Meat Institute

Greenhouse Gas Accounting Emissions Factors Briefing

Background

The Meat Institute is the oldest and largest trade association representing U.S. packers and processors of beef, pork, lamb, veal, turkey, chicken, and other meat products. We support the industry through regulatory, scientific, legislative, communications, and educational work. Our goal is simple: help build trust and confidence in meat and poultry by being transparent and using solid, science-based information—without ever touching competitive business decisions.

Many companies use greenhouse gas accounting frameworks, like the Greenhouse Gas Protocol, to calculate emissions from their supply chains, however there is no single U.S. standard for how to do this, so companies often rely on third-party tools, databases, or consultants. These resources can feel like "black boxes," making it hard to see how numbers are calculated and to build an informed strategy for action. That's why the industry is asking for more clarity and consistency—so reporting is easier to understand and supports better decision-making.

This report points shines light on the status of scope 3 emission factor usage and highlights practical ways companies can improve how they measure and report their supply chain impacts. Over the past year, packers and processors shared their experiences through surveys, interviews, and roundtables hosted by the Meat Institute Sustainability Committee, along with input from independent experts.

No sensitive or competitive information was asked for or shared at any point. All feedback was aggregated and anonymized. Participation is voluntary, doesn't influence business decisions, and every company remains free to choose whatever accounting methods, suppliers, or reporting approaches work best for them. Anyone interested in contributing or joining future conversations is welcome.

For more information, please contact Sam Wildman Swildman@meatinstitute.org

Scope 3 Emission Factors for Beef:

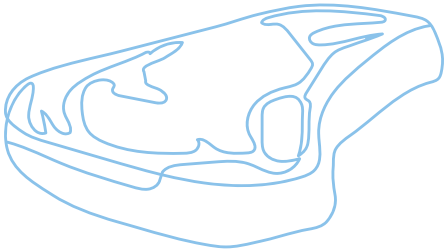
Reported emission factors for beef range widely—from 21.4 to 33 kg CO_2e per unit. The most common functional units were live weight and carcass weight, though some reported their functional unit using spend-based accounting. We have selected to omit spend-based emission factors from this study for consistency of comparisons. Most system boundaries focus on upstream emissions from raising cattle, though a few also include some processing plant impacts.

Many stakeholders reported utilizing the same study (Rotz, 2019), to identify their beef emission factors suggesting it is a commonly used reference for understanding emissions from U.S. beef production and may serve as a reliable U.S. emission factor for beef. Within the submissions that cited Rotz, 2019 as the source for their emission factor, there is some variation, which is likely due to regional specifications or further manipulation to fit the context of their specific system.

Type and Region	Scope	Source	Year	Functional Unit	Value	FLAG Value Integrated in Emission Factor	IPCC Values
Beef cattle, United States	Cradle-to-farm gate	Rotz et al.	2019	CO_2e/kg carcass weight	23.3	No	AR5
Beef cattle + dairy culls, United States	Cradle-to-farm gate	Rotz et al.	2019	CO_2e/kg carcass weight	21.3	No	AR5
Beef cattle, United States	Cradle-to-farm gate	Putman et al.	2023	CO2eq/ kg carcass weight	24.45 (adapted w/ AR6)	No	AR6
Beef cattle, United States	Cradle-to-farm gate	Putman et al.	2023	CO2eq/ kg carcass weight	21	No	AR5
Beef co-product, food grade, Ireland	Cradle-to-farm gate	Blonk Agri-footprint 2.0	2014	Kg CO2eq/ kg	13.51	No	AR4
Beef cattle, Global	Cradle-to-gate	AGRIBALYSE	2024	kgCo2e / kg product purchased	33.8	No	AR5
Beef production, United States	Cradle-to-gate	Ecoinvent (v 3.10)	2024	kg CO2e/ kg live weight	18.46	No	AR5

Beef Insights Continued:

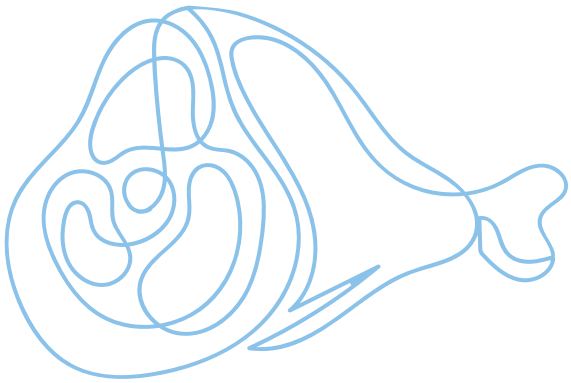
Type and Region	Scope	Source	Year	Functional Unit	Value	FLAG Value Integrated in Emission Factor	IPCC Values
Beef production, United States	Cradle-to-gate	Ecoinvent (v 3.10)	2024	kg CO2e/ kg live weight	18.46	No	AR5
Beef production, Brazil	Cradle-to-gate	Ecoinvent (v 3.10)	2024	kg CO2e/ kg live weight	22.85	No	AR5
Beef cattle, Canada	Cradle-to-farm gate	National Beef Sustainability Assessment	2016	kg CO2e/ kg live weight	10.4	No	AR6
Beef cattle, Canada	Cradle-to-harvest gate	National Beef Sustainability Assessment	2016	Kg CO2e/ kg boneless beef	22.6	No	AR6
Beef, United States	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	KG CO2e/KG Live Weight	17.66	Yes CEDA	AR5
Beef, Canada	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	KG CO2e/KG Live Weight	22.92	Yes CEDA	AR5
Beef, New Zealand	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	KG CO2e/KG Live Weight	18.01	Yes CEDA	AR5
Beef, Australia	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	KG CO2e/KG Live Weight	28.31	Yes CEDA	AR5



Scope 3 Emission Factors for Pork:

Reported emission factors for pork range from about 3.08 to 9.3 kg CO_2e per kilogram. The variance is mainly due to differing system boundaries and functional unit selections. Multiple stakeholders reported using the same study (Thoma, 2015) in their emission factor selection, which seems to be the most used and trusted reference for U.S. pork today.

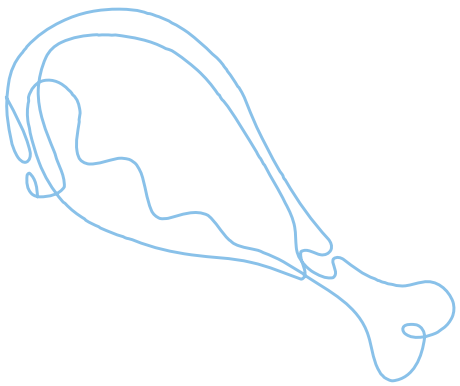
Type and Region	Scope	Source	Year	Functional Unit	Value	FLAG Value Integrated in Emission Factor	IPCC Values
Pork, United States	Cradle-to-farm gate	Thoma et al.	2015	Kg CO2e / kg live weight	3.08	No	AR4
Pork, United States	Cradle-to-harvest gate	Blonk Agri-footprint 2.0	2014	Kg CO2eq/ kg	4.36	No	AR4
Pork, United States	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	KG CO2e/KG Live Weight	8.03	Yes CEDA	AR5
Pork, Global	Cradle-to-gate	AGRIBALYSE	2024	MTCo2e / MT of product purchased	9.3	No	AR5



Scope 3 Emission Factors for Poultry:

Reported emission factors for poultry range from 0.2 to 3.36 kg CO_2e per kilogram. The range seems to relate again to the differing system boundaries and functional unit selections. None of the reported emission factors are based on publicly available literature or data, indicating that either companies can get more accurate and credible data through third-parties, or no data exists in the public domain.

Type and Region	Scope	Source	Year	Functional Unit	Value	FLAG Value Integrated in Emission Factor	IPCC Values
Chicken, United States	Slaughterhouse	Blonk Agri-footprint 2.0	2014	Kg CO2eq/ kg functional unit?	0.204	No	AR4
Chicken, United States	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	Kg CO2eq/ kg live weight	2.94	Yes CEDA	AR5
Chicken, United States	Cradle-to-gate	Ecoinvent (v 3.10)	2024	kg CO2e/ kg live weight	2.35	No	AR5
Chicken, Global	Cradle-to-gate	AGRIBALYSE	2024	MTCo2e / MT of product purchased	3.36	No	AR5
Turkey, United States	Slaughterhouse	Ecoinvent, TRACI 2.2 analysis	2014	Kg CO2eq/ kg functional unit?	0.204	No	AR5
Turkey, United States	Cradle-to-gate	Watershed (Ecoinvent v 3.9.1)	2024	Kg CO2eq/ kg live weight	3.04	Yes CEDA	AR5



Knowledge Gaps

The reported information provides context on how companies are calculating supply-chain emissions and highlights how the scope 3 accounting field is still an immature discipline which relies on imperfect and sometimes inconsistent data. This section outlines key knowledge gaps where clearer guidance and alignment on best practices could make reporting easier and more reliable.

1. Spectrum of maturity and carbon accounting programs

Every organization operates in a different business context, meaning that supply chains, geography, customer requirements, voluntary and regulatory compliance approaches, and stakeholders need change for each unique situation. Advancing industry knowledge and sharing of best practices will increase capacity across the industry as each business addresses the context facing their organization.

2. Inconsistent System Boundaries

Different life cycle analyses (LCA) endpoints will be required for packers and further processors. For packers the associated emissions from harvest will be reflected in their Scope 1 & 2 inventories. However, processors emissions associated with harvest will also be included in their Scope 3 inventory.

3. Calculating Warming Impacts

Different methods for estimating methane and nitrous oxide can produce very different results—sometimes two to three times higher or lower. The tables provide transparency in what modeling approach is used, but comparison of emission factors based on this data alone would be inappropriate due to the previously identified challenges with data consistency, system boundaries and functional units in reporting. This report is a resource to use in advancing your strategy with data providers to explain their approach so you understand whether it's the best fit for your needs.

4. Integration of Land use change impacts

The tables outline whether land use change values (FLAG) are included in the reported emission factors. A "no" in this column doesn't mean a company isn't reporting land use change associated with purchased raw materials in their corporate inventory, it could be reported separately from their beef emissions factor. For comparison of the data reported, what this means is that if a company is integrating LUC into their beef emissions factor, the value will be higher, whereas if they are calculating them separately, the value will be lower, but the net emissions associated with beef + LUC won't necessarily be lower. More guidance is needed on the most appropriate way to report across the industry so that accurate analysis and comparison can occur. Understanding the integration of LUC in the emissions factor is important as well because GHG Protocol Land Sector Removals Standard is referenced as the guideline for compliance with California SB 253, and reporting these LUC values is now a requirement of the standard.

5. Differences in data sources and regional values

Frameworks like SBTi FLAG outline the use of values that differ significantly from some of the regionally specific research such as the U.S. sources reported in this paper. More transparency and guidance on which sources are being used—and why—would help close these gaps and avoid confusion.

Terminology

System Boundaries

- Cradle-to-farm gate: associated with upstream impacts of the packers
- Cradle-to-harvest gate: associated with upstream impacts + harvest emissions (important because this is needed by further processors)

IPCC AR Methodology and Definitions

- The Intergovernmental Panel on Climate Change (IPCC) issues assessment reports (AR) to the United Nations. Values associated with warming impact of each ghg emission source are updated in each version of the methodology
- Common factors include AR4: IPCC 2007 values, AR5: IPCC 2013 values, AR6: IPCC 2021 values. More information available here.

FLAG Values

- The Science-Based Target initative (SBTi) defines how report on targets for emissions reduction associated with Forest, Land and Agriculture (FLAG). These values are not always integrated into emission factors, as they can be reported separately from purchased goods and services in a corporate GHG inventory.

Additional Resources to share:

- Watershed Comprehensive Environmental Data Archive (CEDA)
- EDF/Deloitte SBTi FLAG meta analysis
- STBi FLAG Commodity Pathway data in target setting tool
- FAO GLEAM for global data live Animal emission factors (Category 1)
- US EEIO Purchased Goods & Services/ Capital Goods
- AgriFootprint for bulk commodity LCA information
- GOV.UK - Department for Energy Security and Net Zero - Fuel & Energy Related
- Ecoinvent - Scope 3 all categories
- WFLDB: World Food LCA Database - Quantis

Informing Future Work

The Meat Institute is creating a new resource hub to help the industry—and everyone in its supply chains—tackle greenhouse gas reporting in a clearer, more practical way. We know this work benefits from many viewpoints, including farmers and ranchers, packers and processors, restaurants and retailers, researchers, consultants, auditors, and verification partners.

If you have ideas, questions, or experiences to share, we'd love to hear from you. Reach out to Sam Wildman at swildman@meatinstitute.org to get engaged.

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For More Information:

Sam Wildman, Strategic Projects Director
swildman@meatinstitute.org