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Planet at risk from grazing animals?

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Introduction

The famous FAO report "Livestock's Long Shadow" (Steinfeld et al. 2006) and hundreds of subsequent publications blamed domestic livestock, in general, and grassland-based production systems in the (sub) tropics, in particular, of causing serious environmental hazards such as climate change, claiming that 18% of anthropogenic greenhouse gas (GHG) emissions are from livestock, more than from the transport sector. Few reviews challenged this claim, and those that did received little attention from the media. Pitseky et al. (2009) revealed the double standard applied by the FAO in this matter: Whereas for livestock products a full life cycle assessment for GHG emissions was applied, for the transport sector only fuel consumption was taken into account. This striking weakness of the FAO report alone considerably disadvantages livestock husbandry due to a scientifically questionable comparison.

Approach

In this review the most widely spread claims of alleged negative environmental impacts produced by livestock are discussed, partly in the light of lesser known publications, as well as empirical facts and data determined on a global scale, and partly with specific reference to the grazing systems in the Paraguayan Chaco.

Results and Discussion

Critique: "Livestock contributes to climate change"

The basic assumption for human-caused climate change is a noticeable climate sensitivity to anthropogenic GHG emissions, which is supported by the conclusions of the latest IPCC Assessment-Report AR4 (IPCC 2007). There is, however, quite a bit of empirical evidence which casts doubt on these conclusions:

- In Table 2.11of that report, 16 variables are identified as global warming-forcing agents and the level of understanding for 11 of them is specified as 'very low to low'. Yet the IPCC comes up with a 90 to 99% certainty in the results of its models, a conclusion which is logically unacceptable and scientifically indefensible.
- Mean global temperature has not increased in the past 15 years in spite of steadily increasing CO_2 levels in the atmosphere, an observed reality contrary to all model projections published by the IPCC.
- A large number of recently published peer-reviewed papers, such as Kobashi et al. (2011), Esper et al. (2012), Markonis and Koutsoyiannis (2012) and Axford et al. (2013), present evidence of the existence of various eras during the Holocene (since the end of the latest ice age about 12,000 years ago), which were warmer than or at least as warm as the present age (in spite of the pre-industrial atmospheric CO_2 levels in those times).

Even if we ignore these objections and keep assuming a measurable climate sensitivity to anthropogenic GHG emissions, many inconsistencies between the reality and the popular claim "meat = heat" still remain. CO_2 emitted by livestock respiration, forage digestion and the consumption of meat and milk, does not increase atmospheric CO_2 levels, as it is part of the natural carbon cycle. Not a single livestock-born CO_2 molecule is added *additionally* to the atmosphere, as it has previously been captured through photosynthesis. The amount of CO_2 released annually by livestock is offset by re-growing CO_2 assimilating forage. The only sources of *additional* CO_2 emissions caused by livestock husbandry beyond the natural carbon cycle are: (1) fossil fuel consumption during the production process, which is particularly low in grazing systems; and (2) deforestation for pasture establishment, which is partly offset by carbon captured by deep-rooted tropical grasses (Fisher et al. 1994), by persistent charcoal residues from burned wood (Mannetje 2007) and by bush encroachment and for-

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age hedgerow establishment. Deforestation causes a unique "carbon debt", which has to be shared out over the animal products generated during the total utilization period of the pasture, which replaced the forests, which may easily be hundreds of years (as in the case of European grasslands). However, for life cycle assessments of livestock products, this carbon debt is either neglected or charged entirely to the year of its appearance.

Just like CO_2, methane emissions also form part of a natural cycle with a relatively short atmospheric lifetime of 8.7 ± 1.3 years (IPCC 2007). Therefore, constant emissions from ruminant enteric fermentation cannot change atmospheric methane concentration, as they are counteracted by a constant or oscillating rate of breakdown. To my knowledge, not a single relevant publication takes this consideration into account, as livestock-born methane emissions are consistently interpreted at a 100% level as an *additional* anthropogenic GHG source, just like fossil fuel-born CO_2. Methane baseline scenario considerations over time and space are virtually absent in literature.

Between 1990 and 2007, the global cattle and buffalo population rose by more than 125 million head, or by 9% (FAO: http://faostat.fao.org/site/291/default.aspx), while the growth rate of atmospheric methane fell to zero (NOAA: www.esrl.noaa.gov/gmd/aggi). These empirical observations are hardly consistent with a domestic livestock contribution to anthropogenic methane emissions of 35–40% as claimed by Steinfeld et al. (2006). Quirk (2010) showed that historical increases of atmospheric methane concentrations are best explained by human fossil fuel consumption. The stabilization of methane emissions in the 1990s is very likely to be associated with the adoption of modern technology in fossil fuel production and use, particularly the replacement of leaking pipelines in the former Soviet Union. Since 2008, methane is slightly rising again, which Quirk (2010) attributes to natural atmospheric changes modulated by El Niño. The idea of a considerable livestock contribution to global methane emissions relies on theoretical bottom-up calculations. However, there is no discernible relationship between mean atmospheric methane concentrations, as measured by the ENVISAT satellite (http://goo.gl/OVkUJ3) over 3 full years (2003–2005) and global livestock distribution (Steinfeld et al. 2006, Map 20, p. 344).

Critique: "Livestock affects groundwater recharge and ineffectively uses huge amounts of water"

In the Chaco, groundwater recharge is less under bushland than under grassland (Glatzle et al. 2008). A great part of the beef industry in the semi-arid Chaco relies entirely and sustainably on locally harvested rainwater.

Critique: "Livestock causes loss of biodiversity through deforestation and grazing land development"

Paraguayan regulations on land clearing strictly prohibit pasture establishment on more than half of each cattle ranch's area, bringing about a diversification of habitats (pronounced bush-border effects, savanna-like grasslands, and rain water collection basins that provide water for wild game throughout the year as well). This causes an increase in the diversity of native vertebrate species by about 50% as compared with the closed pristine dry forest (Glatzle 2012).

Critique: "Grazing livestock 'consumes' a lot of land and ruminant food energy conversion is very poor"

Enteric cellulolytic bacteria enable ruminants (unique among vertebrates) to convert the most abundant substance in the biosphere, cellulose, into high value food, such as meat and milk. Therefore, grazing makes efficient use of marginal lands with highly fibrous feed, which comprise up to half the global terrestrial surface. Hence grass-fed beef is a complementary and not competing food for humans, thereby contributing considerably to global food security.

Conclusion

The contribution of domestic livestock and particularly grazing animals to climate change, as has been claimed in some published reports, has never been proved. Careful land development and appropriate management practices can assure full compatibility of grazing systems with the environment.

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