

The carbon footprint of cattle milk

CarbonCloud has assessed the carbon footprint of cattle milk. This document gives a short summary of how the calculations were done and what is included.

An attributional approach to life cycle accounting

We use the so-called "attributional" approach to life cycle accounting. This means that the processes used to produce a product are considered, and their combined climate impact is attributed to the product. This contrasts to the "consequential" approach, which is used to assess the climate impact from changing the level of output of a product.

From cradle to store

We assess the climate footprint of the product from "cradle to store". In this case it means that we consider all major steps of the life cycle up until the product reaches the gate of the grocery store. Hence, the calculated climate footprint does not consider e.g. lighting and refrigeration at the grocery store, transport from grocery store to home, cooking of product or disposal of packaging.

What is included?

The emissions from the agricultural production of cattle milk are calculated with ALBIO, a computer model that calculates all major greenhouse gas (GHG) emissions related to the production of a specified food product. The model accounts for:

- Emissions of nitrous oxide (N_2O) from mineral soils used for feed production and grazing
- Nitrous oxide and methane (CH_4) from manure management
- Methane from enteric fermentation
- "Indirect" emissions of nitrous oxide related to ammonia and nitrate emissions
- Emissions of nitrous oxide and carbon dioxide (CO_2) from organic soils used for feed production and grazing
- Carbon dioxide emissions from production and use of fuels (e.g. for tractors and machinery) and electricity at farm and dairy
- Carbon dioxide emissions from transport of inputs to farm, and from farm to dairy
- Emissions of carbon dioxide and nitrous oxide from production of mineral fertilizers and other inputs

A more detailed description of the ALBIO model can be found in Bryngelsson et al (2016). The total climate impact also includes emissions from packaging and transport from dairy to market.

What is not included?

Most importantly the calculations omit

- Capital goods (e.g., manufacture of machinery, trucks, infrastructure)
- Corporate activities and services (e.g., research and development, administrative functions, company sales and marketing)
- Travel of employees to and from works

We estimate that emissions from these sources are small compared to the total, and therefore can be neglected.

Key parameters

Key parameters for our assessment of the climate impact of cattle milk include:

- Whole-milk production per cow and year
- Weight of cow
- Number of calves born per cow and year
- Feed ration of cow and replacement heifer
- Grazing period
- Annual yield per hectare of each crop included in feed ration
- Share of cropland and grazing land that is located on organic soil
- Type of manure management system
- Emission factors of manure management systems
- Average CO₂ emission intensity of electricity production
- Type of packaging
- Fat content of consumer milk

Electricity use

For electricity we apply an emission intensity factor that accounts for upstream emissions and power losses.

Time horizon

We use yield data representing the average of the most recent 5-year period.

The weighting of greenhouse gases

The total climate impact is given in CO₂ equivalents. All greenhouse gases are weighted with the latest values of GWP₁₀₀ given by IPCC.

Allocation

When a process generates more than one product, the climate impact from the process needs to be allocated between the products. We allocate emissions between milk of different fat contents according to industry standard.

References

Bryngelsson, D., Wirsenius, S., Hedenus, F., & Sonesson, U. (2016). How can the EU climate targets be met? A combined analysis of technological and demand-side changes in food and agriculture. *Food Policy*, 59, 152-164.