
A fresh look at livestock greenhouse gas emissions and mitigation potential in Europe

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This journal published an article by Bellarby *et al*. entitled "Livestock greenhouse gas emissions and mitigation potential in Europe" (Bellarby *et al*., 2013), which became the sole source for a news release by the European Commission's Joint Research Centre entitled "GHG emissions from the EU livestock sector could be mitigated by up to 60%" (EC, 2013). I will outline four sets of issues that may change the Joint Research Centre's conclusions.

The first set of issues relates to Bellarby *et al*.'s assertion that "there is only one whole life cycle estimate of GHG emissions from the global livestock sector... which suggested that global contributions from livestock were 18% of total GHG emissions".

In fact, Steinfeld *et al*.'s 18% figure counts only anthropogenic greenhouse gas (GHG) emissions, rather than total GHG emissions (Steinfeld *et al*., 2006). Moreover, Bellarby *et al*. have overlooked a widely-cited assessment by Jeff Anhang and me (Goodland and Anhang, 2009). Our assessment suggests that Steinfeld *et al*. have failed to develop a true whole life cycle estimate of GHG emissions attributable to livestock, and that livestock products actually account for at least 51% of annual worldwide anthropogenic GHG emissions. Links to many consequential citations of our analysis can be found on our website (http://www.chompingclimatechange.org/).

A second set of issues relates to good practice in environmental assessment. The team of Steinfeld *et al*. appears to have been clearly disadvantaged by including no specialist in environmental assessment (the profession of Jeff Anhang and me).

Notably, Steinfeld *et al*.'s assessment of livestock examines risks involved in land degradation, climate change and air pollution, water shortage and water pollution, and loss of biodiversity. Steinfeld *et al*. assert that those risks must be balanced with benefits available from raising livestock. Such an assessment fails to separate livestock's lesser risks from their greater ones, a basic task of environmental assessment. The greatest environmental risks are normally defined as those that are diverse, irreversible, and unprecedented – which are not normally associated with air pollution, water shortage, or water pollution, but are notably associated with climate change.

In fact, Steinfeld *et al*.'s assessment fails to recognize that sound management of climate change is widely agreed to require capping atmospheric carbon no later than 2020. Nor does their assessment recognize

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the EU's objective of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990 (EC, 2011). Such failure by Steinfeld *et al*. enables their assessment to project a doubling in livestock production by 2050, paired with only minor prescriptions for reducing GHG emissions. Moreover, Steinfeld *et al*. assess only livestock products and fail to perform any analysis of alternatives, another basic element of environmental assessment.

In contrast, Jeff Anhang and I have identified a unique dual benefit of replacing a moderate amount of today's livestock products with alternatives. That is, such replacement can both significantly reduce GHG emissions and free up land to permit reforestation that would provide large-scale GHG sequestration. Most land used for livestock and feed production was once forested, and could be forested again (WRI, 2011). Livestock grazing alone, without counting feed production, has been estimated by the International Livestock Research Institute to occupy 45% percent of all land on earth (Thornton *et al*., 2011).

A third set of issues relates to climate disruption. There have been unprecedented levels of die-offs of livestock in 2013 due to climate disruption in some regions of the world (e.g., Gleeson, 2013). Such die-offs appear to have increased in scope in recent years, and climate change threatens to make them increase further. This isn't addressed by Bellarby *et al*. or by Steinfeld *et al*.

Indeed, according to Bellarby *et al*., their recommendations "are in line with GHG mitigation options suggested by Steinfeld *et al*." – who consider carbon dioxide in livestock respiration to be perfectly balanced by photosynthesis, so they do not include any carbon dioxide from livestock respiration in their GHG accounting.

However, reality no longer reflects the old model of the carbon cycle, in which photosynthesis balanced respiration. That model was valid as long as there were roughly constant levels of respiration and photosynthesis on Earth. In recent decades, respiration has increased exponentially with livestock production – while intensified livestock and feed production has been accompanied by large-scale deforestation and forest-burning, huge increases in volatilization of soil carbon, and dramatic declines in Earth's photosynthetic capacity and therefore in its GHG sequestration capacity (Goodland, 2013).

As a result, either carbon dioxide in livestock respiration – or its reflection in carbon absorption forgone on land used for livestock and feed production – should be counted as emissions. When that is done, it becomes apparent that EU governments should provide incentives for halting deforestation and for reforesting a significant amount of land used today for livestock and feed production.

In contrast, Bellarby *et al*. recommend prioritizing beef and dairy production on grassland. Yet that is contrary to their claim that their recommendations are in line with Steinfeld *et al*., who propose virtually the opposite of prioritizing beef and dairy production on grassland: "The principle means of limiting livestock's impact on the environment must be... intensification" (Steinfeld et al., 2006, p. 236). Others have validated Steinfeld *et al*.'s assessment that beef and dairy cattle produced on grassland emit much more methane than intensively-produced ones (e.g., Harper *et al*., 1999). Also, livestock on grassland take up much more land than do intensively-produced ones, leaving much less forest available to absorb atmospheric carbon.

A fourth set of issues relates to timing. Bellarby *et al*. recommend that European consumers reduce their consumption of livestock products. However, they recommend no specific amount to be reduced. Nor do they provide any target date for any of the reductions that they recommend in livestock products, food waste, or GHGs.

In contrast, both the International Energy Agency (2011) and the Intergovernmental Panel on Climate Change (Spotts, 2011) have projected that climate change may become practically irreversible by 2017, which means that later GHG reductions could be ineffective. Yet the International Energy Agency (2011) has also estimated that sufficient renewable energy infrastructure to stop climate change would take at least 20 years and US$18 trillion to develop. That is because renewable energy infrastructure has long and complex product-development cycles and capital-intensive requirements.

The only way for most economic sectors to achieve GHG reduction on a large scale is by using renewable energy and energy efficiency. The livestock sector is a notable exception, as most of its GHG emissions are not from energy usage, but from biological processes. Therefore, it is easier – and especially important – to achieve a large and rapid GHG reduction from the livestock sector.

The objective of recent international climate treaty negotiations has been to reduce GHG emissions by about 13% by 2017. If, as our analysis shows, at least 51% of anthropogenic GHGs are attributable to livestock, then the treaty objective could be met by replacing about 25% of today's livestock products with alternatives by 2017.

Paradoxically, if livestock GHGs are actually at the lower level of 18% of anthropogenic GHGs that Steinfeld *et al*. assert they are, then replacing about two-thirds of today's livestock products with alternatives by 2017 would be required to achieve the treaty target.

Alternatives to livestock products can range from whole grains and legumes to an array of meat and egg substitutes made from such items as peas, sorghum, and beans. Such products are generally responsible for minimal greenhouse gas emissions (Goodland, 2013a).

There is documented potential for agricultural change to draw down atmospheric carbon to pre-industrial revolution levels within five years (e.g., www.remineralize.org/research/the-potential-of-remineralization), through stopping deforestation and prioritizing reforestation. Doing so while simultaneously replacing a moderate amount of livestock products with alternatives may be the only pragmatic way to halt climate change within the few years remaining before climate disruption may become irreversible.

One of the advantages of replacing livestock products *versus* replacing fossil fuel infrastructure is that it is easy for any individual consumer to do the former on their own, unlike the latter. Still, to ensure that sufficient action is taken, the E.C.'s Joint Research Centre should develop policy prescriptions to provide for incentives to replace at least 25% of today's livestock products with alternatives by 2017.

Finally, agriculture is outdoors to a unique degree, exposing it to greater risk from emissions attributable to livestock than any other industry's risk from the same emissions. So food industry leaders have a compelling commercial incentive to reduce these emissions. Indeed, replacing at least 25% of today's livestock products with alternatives by 2017 may be the only available business case for industry leaders to act pragmatically to halt climate change before it is too late.

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