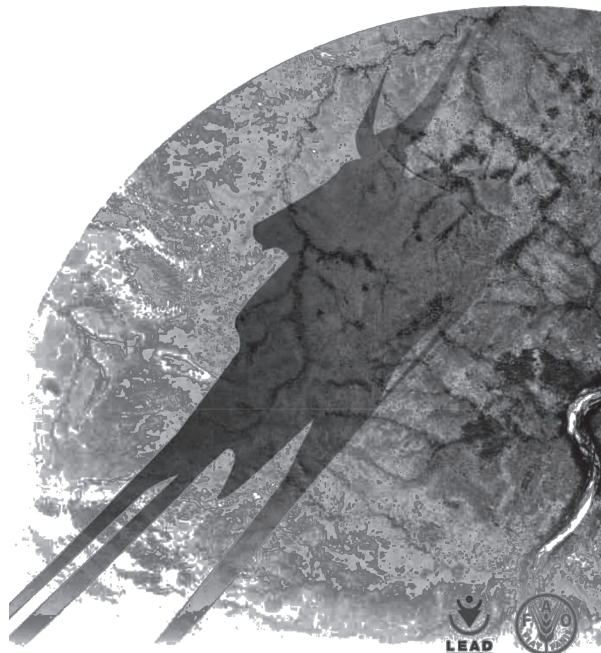
The difference in behaviour between the two gases can be seen in the graphs on the next page. If emissions of the two gases are rising, then the global warming effect also rises, but more

steeply in the case of CO₂. If emissions of the two gases are constant, then the warming effect of methane is relatively constant, whereas the warming effect of CO₂ increases as it accumulates in the atmosphere. Finally, if emissions of both gases are falling, then the net warming effect of methane begins to drop (in other words the drop in emissions has a cooling effect), whereas the warming effect of CO₂ continues to increase, albeit at a slower rate, and only becomes constant when emissions cease altogether.

This means that a single pulse of CO₂ can be equated to a sustained increase in the emissions rate. A farmer who has been keeping the same number of cows on their land for several decades will not be increasing global warming significantly because the methane will be disappearing from the atmosphere almost as fast as it is being added. The same applies to a nation, or indeed the world, if its total cattle population remains stable over a number of decades.

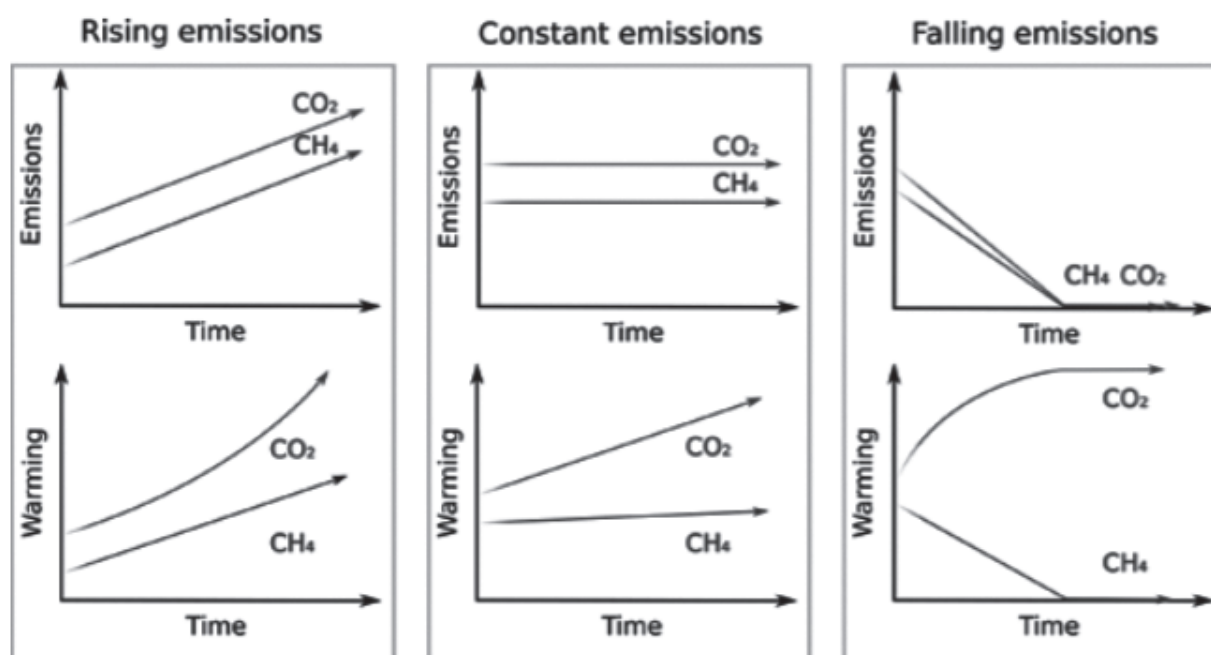
livestock's long shadow

environmental issues and options



“The problem with developing a concept is that people might use it. Worse they might use it and ignore all the caveats that attended its development.”

Livestock's Long Shadow, the FAO's 2006 report which claimed farm animals were responsible for 18 percent of anthropogenic global warming, did just that. The report itself has cast a long shadow over subsequent assessments of the environmental impact of livestock.



Oxford Martin, *Climate Metrics for Ruminant Livestock*, July 2018, <https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf>

But a single emission of CO₂, say from using a tractor to spread artificial fertiliser, will remain in the atmosphere and continue to have a warming effect more or less indefinitely. And repeated emissions of CO₂ from annual use of diesel and applications of fertiliser will accumulate in the atmosphere, causing the global temperatures to increase. GWP₁₀₀ fails to account for this crucial difference, resulting in perverse assessments of the relative performance of the two gases and frequent exaggeration of the role played by methane.

There Are None So Blind . . .

None of this is really news. There have been plenty of scientific papers analysing the problem.⁴ Myles Allen comments:⁵

“Researchers have debated for decades about the adequacy of this approach . . . The point was made in the first major climate report produced by the Intergovernmental Panel on Climate Change (IPCC) way back in 1990. Those early discussions were loaded with caveats: Global Warming Potentials, which underpin the traditional practice of CO₂ equivalence, were introduced as “a simple approach . . . to illustrate the difficulties inherent in the concept.”

“The problem with developing a concept is that people might use it. Worse they might use it and ignore all the caveats that attended its development. This is more or less what happened with GWPs as used to create CO₂ equivalence.

“The science caveats were there, and suggestions for alternatives or improvements have continued to appear in the literature. But policy makers needed something (or thought they did) and the international climate negotiations community grasped the first option that became available, although this has not been without challenges from some countries.”⁶

This doesn't entirely explain why the FAO, who ostensibly exist to support farmers, should adopt a metric that is so unfavourable to ruminant husbandry. There is a suspicion that FAO economists feel comfortable with GWP₁₀₀ methodology (at its higher exchange rate of 34:1) because of its bias in favour

of intensive fossil-fuel dependent sectors such as pig and poultry factory farms, and against ruminant livestock herders reliant on biomass. In their original assessment in 2006, the FAO stated that “by far the largest share of emissions come from more extensive systems where poor livestock holders often extract marginal livelihoods from dwindling resources,”⁷ — a jaundiced and inaccurate view of peasant farming.

Allen and his colleagues note that the GWP₁₀₀ methodology particularly impacts upon countries with a relatively high share of methane in their emissions portfolios, “which tend to be either middle income countries with large agricultural sectors . . . or less developed countries where agricultural emissions dominate because their energy sector is small.”

They propose an alternative metric which they call GWP*. Instead of measuring a pulse emission of CO₂ against a methane pulse of the same mass, GWP* compares a pulse emission of CO₂ with an increase in the *emission rate* of methane. The methane emissions resulting from adding an extra cow to a herd for an indefinite period would be directly comparable to a one-off single emission of fossil fuel CO₂.

The discrepancy between the two metrics can be large, especially if emissions are declining. Under the conventional GWP₁₀₀ methodology, if a source of methane undergoes a reduction of 25 percent in methane emissions over 30 years it will over that period cause global warming equivalent to 735 tonnes of CO₂ for every tonne of methane emitted in year one. Under the more accurate GWP* methodology it results in global *cooling* equivalent to 420 tonnes of CO₂.⁸

The UK cattle herd declined by 25 percent from 13.3 million head in 1984 to 10 million in 2017, a period of 33 years. Assuming that methane emissions per cow are broadly the same over the whole period, this means that methane emissions from the UK herd currently have no net global warming impact, and are probably having a global cooling effect.

The Cart Before the Horse

The adoption of GWP_{*} would be a great improvement over the current employment of GWP₁₀₀. It provides a much fairer assessment of the climate impacts of ruminant husbandry as compared with those of intensively farmed pigs and poultry, or vegan substitutes. Many of the scientific papers comparing the impact of meat and plant-based diets would have to be reconsidered.

However if policy-makers and politicians were doing their job and reducing CO₂ emissions in line with the pathways mapped out by the IPCC to limit global warming to a rise of 1.5 degrees above pre-industrial levels, then it is questionable whether we would need any metric at all, because substantial reductions in methane emissions would be a consequence of reductions in CO₂.

The increase in methane levels in the atmosphere since 2000 is in the order of four percent (much less than the increase in CO₂ in the atmosphere over the same time). Since a constant flow of methane over time does not cause any substantial increase in global warming, it would take a relatively modest decline in methane emissions to stabilise methane levels in the atmosphere at a level that causes no increase. IPCC estimates of what is necessary to achieve stability range between a 6.1

percent drop and a “less than 30 percent” drop in methane emissions.⁹ Most recently, in the pathways which it proposes to limit global warming to 1.5°, the IPCC advocate a drop in methane emissions of “35 percent or more relative to 2010 levels”. Net emissions of CO₂, on the other hand, because they are cumulative, have to be reduced to zero by 2050.¹⁰

The IPCC also points out that “non-CO₂ emissions can be reduced as a result of broad mitigation measures in the energy sector.”¹¹ In other words, as we progressively reduce fossil fuel use and CO₂ emissions to zero, reductions in methane emissions are likely to follow:

- About one third of anthropogenic methane emissions result directly from the extraction of fossil fuels, particularly gas, which is partially composed of methane. If and when the use of fossil fuels declines to zero, we can expect the associated methane emissions to decline correspondingly.
- Another one-sixth of methane emissions come from landfill. As we transition from fossil fuels to a circular bio-economy, and abandon throwaway plastics, landfill will become increasingly rare and associated methane emissions will also diminish.
- Another third of anthropogenic methane emissions are derived from livestock. But we can reasonably expect these to decline as well, as a result of reduced fossil fuel availability. Artificial fertilisers will become more expensive, leading

Why a Herd of Cows is Like a Closed Power Station



If all greenhouse gases are taxed then using GWP₁₀₀ would unfairly penalise short-lived emissions, assuming the aim was to penalise global warming.

Consider a power station and a herd of cows. A power station emits CO₂ by burning fossil fuels. This is CO₂ taxed. When it shuts down permanently, it emits no more CO₂, so is no longer taxed. However the CO₂ already emitted continues to affect the climate for hundreds or potentially thousands of years. So even after closing down, that power station still contributes to holding up global temperatures because of the CO₂ that remains in the atmosphere.

Now to the cows. A herd of cows emits methane, so the farmer is taxed

for those emissions. If the herd remains the same size with the same methane emissions every year, it will maintain the same amount of additional methane in the atmosphere year on year. In terms of its contribution to global warming, this is equivalent to the closed power station.

The power station pushed up global temperatures when it was running in the past, just as the farmer's great-grandparents pushed up global temperatures when they were building up the herd. But neither a steady herd of cattle, nor a defunct power station is pushing up global temperatures any more.

However under almost all proposed systems for taxing emissions that attempt to include methane, the farmer would get taxed for their herd's methane emissions every year while the owner of the closed power station would not.

One way to make this fairer would be employ a methodology (such as GWP) that equates changes in methane emission rates with

tonnes of CO₂. Thus a stable emission of methane equates to a zero-rate of CO₂ emissions, as it does not change the level of warming into the future, and therefore would not be taxed.

The flip side of this is that any sustained increases in methane emissions would be heavily taxed, as they would contribute very substantially to future warming. Conversely any sustained cuts would be rewarded for contributing to future cooling.

By Michelle Cain

Drawn from *GWP Masks True Effects of Short-Lived Gases*, Carbon Brief, 2018, www.carbonbrief.org



to reduced animal feed production; and livestock will be competing for grazing and forage land with the demand for biomass energy.

Some methane will no doubt rebound in other forms, for example from leaky biogas plants, compost heaps etc. But the point here is that methane emissions are not the driver of global warming, they are better understood as a symptom or function of a system currently driven by fossil fuel extraction.

There is a danger that the increasing clamour for a reduction in livestock emissions will backstage the effort to reduce the use of fossil fuels — that would be a case of putting the cart before the horse. It doesn't matter how many people go vegan, or how little meat we eat, it will not stop global warming. Only one thing will do that — reducing net carbon emissions from fossil fuel extraction to zero.

The Caveat

Nonetheless there are strong reasons for immediately reducing meat consumption in rich countries, since the wealthy of the world eat more than their fair share. It is vital that livestock numbers do not increase around the world because that *would* generate more methane in the atmosphere and cause global warming. It is vital that livestock are not used to clear wide expanses of tropical forest—that would increase CO₂ emissions. We must stop felling forest in South America to provide soya meal to feed to livestock in factory farms. To ensure that these scenarios do not happen, the limited amount of meat and dairy that can be sustainably produced must be distributed more equitably. The strongest argument for reducing meat consumption in industrialised countries is one of environmental justice.

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NOTES AND REFERENCES

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4. See references 1-9 in M Allen et al, "A Solution to the Misrepresentations of CO₂ Equivalent Emissions of Short-Lived Climate Pollutants under Ambitious Mitigation", *NPJ: Climate and Atmospheric Science*, 1 Article 16, 2018.
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6. Notably from Brazil whose targets for mitigating climate change are expressed using a different metric, GTP₁₀₀, which allocates a much lower value to methane emissions over 100 years. Federative Republic of Brazil, *Intended Nationally Determined Contribution Towards Achieving the Objective of the United Nations Framework Convention on Climate Change*. <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20iNDC%20english%20FINAL.pdf>
7. H Steinfeld et al, *Livestock's Long Shadow*, FAO, 2006. The bias in this document against peasant farming is discussed in S Fairlie, *Meat: A Benign Extravagance*, Permanent Publications, 2010.
8. Under GWP, a drop in methane emissions of 10 percent over 30 years is equivalent to zero tonnes CO₂ emissions. Under GWP₁₀₀, the same rate of reduction in methane emissions is regarded as equivalent to 800 tonnes of CO₂eq over the 30 years, for every tonne of methane emitted in year one. Oxford Martin, *Climate Metrics for Ruminant Livestock*, July 2018, <https://www.oxfordmartin.ox.ac.uk/downloads/reports/Climate-metrics-for-ruminant-livestock.pdf>
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11. Ibid.

Goats to the Rescue

After the horrific fires that swept through California in November 2018, not to mention those in Greece and Britain earlier in the year, you might assume that wildfires are increasing in scale and frequency. Since wildfires emit methane you might also think that helps to account for the rise of methane in the atmosphere over the last decade.

According to NASA, the reverse is true. Worldwide there have been fewer fires, because of agricultural encroachment, and hence lower methane emissions from this source. This explains why the increase in atmospheric methane — due to increased fossil fuel extraction (eg fracking) and tropical wetland expansion (eg rice) — has been less than anticipated.

The fires we hear about in the media are those that threaten lives and property because they take place close to towns and cities. If these are on the increase it may be partly because of climate change, but also because of agricultural abandonment. The time-honoured way of preventing wildfires from engulfing human settlement is to graze sheep or goats on nearby marginal land that

might otherwise become a tinderbox of dry grass and scrub. But as the radius of the urban economy expands, peasants that might have grazed this land are squeezed out by property prices and the rising cost of living.

However, on the west coast of the US, a new breed of shepherd is emerging. Promoting themselves with brand-names such as "Healing Hooves" and "Rent-a-Ruminant", they hire out herds of sheep and goats to private and municipal landowners for the sole purpose of keeping the vegetation under control.

Craig Madsen, pictured above, moves his goats from site to site in Washington State during the summer using solar powered electric fencing. In winter he takes them back to his farm where they kid.

"More and more, people are looking at goats as a tool for fire suppression," says



Madsen. "Not too many people want to be herders in the US; to live a nomadic lifestyle. But millennials are starting to look back, and some may want to get back to the land."

SOURCES

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