Agricultural emissions make up about 12% of total Canadian emissions.\textsuperscript{1} Canada’s farms produce three main greenhouse gases:\textsuperscript{2}

\begin{itemize}
  \item Carbon dioxide (CO\textsubscript{2}) from combustion of farm fuels; production of the electricity used on farms; and production of farm inputs (fertilizers, chemicals, machinery, etc.);
  \item Nitrous oxide (N\textsubscript{2}O) from nitrogen chemistry in our soils (and this mostly from the application of synthetic nitrogen fertilizer), with some from manure; and
  \item Methane (CH\textsubscript{4}) emitted from the mouths of cows as they digest grass, with some from manure decomposition.
\end{itemize}

Agricultural emissions are rising -- up about 20% since 1990. The 11 categories of emissions shown can be grouped into 3 main classes: nitrogen fertilizer related (shown in green); fossil fuel consumption (red); and livestock-related (blue).

Nitrogen fertilizer emissions from “Soils,” are mainly nitrous oxide from nitrogen fertilizer application\textsuperscript{3} and “Fertilizer and chemical production,” and from CO\textsubscript{2} emitted during nitrogen-fertilizer manufacturing. This also includes emissions from the production of other fertilizers and pesticides.

Fossil fuel consumption emissions are from on-farm use of gasoline, electricity, heating fuels, and diesel.

Emissions from “Manure storage and application” are nitrous oxide and methane emissions from wet or dry storage and application of hog, poultry, sheep, and cattle manure (pasture-dropped manure is excluded). “Enteric fermentation” is methane emitted from the mouths of ruminants (mostly cattle) when they digest grass.

Emissions related to the production and use of nitrogen fertilizer are driving the increase, increasing faster than overall emissions. Emissions associated with nitrogen fertilizer increased by more than 50% between 1990 and 2017. The tonnage of nitrogen fertilizer used in Canada doubled since 1993; in Saskatchewan, it has quadrupled since 1991.
The diagram above is another way of showing agricultural sources described above. Factories and mines that produce fertilizers (nitrogen, potassium and phosphorus), pesticides, or machinery emit CO₂. The generation of electricity also emits CO₂, except in jurisdictions where much of the electricity comes from hydroelectric dams. Heating the house and powering the tractor releases CO₂ as fuels are combusted. Nitrogen fertilizers and manure applied to the land give off N₂O, as does manure storage and handling and manure dropped in pastures. Cattle give off CH₄, as does manure storage.

To produce, transport, and apply one tonne of nitrogen fertilizer requires energy equivalent to nearly two tonnes of gasoline. Nitrogen-fertilizer factories have a natural gas pipeline feeding into one end and an ammonia pipe coming out the other. The ammonia is used directly or as feedstock for granular nitrogen fertilizers. Nitrogen fertilizer creates emissions in its manufacture (mostly CO₂) and when applied to fields (mostly N₂O). Roughly 28% of all Canadian agricultural emissions come from the manufacture and application of nitrogen. As we double and redouble its use, agricultural emissions rise.

Farmers farmed for 9,900 years and GHG levels did not rise. Farming did not alter the atmosphere or the climate. Now, however, our high-input, high-energy-use system is a huge source of climate-destabilizing emissions.

During the 20th century, we broke open the circular flows of energy, fertility, seeds, etc. that were the basis of agriculture for 9,900 years. Today, our food systems are high-output, high-throughput, linear systems. Nearly all the inputs we push into one end must come out the other. The more fertilizer and other inputs we push into our food systems, the more emissions we push out.

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1. This percentage does not include transport of farm inputs and products by non-farm trucks or by rail. Including those emissions from transport, however, would leave the 12% figure largely unchanged.

2. In addition to these main sources, agricultural land use also creates emissions from the conversion of forests to farmland; the destruction of shelterbelts, bluffs, and other trees; and the destruction of wetlands. The removal of trees and wetlands is often driven by farm economics and the imperative to farm ever more land to makes ends meet. In this and other ways the challenging farm income situation contributes to rising emissions.
