Tropentag, September 16-18, 2015, Berlin, Germany

"Management of land use systems for enhanced food security: conflicts, controversies and resolutions"

Rapid *ex-ante* Environmental Impact Assessment of Livestock Intensification Strategies on Mixed Crop-Livestock and Agro-Pastoralist Farmers in Tanga Region, Tanzania

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Abstract

Livestock production supports the livelihoods of about 600 million poor smallholder farmers in the developing world. Environmental impacts include atmospheric and water pollution, global warming, soil degradation, water use and pollution and biodiversity loss. Thus, long-term sustainability needs to be assessed before embarking on large-scale livestock development projects. Quick scientific results are often requested to support development actors in their investment decisions. However, data availability for smallholder farming systems in the developing world is typically limited. Therefore, the CLEANED project developed a generic conceptual framework for rapid ex-ante impact assessment of interventions in livestock value chains across temporal and spatial scales.

In this study, parts of the framework were operationalized for smallholder dairy production in the Tanga region in Tanzania. Representative farming systems were identified through a participatory GIS workshop: more commercial mixed crop-livestock farmers and mostly pre-commercial agro-pastoral farmers. On-farm greenhouse gas emissions including enteric fermentation from livestock, manure, soils, soil organic carbon, aboveground biomass, rice cultivation and residue burning was calculated using IPCC tier 2 methods. Nutrient balances and well as soil erosion were projected with NUTMON and RUSLE approaches. Minimum input data for baseline performance included focus group discussions as well as two hour household interviews with two representative farmers. Four intensification scenarios were derived from existing village development plans and extension officer interviews: genetics, health, feeding, and marketing.

First results show that on-farm emissions of agro-pastoral farmers are higher (20.5 t CO_2-eq) than from mixed crop-livestock systems (2.6 t CO_2-eq). Mixed systems are more efficient than agro-pastoral systems, with 1.02 kg CO_2-eq kg^{-1} fat and protein corrected milk (FPCM) as compared to 1.42 kg CO_2-eq kg^{-1} FPCM. In both systems, the bulk of emissions originates from enteric fermentation (75 % and 69 % for agro-pastoralist and mixed crop-livestock respectively), while manure contributes 24 % and 22 % and soil N_2O 1 % and 9 % to the overall balance. Nutrient balances were negative for both systems. Mixed crop-livestock systems do not produce sufficient manure, whereas agro-pastoralists do not reallocate their large amounts of manure from rangelands and homestead to cropland. The scenario analysis shows efficiency gains from intensification, but underlines potential

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feasibility issues. For example, potential gains from improved cattle breeds may in reality manifest as diminished long term sustainability if implemented without a concurrent improvement of veterinary health, improved feeding, housing and water supply. Many such interventions are currently constrained by lack of land, labour, cash and markets.

Keywords: GHG emissions, livestock production, rapid assessment, sustainable intensification