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Tackling GHG Emissions from Livestock Production

To reduce agricultural emissions we need to reduce methane from livestock, and we need to do it in a way that supports farmer livelihoods.

Three sources account for about 70% of total agricultural greenhouse gas (GHG) emissions in Canada:

⇒ fuel combustion and electricity from fossil fuels → about 11%;

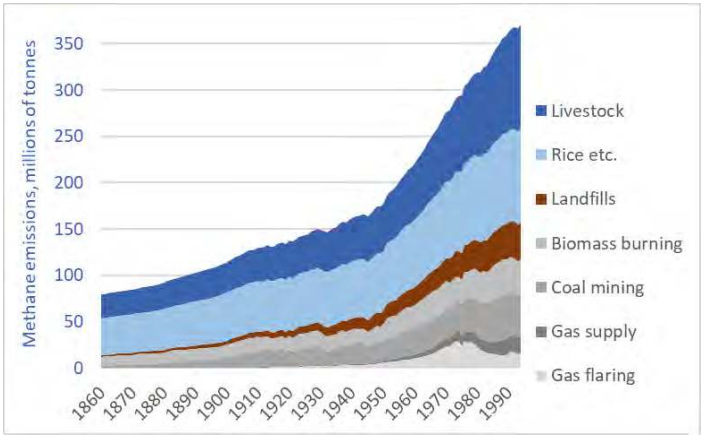
⇒ nitrogen production (11%) and soil emissions from fertilizer use (18%) → 29%; and

⇒ **emissions from livestock: enteric methane + emissions from manure storage + application → over 30%.**

Livestock: a problem or a solution

Methane is 28 times more effective than CO_2 at trapping heat. Humans have tripled atmospheric methane concentrations since 1800 through coal, oil, and gas production; rotting garbage in landfills; rice paddy agriculture; and livestock production—methane emitted from the mouths of cows and other ruminants as they digest grass -- and manure. This graph shows the relative contributions of these emission sources over 150 years.

One factor in rising livestock-related methane is sheer numbers. The total mass of domestic animals on Earth is 20 times that of all wild land mammals and birds.[1] There are 1.5 billion head of cattle, 3 billion sheep, goats, and hogs, and tens-of-billions of chickens, turkeys, and ducks[2] -- and growing! Global meat production doubled since 1986, quadrupled since 1964,[3] and will probably double again this century.[4]



Emissions of anthropogenic methane, 1860–1994
Source: D. Stern and R. Kaufmann, Boston University Center for Energy and Environmental Studies, https://cdiac.ess-dive.lbl.gov/ftp/trends/ch4_emis/ch4.dat

On the other hand, cattle are essential to healthy grassland ecosystems. Grazing can increase soil carbon levels and organic matter. This builds topsoil, enhances fertility, and helps retain water. Livestock enable us to produce food on land that could not, or that should not, be cropped. Animals are part of sustainable, nutrient-cycling mixed farming operations. An agricultural landscape that had only plant monocultures would be empty, lonely, and massively dependant on petro-industrial inputs, emitting vast quantities of GHGs.

Or both?

Our farms and food systems are complex. We must consider the whole system and how emission-reduction measures interact. Reductionism, black and white thinking, half-measures, one-size-fits-all and solutions too good to be true can do more harm than good.

For example, increasing soil carbon and reducing nitrous oxide emissions by adding alfalfa to crop rotations[5] could reduce its price, making it uneconomic to grow or could lead to bigger cattle herds, *increasing* enteric methane

Understanding methane from cattle
Humans cannot digest grass. Cellulose, which makes up most grass biomass, is especially difficult to digest. Cattle and other ruminants can digest grass, because their stomachs host bacteria that convert it to digestible compounds. The stomach is an "anaerobic" (airless) environment, so the bacteria exhale methane (CH4) instead of carbon dioxide (CO2). When cattle digest grass and forage they expel the CH4 out of their mouths. The methane problem in livestock is due to ruminants' digestive processes. It is not caused by feedlots, grain feeding, or factory farming, though these practices create other environmental problems.

emissions. *On the other hand*, if cattle numbers were reduced, farmers might turn hay fields and pastures into cropland, releasing soil carbon and adding nitrous oxide GHGs through nitrogen fertilizer use.

A climate-friendly cattle sector

Answers are most likely found in mixed-farming systems that utilize natural nutrient cycles; diverse animal and plant mixes; sensitive management; and best-possible grazing methods to restore soils, raise carbon levels, protect water, enhance biodiversity, and support sustainable livelihoods.

There are a host of technical changes farmers can make to their production systems to lower emissions from manure application and ruminant livestock and to sequester carbon in soils through enhanced grazing management. Many of these changes are already well underway.

To cut Canada's livestock emissions by 20 to 30%, more is needed. Options include reducing beef output by 10 to 15% and implementing practices that increase beef output per animal and reduce emissions per animal.

Grain and other livestock

To deal fully with livestock emissions we must also consider grain. Not all livestock production takes place on grass. In winter, animals are fed hay and grain; cattle are fed partly or wholly on grain in finishing operations before slaughter. Dairy cows are often fed carefully controlled mixes of silage and grains. When cattle eat grain their methane emissions go down. Most chickens and hogs are grain-fed. Grain has an emissions footprint from the fuel and fertilizer and chemicals that went into producing it. Low-emission livestock systems thus require access to low-emission grain and feed supplies.[6]

Manure

Methane from manure makes up about 10% of Canadian agricultural emissions. Manure produces methane when it decomposes in the absence of oxygen. This can be reduced through composting, biodigestion, or dry storage.

Balancing atmospheric methane

Unlike atmospheric CO_2, which lasts centuries, methane usually persists under ten years. Natural processes remove all but 10 million of the 558 million tonnes annually emitted from human and natural sources.[7]

Emissions from livestock are only part of the methane problem. Canada's fossil fuel production emits at least 47 million tonnes per year CO_2e[8] from methane — twice the amount from our cattle. Halving oil and gas-related methane would be equivalent to getting rid of all cattle in Canada, creating emissions space for continued cattle production.

A farmer-friendly livestock sector

Climate-friendly livestock systems are not just a production challenge. Technical improvements must go hand in hand with structural change to improve farm profitability.

In 1986, Canada had fewer cattle and a much lower output than it does today, but had *twice* as many farms raising cattle.[9] Globally dominant livestock packers push farmers to increase production to promote oversupply and move animals and meat across borders to "discipline" producers whenever prices threaten to rise. Poor net returns have pushed many Canadian livestock farmers out of business.

We need a system where fewer cattle support more farmers with sustainable incomes. We need to ensure that cattle are raised in ways that maximize soil-building, grassland health and other ecological services. To do this, we must get rid of control by huge meat industry corporations that maximize production and minimize farm gate prices. We must also address the gap between what consumers pay for meat and the prices farmers get.

Citizens, farmers, and governments can work together to reduce cattle-related emissions while restoring balance and farmer profitability by dismantling the corporate-controlled cattle-industrial complex and replacing it with a farmer-focused cattle-ecological collaboration.

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1 Y. Bar-On, R. Phillips, and R. Milo, "The Biomass Distribution on Earth," Proceedings of the National Academy of Sciences 115 (2018); A. Barnosky, "Megafauna Biomass Tradeoff as a Driver of Quaternary and Future Extinctions," Proceedings of the National Academy of Sciences 105 (2008); V. Smil, Harvesting the Biosphere: What We Have Taken from Nature (Cambridge: MIT Press, 2013)

2 United Nations Food and Agriculture Organization (UN FAO), FAOSTAT website, "Production: Live animals," http://faostat3.fao.org/browse/Q/QA/E Accessed September 29, 2016.

3 FAOSTAT website, "Production: Livestock primary,"

4 Nikos Alexandratos, Jelle Bruinsma, and others, "World Agriculture Towards 2030/2050: The 2012 Revision," EAS Working Paper (Rome: UN FAO, 2012), http://large.stanford.edu/courses/2014/ph240/yuan2/docs/ap106e.pdf.

5 Alison J. Eagle et al., "Greenhouse Gas Mitigation Potential of Agricultural Land Management in the United States: A Synthesis of the Literature," 3rd Ed. (Durham, NC: Duke University, The Nicholas Institute for Environmental Policy Solutions, 2012), 15, https://nicholasinstitute.duke.edu/ecosystem/land/TAGGDLitRev.

6 See Tackling the Farm Crisis and the Climate Crisis for ways to reduce grains-related emissions.

7 Marielle Saunois and 80 coauthors, "The Global Methane Budget 2000–2012," Earth Systems Science Data 8, no. 2 (2016).

8 Environment and Climate Change Canada, Canada's Official Greenhouse Gas Inventory, http://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/

9 Statistics Canada Table 32-10-0155-01 (formerly CANSIM 004-0004).