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Revised greenhouse gas emission factors for smallholder livestock systems in East Africa

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Current GHG emissions estimates for livestock in East Africa are based on IPCC Tier 1 (default) methodology, that are based on (annual enteric methane production) Emission Factors (EF) derived from a combination of data from livestock systems in developed agricultural systems and "expert opinion". This approach results in large uncertainties around overall GHG emissions from African livestock systems. Accurate GHG emissions estimates are not only necessary following the Paris Climate Agreement (COP21), where the majority of countries agreed to (improved) Tier 2 GHG reporting for the agricultural sector, but also to reliably assess potential mitigation options. Within the framework of climate smart agriculture (CSA) and the required sustainable intensification of livestock systems in Africa to achieve food security, reliable estimates of GHG emissions from livestock systems are absolutely essential.

We have developed more accurate EFs from livestock systems on enteric fermentation and manure management in three counties in Western Kenya through field measurements on animal and production performance enabling us to estimate energy expenditure, intake, in combination with digestibility of defined seasonal feedbasket. Based on this data, Tier 2 GHG EFs for enteric fermentation from livestock (methane, CH4) and manure management (CH4 and nitrous oxide, N2O) were calculated. Our estimated CH4 EFs from livestock were up to 40% lower than existing Tier I estimates, with our data diverging in several important ways from the default estimates. These differences were not uniform across animal classes, highlighting the heterogeneity of smallholder livestock systems. Additionally, we calculated Tier 2 CH4 and N2O EFs for manure management within two counties in Kenya. We found greater CH4 and slightly lower N2O emissions compared to the Tier 1 approach. The observed divergence is likely as the Tier 1 approach assumes that all African livestock manure is deposited on rangelands, rather than conserved and managed. Lower N2O emissions are related to low-quality feeds resulting in lower N excretion. Our findings highlight the necessity for accurate GHG emission estimates from African livestock systems to achieve reliable reporting and identification of mitigation options.