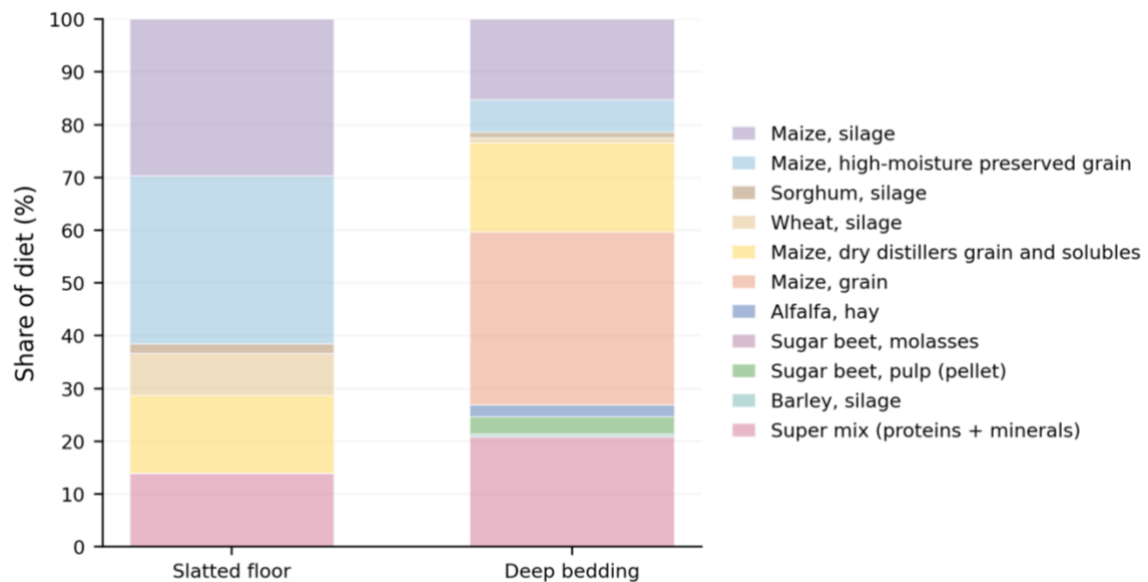
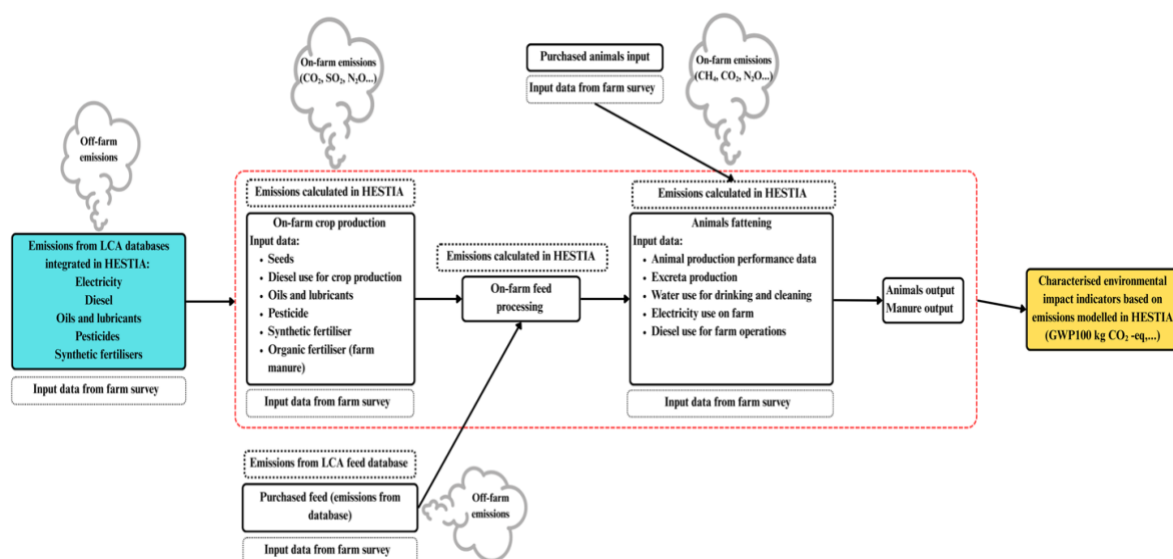


Supplementary material:

Supplementary figure 1. Comparison of the global warming potential of the average diets used in the slatted floor and deep bedding systems. Different forms of maize ingredients are dominant in both diets (see Supplementary table 3) and are the largest contributors to their environmental impact. Changes in diet composition, therefore, led to changes in emissions.



Supplementary figure 2. Simplified workflow of the study. Primary data were collected on-farm through a structured survey. Crop production data included land use, irrigation water, fuel, lubricants and motor oil for agricultural machinery, seed, organic and mineral fertilisers, crop protection chemicals, and crop yields. Background emissions for inputs such as diesel, electricity, and crop protection chemicals were sourced from different international databases integrated into HESTIA. Animal performance data comprised the number of animals by sex, initial and final body weight, feed consumption, mortality and early culling rate, and duration of the fattening period, which were collected during the survey, uploaded to HESTIA, and finally used for calculations of emissions. Off-farm feed production data were obtained from the ECOALIM LCA feed database and combined with on-farm feed data (on-farm feed processing) to get emissions from animal diets used in the fattening system. Excreta production was modelled in HESTIA following Poore and Nemecek (2018) and used to calculate emissions during the animal fattening phase. On-farm energy and resource use, including electricity, diesel for machinery operations on the farm, oils, lubricants, and water for drinking and cleaning, were recorded in the survey and used to estimate emissions from animal fattening. Finally, Life cycle impact assessment was classified in HESTIA according to the following impact categories: global warming potential (kg CO₂-eq), acidification potential (g SO₂-eq), eutrophication potential (g PO₄³⁻-eq), land occupation (m²/year) and freshwater withdrawals (L).



Supplementary table 1. Environmental impacts per kilogram of body weight gain for bulls and heifers raised on slatted floors and deep bedding in Italian fattening systems

	Slatted floor bull	Slatted floor heifer	Deep bedding bull	Deep bedding heifer	Slatted floor early culled bull	Slatted floor early culled heifer	Deep bedding early culled bull	Deep bedding early culled heifer
GWP, kg CO ₂ - eq	7,64	9,96	6,34	8,50	8,35	10,94	7,06	9,42
Eutrophication potential, g PO ₄ ³⁻ -eq	47,81	64,29	53,14	75,42	52,36	70,63	59,17	83,83
Acidification potential, g SO ₂ -eq	107,74	153,57	91,42	148,33	117,51	168,88	101,78	164,19
Freshwater withdrawals, L	965	1217	883	1143	1051	1339	983	1263
Land occupation, inputs production, m ² *year	5,35	6,79	5,45	7,00	5,88	7,43	6,07	7,74

Supplementary table 2. Input data used for estimating the environmental impact of animals on slatted floor and deep bedding, including electricity and diesel consumption for farm practices.

Breed	Slatted floor system		Deep bedding system	
	Limousin		Charolais	
Sex	Bulls	Heifers	Bulls	Heifers
Heads (n)	894	458	3,312	1,010
Body weight initial (kg)	293	281	447	352
Body weight final (kg)	580	505	750	592
Length of fattening period (days)	196	187	184	187
Average daily gain (kg/day)	1.46	1.19	1.65	1.28
Dry matter intake per animal (kg/day)	8.88		9.95	
Mortality rate (%)	1	0.7	0.61	0.35
Average literature mortality rate (%)	1.07	0.95	0.88	0.83
Early culling rate (%)	0.2	0.1	2.6	2.01
Average literature early culling rate (%)	3.51	3.51	3.03	3.03
Farm electricity used (kWh)	54,876		146,042	
Diesel used for farm operation (kg)	18,827		61,010	

Supplementary table 3. Diet composition per system (kg dry matter)

	Slatted floor diet 1 phase	Slatted floor diet 2 phase	Deep bedding diet 1 phase	Deep bedding diet 2 phase	Deep bedding diet 3 phase	Deep bedding diet 4 phase
Maize, silage	2.8	2.45	1.54	1.89	2.28	2.28
Maize, high moisture preserved grain	2.8	3.15	0.63	1.19	1.47	1.47
Sorghum, silage	0.6	-	0.24	0.24	0.24	0.24
Wheat, silage	-	0.7	0.21	0.25	0.25	0.18
Maize, dry distillers' grain and soluble	1.6	1.78	0.8	0.89	0.89	0.89
Maize, grain	-	0	0.86	1.29	2.58	3.35
Alfalfa, hay	-	-	1.55	0.77	0.6	0.6
Sugar beet, molasses	-	-	0.38	0.53	0.53	0.53
Sugar beet, pulp	-	-	0.71	0.62	0.53	0.53
Barley, silage	-	-	0.06	0.06	0.06	0.06
Super mix supplement	0.94	0.94	1.04	1.49	1.39	1.64