An inventory of methane emissions from ruminant animals in Northern Ireland due to enteric fermentation-a comparison using Tier 1 and Tier 3 emission factors

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Introduction In Northern Ireland, 21% of GHG emissions came from agriculture in 2007. The UK Climate Change Bill requires a reduction in emissions of 80% by 2050, posing a significant challenge for the industry. A calculation of the baseline GHG footprint of animal production is required to determine sustainable GHG mitigation strategies. The IPCC provide standard Emission Factors (EF) (Tier 1) for CH_4 produced by enteric fermentation and classify ruminant animals as dairy, non-dairy and sheep. The age and diet of the animal is taken into account by the IPCC. Previous research at AFBI Hillsborough has generated data detailing actual CH_4 and CO_2 emissions from 800 dairy cows, 146 beef cattle and 50 sheep (Tier 3 EF). The aim of this study was to compare the GHG footprint of ruminant animals in Northern Ireland in 2008 using Tier 1 (standard) and Tier 3 (actual) EF.

Materials and methods Tier 3 CH_4 emissions from dairy cows are representative of cows housed indoors and offered a range of indoor diets. Data for beef animals are representative of Friesian, Aberdeen Angus, Simmental and Charolais breeds offered diets with a forage proportion of 295-1000 g/kg dry matter (DM). Data for sheep are representative of Blackface and lowland crossbreds (Suffolk and Texel x Greyface) offered grass silage-based diets (178-1000 g/kg DM). Tier 3 EF for dairy cows, beef cattle and sheep were estimated by calculating the total ME requirement (MJ/year) and feed intake (kg DM/year) for each breed at different physiological states, followed by the conversion of ME intake to enteric CH_4 emissions (kg/year). Total ME requirements for dairy cows were estimated from Feed into Milk (FiM) models (Agnew *et al*., 2004) and for beef cattle and sheep, AFRC systems (AFRC, 1993) and the Dawson and Steen (1998) model were used. Total enteric CH_4 emissions for each breed were calculated using the ratio of CH_4 energy output to ME intake, measured in calorimeter chambers at AFBI Hillsborough for each breed (Yan *et al*., 2010).

Results The GHG footprint of ruminant animals in Northern Ireland using Tier 1 and Tier 3 EF is presented in Table 1.

Table 1 GHG footprint of ruminant animals in Northern Ireland in 2008 (Tier 1 V Tier 3 calculations)

		Tier 1 Standard IPCC (2006) EF			Tier 3 Actual EF (AFBI data)		
Livestock Category	Number of animals	Tier 1 EF (kg CH_4/hd/y)	Emissions (tonne CH_4/y)	Footprint (tonne CO_2e/y)	Tier 3 EF (kg CH_4/hd/y)	Emissions (tonne CH_4/y)	Footprint (tonne CO_2e/y)
Dairy cows	289247	117	33842	846047	109.5	31673	791814
Dairy heifers in calf							
-2 years old	26883	57	1532	38308	52.9	1422	35553
-1 to 2 years	37389	57	2131	53279	69.5	2599	64963
Beef cows	265663	57	15143	378570	59.1	15701	392517
Beef heifers in calf							
-2 years old	24311	57	1386	34643	59.1	1437	35920
-1 to 2 years	15433	57	880	21992	64.0	988	24693
Other cattle 1-2 years	333531	57	19011	475282	64.0	21346	533650
Other cattle 6-12 months	186933	57	10655	266380	29.1	5440	135994
Ewes	935417	8	7483	187083	10.5	9822	245547
Other sheep							
-Rams for service	26868	8	215	5374	10.5	282	7053
-1 year and over	12543	8	100	2509	7.5	94	2352
-Lambs < 1 year old	998765	8	7990	199753	4.6	4594	114858
Total emissions			100369	2509220		95396	2384912

Animals in the "Breeding bulls", "Other cattle-2 years old" and "Other cattle < 6 months old" categories were not included in this inventory due to the absence of Tier 3 EF

Conclusions The overall GHG footprint of ruminant animals included in this study was 5% lower with Tier 3 EF than with Tier 1 EF values, but in some classifications the Tier 3 values were higher. This wide variation demonstrates a requirement for actual EF data that is representative of the age and diet of the animal. There is also a need to develop a more precise Tier 3 EF database for agriculture, particularly for the animal categories not included in this exercise, younger animals and animals at grass.

References

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