

Agriculture and Greenhouse Gas Emissions

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Background

A 2006 report by the Food and Agriculture Organization (FAO) of the United Nations found that livestock generated ~18% of all global anthropogenic greenhouse gas (GHG) emissions. This report also stated that livestock produced more GHGs than the entire global transportation system. This report and extrapolation of the data presented has often been used to blame agriculture (livestock in particular) as being large contributors to global warming and the destruction of our planet.

There are two primary problems with using this data to describe US agriculture:

- In this study, livestock emissions were calculated using a lifecycle approach (all emissions connected to the good or service are tabulated -- regardless of which industry, or economic sector produced them). However, the transportation values were calculated based only on tailpipe emissions. For the results to be comparable, the same approach (e.g., lifecycle approach) should be used for both the transportation and livestock emissions.
- Global values for GHG emissions from livestock are not representative of GHG emissions from livestock in the US.

A more recent estimate by the FAO (2013) attributes ~14.5% of the total anthropogenic GHG emissions as coming from livestock. This report also uses a lifecycle approach for determining livestock emissions; but, only tailpipe emissions for the transportation sector.

Based on direct emissions, livestock contribute ~5%, and transportation contributes ~14%, of the global GHG emissions (Mottet and Steinfeld, 2018).

Current U.S. Greenhouse Gas Emissions by Sector

The US EPA (2020) has identified agriculture as contributing ~9.3% of the total GHG anthropogenic emissions based on CO₂ equivalents. Of this, livestock and agricultural soil management contributed ~4% and ~5%, respectively, of the total anthropogenic emissions for GHG in the U.S. (Figure 1).

EPA data (2020) attributes over 50% of the agricultural emissions to agricultural

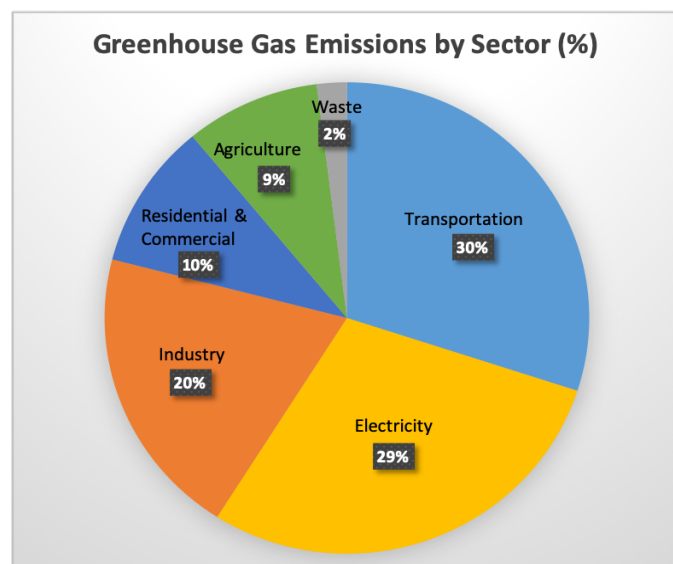


Figure 1. Greenhouse gas emissions (CO₂ Eq.) by sector.

soil management – primarily from N₂O released as microbes decompose organic matter and the nitrification/denitrification processes. Beginning with the 2020 report, EPA updated the calculations and reporting for many agricultural activities to match that of the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National GHG Inventories.

Livestock GHG Emissions -- Global vs U.S.

The majority of the global livestock impact occurs in developing countries, chiefly due to inefficiencies (FAO, n.d.). As we improve efficiencies, the percentage of energy that goes toward animal production increases, and maintenance decreases. This results in a reduction of the carbon footprint per glass of milk, pound of meat, etc. produced.

In the U.S., production efficiencies have improved greatly due to better reproductive efficiency, improved veterinary care, improved genetics, and nutrient-rich diets. In 1950, there were ~25,000,000 dairy cows in the U.S. In 2018, there were ~9,000,000 dairy cows. Yet in 2018, we produced 60% more milk than we did in 1950, resulting in a reduction in the carbon footprint per glass of milk by ~2/3's (Mitloehner, 2019).

Developing countries do not have the same production efficiencies as the U.S., which results in more GHG emissions per unit of production. Milk production per cow/year in India and Mexico are 5% and 20% of the U.S. production, respectively (Mitloehner, 2016, 2019).

Methane Emissions from Cows

Note: The Cows and Climate Video (<https://www.youtube.com/watch?v=RW8BclS27al>) provides a nice overview of methane emissions and cows.

Summary: The carbon in methane produced by cows cycles from being in a plant to CH₄ to CO₂ back into a plant. As long as the number of cows/ruminants stays the same, the amount of CH₄ in the atmosphere will stay the same. The steps are outlined below:

- Photosynthesis removes carbon (as CO₂) from the atmosphere and produces carbohydrates (plant material).
- Livestock eat plants releasing some of the carbon as CH₄.
- Methane has a short life-span (~10 yrs). Methane is converted to CO₂ through a process called hydroxyl oxidation.
- CO₂ lasts ~1,000 yrs.
- As the sun hits carbon molecules in the atmosphere, the molecules heat up contributing to global warming.
- Some of the CO₂ is removed from the atmosphere through photosynthesis to produce plant material.
- As long as the number of cows/ruminants stays the same, an equilibrium is achieved, and we are not adding new carbon to the atmosphere.
- No additional livestock = No additional CH₄ = No additional global warming.

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