Table 1. Summary of global carbon footprint studies associated with beef production. Carbon footprint values given in italics have been converted to kg CO_2e per kg LW.

Study Region	Method/Boundaries/ Allocation	Management/ spatial scale	ΔSOC from LMC ^{†,‡}	ΔSOC from LUC [†]	Footprint kg CO ₂ e per kg LW	Ref	Notes
Mid-West USA	IPCC Tier 1 and 2/cradle to farm gate/chemical energy of co-products	Feedlot finished/ study	eq	×	14.8	—[27]	Inclusion of carbon sequestration associated with LMC reduces carbon footprint to 13.6 and 11 kg CO ₂ e per kg LW for feedlot and pasture finished beef.
		Pasture finished/ study			19.2		
Mid-West USA	IPCC Tier 1 + literature survey/cradle to farm gate/ none	Conventional cow- calf to feedlot/study	\checkmark	×	13.0	[28]	Also provided are emissions estimates associated with 5 alternative production scenarios.
Western Canada	IPCC Tier 1 + 2/cradle to farm gate/none	Conventional cow- calf to feedlot/study	eq	×	13.0	[24]	
Eastern Canada	IPCC Tier 1 + 2/cradle to farm gate/ none	Conventional/ regional + national	\checkmark	×	15.3	_[14]	Updated values from Vergé <i>et al.</i> [14], including emissions associated with LMC and allocated emissions from culled dairy cows and calves.
Western Canada					8.4		
EU-27	IPCC Tier 1 + 2/cradle to farm gate + imported feed/nitrogen content of	Conventional production system specific to each	×	×	10.4	[29]	Estimate including emissions from LMC and LUC represents a mid-range scenario. Values converted from kg CO ₂ e per kg beef (carcass weight).
	products + energetic requirements of cattle	EU-27 member state/national	\checkmark	\checkmark	13.3		
Ireland	IPCC Tier 2/cradle to farm gate/mass based	Conventional suckler beef/study	×	×	13.0	[19]	Several scenarios where emissions from dairy bred animals are estimated. Knowing the ratio of animals reared using each management scenario, it would be possible to estimate a regional average.

Study Region	Method/Boundaries/ Allocation	Management/ spatial scale	ΔSOC from LMC ^{†,‡}	ΔSOC from LUC [†]	Footprint kg CO ₂ e per kg LW	Ref	Notes
Sweden	Not given/cradle to farm gate /none	Organic/study	×	×	11.6	[30]	Various approaches to allocating emissions are discussed, and system expansion is recommended. Value has been converted from kg CO ₂ e per kg bone free meat.
Charolais, France	IPCC Tier 2/cradle to farm gate/not specified	Conventional/study	×	×	14.3–18.3	[31]	Range in emissions for 5 beef production systems. May be suitable as a regional average, however allocation of dairy emissions is not specified.
United Kingdom	Literature based emission factors/cradle to farm gate/primarily economic	Conventional/study	×	×	8.7	[32]	Values have been converted from kg CO ₂ e per tonne beef.
		Organic and alternative/study			10.4		
European Union	IPCC Tier 1/cradle to farm gate + imported feed/ feed energy based	Conventional suckler beef/study	×	×	15.6	- [33]	Approaches to allocating emissions from LUC are presented and assuming a 20 year depreciation period this would increase the carbon footprint by a factor of 3.1 to 3.9. Values have been converted from kg CO ₂ e per kg meat.
		Conventional dairy bred beef/study	×	×	8.6 to 10.1		
NSW, Australia	IPCC Tier 2/cradle to farm gate/none	6 different systems/ study	×	n/o	10.1 to 12.7	[15]	

Table 1. Cont.

Study Region	Method/Boundaries/ Allocation	Management/ spatial scale	ΔSOC from LMC ^{†,‡}	ΔSOC from LUC [†]	Footprint kg CO2e per kg LW	Ref	Notes
NSW + Victoria, Australia	Australian National Inventory report/cradle to exit gate of the meat processing plant/mass based	Organic/ study	×	×	7.9	- [34]	Nitrous oxide emissions from leguminous pastures are excluded, which may underestimate emissions by
		Conventional/ study			8.0		less than 10%. Values have been converted from kg CO ₂ e per kg hot standard carcass weight.
Brazil	IPCC Tier 1 + literature survey/ cradle to farm gate / primary product based	Conventional/ – national	×	×	14.3	[9]	Spatial attribution of emissions from LUC have a significant impact on emissions, and range from 22 to 370 kg CO ₂ e per kg LW. Value given is at the national scale, amortized over 20 years. Values have been converted from kg CO ₂ e per kg carcass weight.
			×	✓	22.4		

Table 1. Cont.

 \dagger LUC: Land use change; LMC: Land management change. \ddagger eq: agricultural soils assumed to be at equilibrium in terms of SOC; \checkmark : included; *: not included; n/o: not occurring.