Raising the steaks: reducing GHG emissions from red meat

Dr Dianne Mayberry
CSIRO and RAID Network

Abstract

The red meat sector makes an important contribution to Australia's economy, but is also a contributor to national greenhouse gas (GHG) emissions. In 2005 (the baseline year for the Paris Agreement), emissions from the Australian red meat industry were 129.3 Mt CO_{2e}; 21% of national emissions. The main sources of emissions were CO_2 from forest land converted to grassland, and enteric methane from grazing beef cattle. Between 2005 and 2016, emissions attributed to the red meat sector decreased by 58% to 54.8 Mt CO_{2e} and 10% of national emissions. This large reduction was primarily due to decreased land clearing for grazing, but there has also been a modest increase in the efficiency of red meat production. Further reductions in GHG emissions from the red meat industry are possible through continued improvements in land management and new options to reduce methane emissions from ruminant livestock. As the custodians of almost half of Australian land, there are also opportunities for grazing livestock industries to be leaders in carbon sequestration. While possible, mitigation and sequestration activities come at a cost, and require investment and policy support from private and government bodies. This needs to be supported by a willingness of consumers, both in Australia and export markets, to pay a higher price for low-carbon products. This case study gives an update to our 2019 paper on carbon neutral pathways, and highlights some of the lessons from Australia that can be applied to developing countries.

The red meat industry is important to Australia and to developing countries. It supports the livelihoods of farming families, and is often the only economic land use in marginal areas where raising crops, pigs or poultry is not possible or profitable. In many systems ruminants also help farmers to mitigate risk by diversifying their sources of income and providing flexibility in their response to economic and environmental conditions.

Australia is one of the biggest producers and consumers of red meat in the world, and around 70% of what we produce is exported to other countries. Locally, the industry employs around 200,000 people and is worth AUD 16 billion. It is also the biggest land use in Australia, with most of our 24 million beef cattle and 71 million sheep raised in extensive grazing systems.

In developing countries, red meat production is a source of income for millions of smallholder farming families. Here, cattle, sheep and goats are used to provide draught power, transport, social status, savings, fibre, fertiliser (manure) and/or milk as well as meat. Red meat production in developing countries

This paper has been prepared from a transcript and the illustrative slides of the presentation.

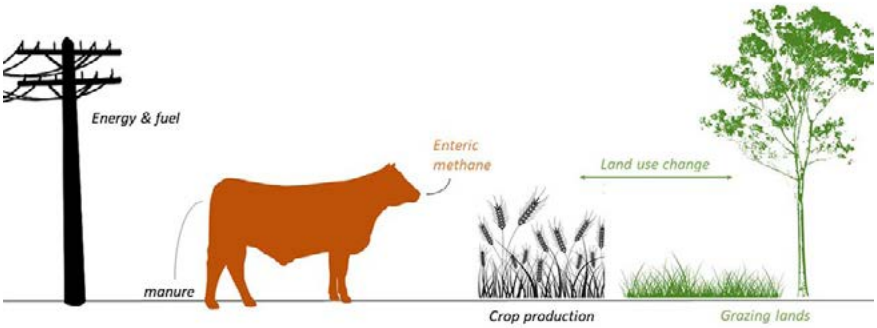


Figure 1. Sources of GHGs during red meat production.

ranges from intensive cut-and-carry systems with small numbers of animals, to extensive grazing of common lands. Productivity in these systems tends to be low, with poor rates of growth and reproduction, and high animal losses.

Worldwide, the red meat industry is facing many challenges, including pressure to minimise its contribution to greenhouse gas (GHG) emissions. To understand how to reduce greenhouse gas emissions from red meat production systems both in Australia and elsewhere, we need to understand the emission sources.

Understanding GHG emissions in red meat production

Greenhouse gases in red meat production come from livestock, crop and grazing land used to produce feed for livestock, and energy and fuel used for transport, machinery and processing (Figure 1). In Australia, the main sources of emissions are livestock and land use change (orange and green in Figure 1). Animal sources of emissions include methane from digestion of feed in the rumen, and animal waste (manure and urine). Enteric methane is the main source of emissions from animals, and the amount of methane produced is directly related to the quality of their diet: animals fed poor quality diets have larger emissions of methane. Emissions from land come from crop and pasture production (e.g. application of fertiliser, decomposition of plant residues, cultivation of soil), and changes to land use and vegetation (e.g. conversion of forest to grazing land).

In a study our team did for Meat and Livestock Australia, we quantified greenhouse gas emissions from the farm, feedlot and meat processing sectors for beef, sheep meat and goats, using data from the Australian National Greenhouse Gas Inventory (Mayberry et al. 2019). As Figure 2 shows, emissions from red meat production in Australia have decreased from 129 million tonnes of CO_2 equivalents (CO_{2e}) in 2005, which is the baseline year for the Paris Agreement, to 55 million tonnes CO_{2e} in 2016: a decrease from 21% to 10% of Australia's total GHG emissions, as CO_2 equivalents.

As a comparison, during the same period, emissions from the energy sector have increased from 65% to 81% of national net emissions.

The red meat industry has committed to further reductions in greenhouse gas emissions and this will rely on methods for reducing enteric methane, especially from grazing cattle, and continued improvements to land management.

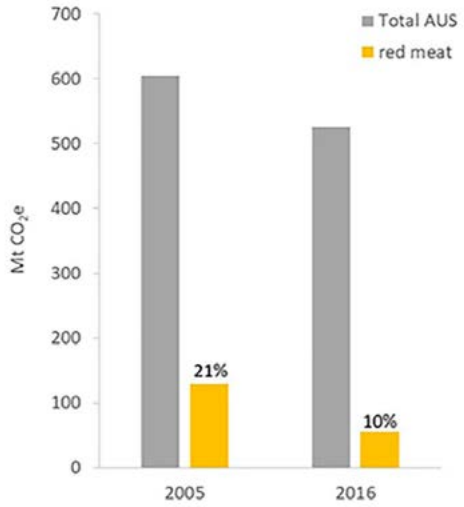


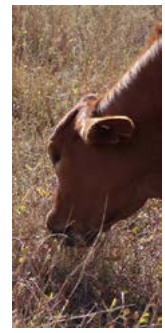
Figure 2. GHG emissions from the Australian red meat industry have decreased since 2005.

Reducing enteric methane

There are several ways to reduce methane production from ruminants, including via feed, vaccines, breeding and animal management.

Feed supplements or additives that reduce the production of methane in the animals' rumens are some of the most promising options. Supplements are perfect for intensive animal production systems such as feedlots, where managers have close control over what and when animals consume. However, most livestock in Australia are extensively managed in pastures or rangelands, and providing a daily feed additive is tricky!

Some current research suggests that tropical legumes, such as *Desmanthus* species, can also reduce enteric methane production from ruminants (Suybeng et al. 2019). Methane-reducing pastures are a much more practical option for graziers. This is important because even if reductions in methane production are not as large as those achieved by some of the feed additives, the method is applicable to a much larger proportion of the national livestock population.



Other options include vaccines that reduce methane production, and genetic selection of animals that naturally emit less rumen methane. While these options are still a long-term goal, especially compared to some of the feed additives, their wide applicability to livestock industries makes them an important part of pathways to reduce emissions.

Finally, methane emissions can also be reduced by improving the productivity of cattle and small ruminants so that we can produce more red meat from less livestock. This method is particularly important for developing countries, where reducing

animal losses and increasing rates of growth and reproduction are currently the goals of many ACIAR-funded projects.

Reducing emissions via land management

GHG emissions can also be reduced through changes in land management. The most important changes to land management are to reduce deforestation and to apply vegetation management that promotes carbon sequestration. These changes can start now. Recent reports have estimated that 58 Mha in Australia would be suitable for revegetation, much of which overlaps with current grazing areas (Bastin et al. 2019). This does not necessarily mean removing livestock from these areas, and increases in vegetation cover may provide some benefits to livestock – such as shade. Vegetation changes could be incentivised by payments for benefits such as carbon sequestration and biodiversity.

Conclusion

The latest IPCC report highlights the need for support from policy, government, markets and institutions to enable change in livestock industries. The red meat production industry requires consistent policies from our leaders, and consumers may need to be prepared to pay more for low carbon products. We also need to remember the multiple benefits of livestock, particularly in developing countries where livestock are kept for multiple purposes.

Finally, the red meat industry gets a lot of press about its contributions to greenhouse gas emissions, but it is not the biggest or only source of GHG emissions in Australia. Reducing emissions from red meat and other agricultural industries is part of the solution, but needs to be accompanied by change in other sectors.

References

Bastin J-F., Finegold Y., Garcia C., et al. 2019. The global tree restoration potential. *Science* **365**(6448): 76–79. DOI: 10.1126/science.aax0848

Mayberry D., Bartlett H., Moss J., Davison T., Herrero M. 2019. Pathways to carbon-neutrality for the Australian red meat sector. *Agricultural Systems* **175**: 13–21. https://www.sciencedirect.com/science/article/pii/S0308521X19301258

Suybeng B., Charmley E., Gardiner C.P., Malau-Aduli B.S., Malau-Aduli A.E.O. 2019. Methane emissions and the use of *Desmanthus* in beef cattle production in northern Australia. *Animals* **9**(8): 542.

Di Mayberry is a senior research scientist with CSIRO Agriculture and Food, a founding member and former Vice-President of the RAID network, and a former Crawford Fund conference scholar. Di combines her background in ruminant nutrition (sheep and cattle) with systems modelling approaches to improve the long-term viability of livestock production systems in Australia and developing countries. This includes the use of science to better understand and reduce the impacts of animal agriculture on the environment. Her research portfolio encompasses work at the animal, farm/household and regional scales, and she has worked on sheep, beef and dairy production systems in Australia, Indonesia, China, Myanmar, India and Tanzania.