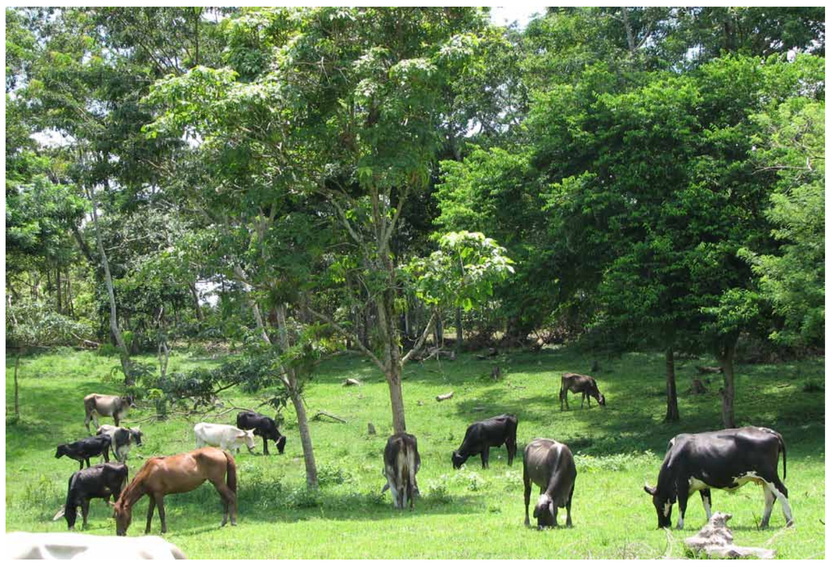
Livestock and Environmental Management Program (GAMMA)

The Mission

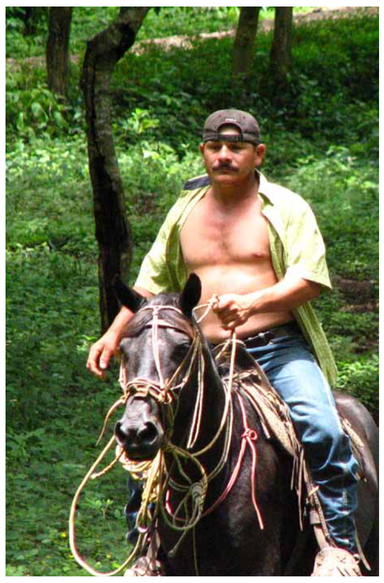
GAMMA aims to develop research and alternatives to promote environmental services in livestock farming: to increase farm productivity, reduce climate change impact, and evaluate different incentives to promote good management practices and silvopastoral systems in the Mesoamerican region.



Towards a Solution

GAMMA has been working on adaptation and mitigation of greenhouse gases in these areas:

- Development of methodologies to estimate water footprint in cattle farms
- Quantification of carbon stock in different land uses in cattle farms
- Study of principal emission of greenhouse gases in livestock production systems
- Construction of database of carbon sequestration in different land uses present on agricultural landscapes
- Training for different groups of farmers, technical personnel and students in the implementation of silvopastoral systems and good practices for development of sustainable livestock farms and adaptation strategies for climate change



The Results

The following results for the Chorotega region of Costa Rica in 2010 have been key inputs for policy makers to create tools for sustainable development of livestock in the Mesoamerican region.

A. **Adaptation to climate change.** Farms with dual purposes have increased adoption of silvopastoral systems (SPS): forage banks, pastures with trees, and protection of secondary and riparian forests. These strategies have been implemented to increase milk production during the dry season (farms with SPS produced 12.48 liters of milk per cow per day compared to 10.3 liters of milk per cow per day in traditional farms).

B. **Modulation of carbon flows in different land uses on livestock farms through carbon stock in the biomass and the soil:** Average emissions from the farms evaluated were as follows: in dual purpose systems, 92.4 tons of CO_2e; on dairy farms, 194.7 tons of CO_2e; and on farms with breeding stock or beef cattle, 361.4 tons of CO_2e (Table 1).

C. **GHG emissions in different livestock production systems:** Dual purpose farms have shown that 85% of GHG emissions come from the physiological processes of animals, enteric fermentation (CH_4) and management of solid and liquid waste (CH_4 and N_2O). On dairy farms, GHG emissions are composed of: 58% of the physiological processes of animals (CH_4 and N_2O), 24% of the manufacture and application of nitrogen fertilizer, 8% of the production of concentrate (CO_2) and 8% of petroleum use in transport and machinery within the farm (Figure 1).

Table 1. Quantification of carbon flow in different land uses in cattle farms of the Chorotega region of Costa Rica, 2010

Land uses	Carbon flows (t ha^{-1} $year^{-1}$)
Degraded pasture	-0.30
Pasture without trees	0.28
Silvopastoral system	1.34
Forage banks of grasses	4.64
Forage banks of woody plants	1.37
Forest plantations	3.21
Secondary forests	3.89

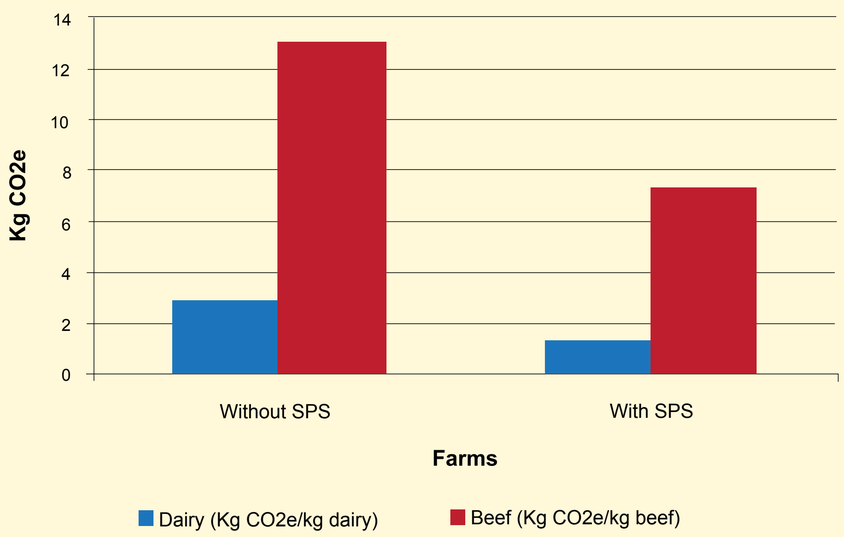


Figure 1. Estimation of carbon footprint of livestock farms in cattle farms of the Chorotega region of Costa Rica, 2010

For more information:
Dr. Muhammad Ibrahim
Leader, GAMMA Program, CATIE
mibrahim@catie.ac.cr
Tel. + (506) 2558-2341