

# The Dairy and Beef Cattle Industry and its Impact on Climate Change

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## Abstract

Climate change results in the gradual warming of the Earth. This increased temperature causes extreme events such as floods and fires. The objective of this study is to characterize the relationship between the global dairy cattle industry and climate change. It is hypothesized that this industry generates significant greenhouse gases (GHG) which contribute to climate change. Peer reviewed journals and research databases were used to familiarize the relationship. Global GHG emissions vary by type of gas and sector, with carbon dioxide (CO<sub>2</sub>) accounting for 76% and agriculture representing 24% of emissions. Within the agriculture industry, the food animal sector is responsible for 8%-18% of all emissions, with beef (41%) and dairy cattle production (19%) accounting for most of this sector's emissions. Global emissions from cattle milk and beef production vary by category of emissions (2). The main source of GHG is enteric fermentation, with feed fertilization being the second largest source, and N<sub>2</sub>O emissions from manure and fertilizers the largest. CH<sub>4</sub> from cattle production is generated largely from enteric fermentation and minimally from manure management. The sources of CO<sub>2</sub> emissions are small. Emission intensities for beef and cattle milk production vary by region. North America, Eastern Europe, the non-EU former Soviet Union and Western Europe are efficient producers of meat and milk energy. Africa, Asia and Latin America are the least efficient regions. The magnitude of GHG emissions from the global beef and dairy cattle industry is a sizable one. Ongoing mitigation efforts must be supported in order to minimize contribution to climate change.

## Objective & Hypothesis

The objective is to characterize the relationship between the dairy and beef cattle industry and climate change.

It is hypothesized that the beef and dairy cattle industry generates a significant amount of greenhouse gases

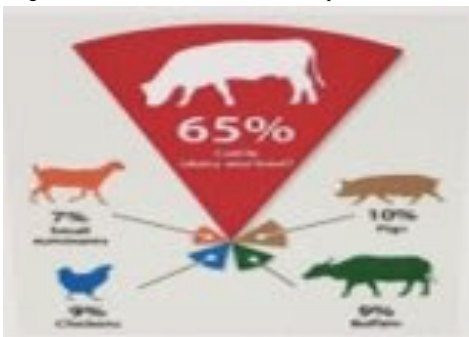
## Introduction & Background

Methane (CH<sub>4</sub>), Nitrous Oxide (N<sub>2</sub>O), and Carbon Dioxide (CO<sub>2</sub>) emissions from (farm) animal agriculture account for 8%-18% of all man-derived GHG emission, thereby contributing greatly to climate change (2). These greenhouse gases are generated when manure is managed, fertilizers are made, feed crops are produced, ruminants undergo enteric fermentation, and when meat, eggs, and milk are shipped (1). Within the animal agriculture sector, it is the global beef and dairy industry which is responsible for most GHG emissions, "generating more GHG emissions than all the world's cars (and) threatening long-term climate targets" (2). CH<sub>4</sub> and N<sub>2</sub>O have significant global warming potential. Furthermore, this industry is expected to increase its food production to meet the demands of a growing world population (3). Unless successful mitigation efforts are put in place, this industry will generate higher rates of GHG emission as food production increases, potentially threatening climate stability. Examining the relationship between the dairy and beef cattle industry and climate change, therefore, is of the utmost importance.

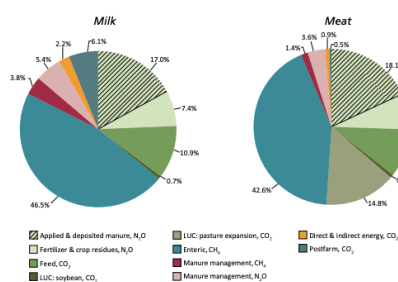
## Methods

## Results

Figure 1: Livestock Gas Emissions Per Species



Pie Chart 1: Global Emissions from the Cattle and Dairy Industries



Bar Graph 1: Regional Variation in Cattle Milk Production and GHG Emission Intensities

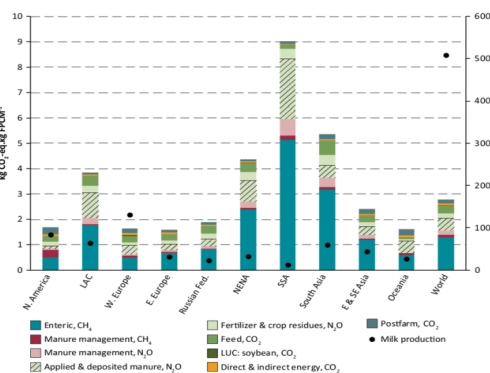


Figure 2: Projected Change in Average Annual Temperature

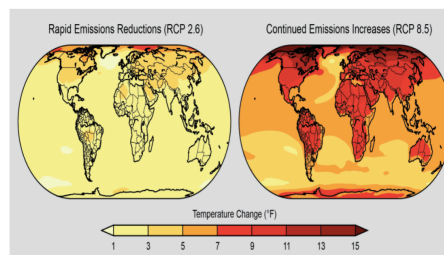
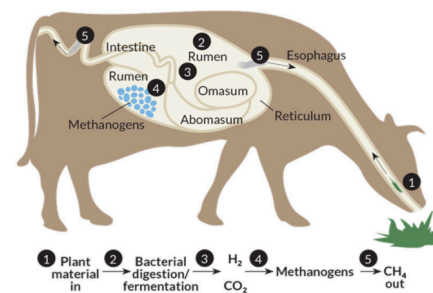
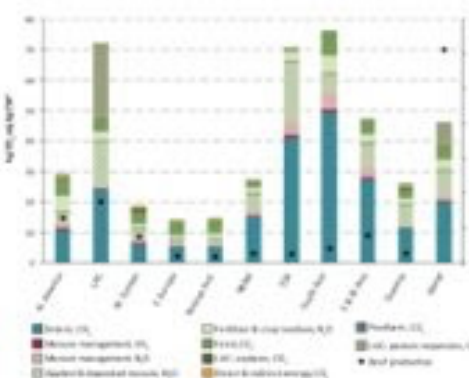


Figure 3: Processes of Methane Production in Ruminants



Bar Graph 2: Regional Variation in Beef Production and GHG Emission Intensities



## Summary

- ❖ The animal agriculture sector is responsible for 8%-18% of all green house gas (GHG) emissions, measured in carbon dioxide equivalents. (2)
- ❖ Beef and dairy cattle account for 65% of the livestock sector's emissions. (2)
- ❖ CH<sub>4</sub> and N<sub>2</sub>O are GHGs emitted in sizable proportions from the global beef and dairy cattle industry and may have significant global warming potential.
- ❖ It is predicted that the world's population will increase from the current 6.5 billion to 9.1 billion by 2050. Unless there are successful mitigation efforts, the beef and dairy cattle industry will generate higher rates of GHG emission as it increases its food production to meet the demands of a growing population (3).
- ❖ There is significant regional variation in global GHG emission which suggests that "the pathway to a reduced GHG emission is complex and challenging" (4).

## Future Studies

Ongoing research to find innovative ways to reduce GHG emission through cattle:

- ❖ Cow vaccines to help reduce methane production
- ❖ Seaweed, probiotics, edible oils, ionophores and other feeding supplements to help reduce methane production
- ❖ Improved genetics and breeding to generate smaller herd sizes which can still deliver increased beef and dairy production (5)
- ❖ Improved management of manure and grazing lands
- ❖ Technical/mechanical measures to prevent released methane from entering atmosphere
- ❖ Increased numbers of trained veterinarians who can assist in the production of healthier, more productive animals by reducing the prevalence of diseases/parasites.

## References

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