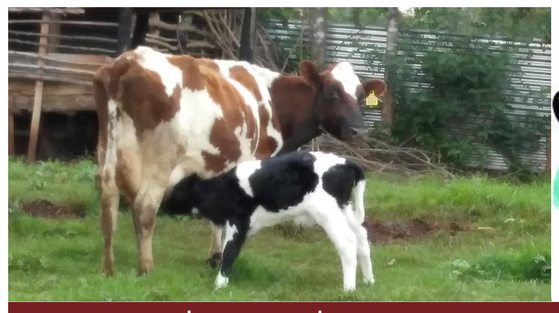
Improved region-specific emission factors for enteric methane emissions from cattle: Nandi County, Kenya



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1. Introduction

- National greenhouse gas inventories in Sub-Saharan Africa use default Tier I emission factors (EF) from the Intergovernmental Panel on Climate Change (IPCC) to estimate enteric methane emissions from livestock.
- IPCC Tier I EF are based on data from intensive livestock systems (LS) from developing world and do not accommodate changes to emissions brought by changes to LS.
- Accurate Tier II GHG emission reporting from developing countries is important following the Paris Climate agreement (COP 21) encouraging accurate reporting and mitigation of GHG emissions.
- Kenya's agricultural sector accounts for 58.6% of the country's total GHG emissions and livestock-related emissions account for 96.2% of the agricultural emissions
- Tier II GHG emissions estimates allow for accurate baseline data from smallholder LS in Kenya.

2. Hypothesis

- The Tier II Efs derived in this Nandi study (Fig. 1) are expected to be considerably different from Tier I estimates.

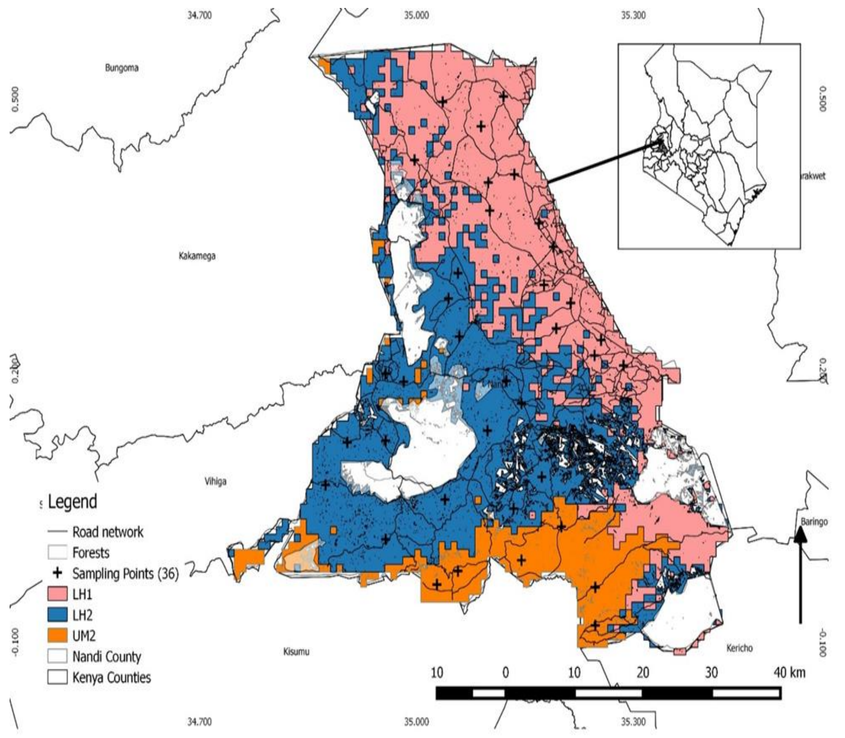

Fig. 1: Map of Nandi County and its three main agro-ecological zones (AEZs)

3. Activities

Fig. 2: Live-weight (LW), heart girth measurements and ageing by dentition.

Fig. 3: Daily Milk yield recording and quality (BF% and SNF%) analysis.

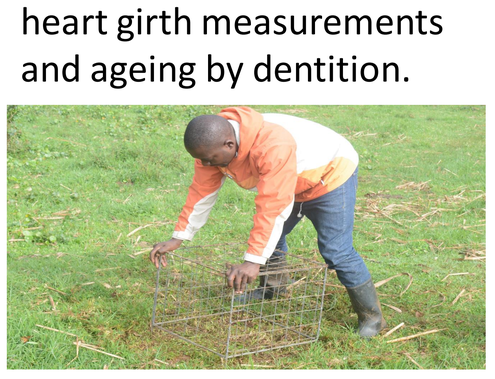

Fig. 4: Set up of exclusion cage for estimating pasture biomass production.

4. Results

Daily CH_4 production was calculated for individual animals grouped in five cattle categories (Table 1) and EF (annual CH_4 emission/animal) estimated.

Table1: Emission factors for females, males, heifers, young males and calves in the three AEZ (fig. 1) of Nandi county and the overall mean (total Nandi)

Agro-ecological zones	Emission Factors (kg CH_4/head/year)				
	Females (>2y)	Males (>2y)	Heifers(1-2y)	Young males (1-2y)	Calves (<1y)
Lower Highland 1	37.9±0.71	41.4±3.25	28.9±0.93	32.7±1.38	29.4±1.02
Lower Highland 2	41.0±1.56	52.2±3.50	28.2±1.82	34.7±2.69	28.7±2.04
Upper Midlands	37.3±1.50	43.3±2.30	27.6±2.27	25.1±3.17*	28.6±2.80
Total Nandi	**38.4±1.66**	**45.9±5.17**	**28.7±2.16**	**33.3±3.45**	**29.1±2.42**

*= there were no young males in the UM zone during the Short rains thus the EF was calculated by multiplying the DMP by 274 days (3 seasons) instead of 365 days (4 seasons).

5. Discussion

- CH_4 emissions from LH1 are highest of the AEZs for all cattle categories except males (>2y) and the difference was attributed to differences in live-weight (a key determinant of MER for maintenance) between the AEZs (Table 1).
- The weighted mean of DMD of feed basket (60-68.4%) was greater than the IPCC default estimates (50-55%) hence considered as a point of difference in the calculation of EFs.
- This study's Tier II estimates were lower than IPCC Tier I estimates for females (6.3%), males (6.3%) and heifers (7.4%) and higher for young males (7.4%) and calves (81.9%) (Table 2).
- LS in the current study (Nandi) and Nyando study (Goopy *et al.* in review) are considered comparable in relation to their geography and climate conditions, still the systems in Nandi had animals with higher live-weights and milk production (Table 2).

Table 2: Comparison of Mean LW and EFs between IPCC Tier I, Nyando study and present study (Nandi)

Cattle category	IPCC Tier I (2006)		Nyando Study		Present Study (Nandi)	
	Mean LW (kg)	EF (kg CH_4/head/year)	Mean LW (kg)	EF (kg CH_4/head/year)	Mean LW (kg)	EF (kg CH_4/head/year)
Females (>2y)	200	41	208.7	24.6	306.9	38.4
Heifers (1-2y)	-	31			286.8	28.7
Males (>2y)	275	49	198	34.4	265.9	45.9
Young males (1-2y)	-	31			156.9	33.3
Calves (<1y)	75	16	73.4	17.3	73.3	29.1

6. Conclusion

- IPCC Tier I tends to overestimate emissions from smallholder systems and estimates based on measurements (Tier II) rather than assumptions are required if valid enteric emission estimates are desired.

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