

# Yield gap analysis to identify attainable productivities and greenhouse gas emissions reductions in Colombian cattle systems

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## Introduction

- » Livestock and crop activities contribute between 10-12% to global greenhouse gas emissions (GHGE).
- » In Latin America, livestock activities generate around 25% of the global GHGE of the Agriculture, Forestry and Other Land Use (AFOLU) sector.
- » In the Latin American region there is a potential for increasing the cattle yields and reducing the environmental burdens through sustainable intensification of the cattle production model.
- » Yield gap analysis is useful for estimating and exploring opportunities to increase agricultural production by identifying factors constraining production.
- » Identifying sustainable strategies to mitigate GHGE will help the Colombian government meet its goal of a 51% reduction in national emissions by 2030.
- » Estimation of yield gaps for identifying the potential to improve cattle farms productivity and efficiency in Colombia helps on reducing the GHGE intensities from the cattle sector.

## Objective

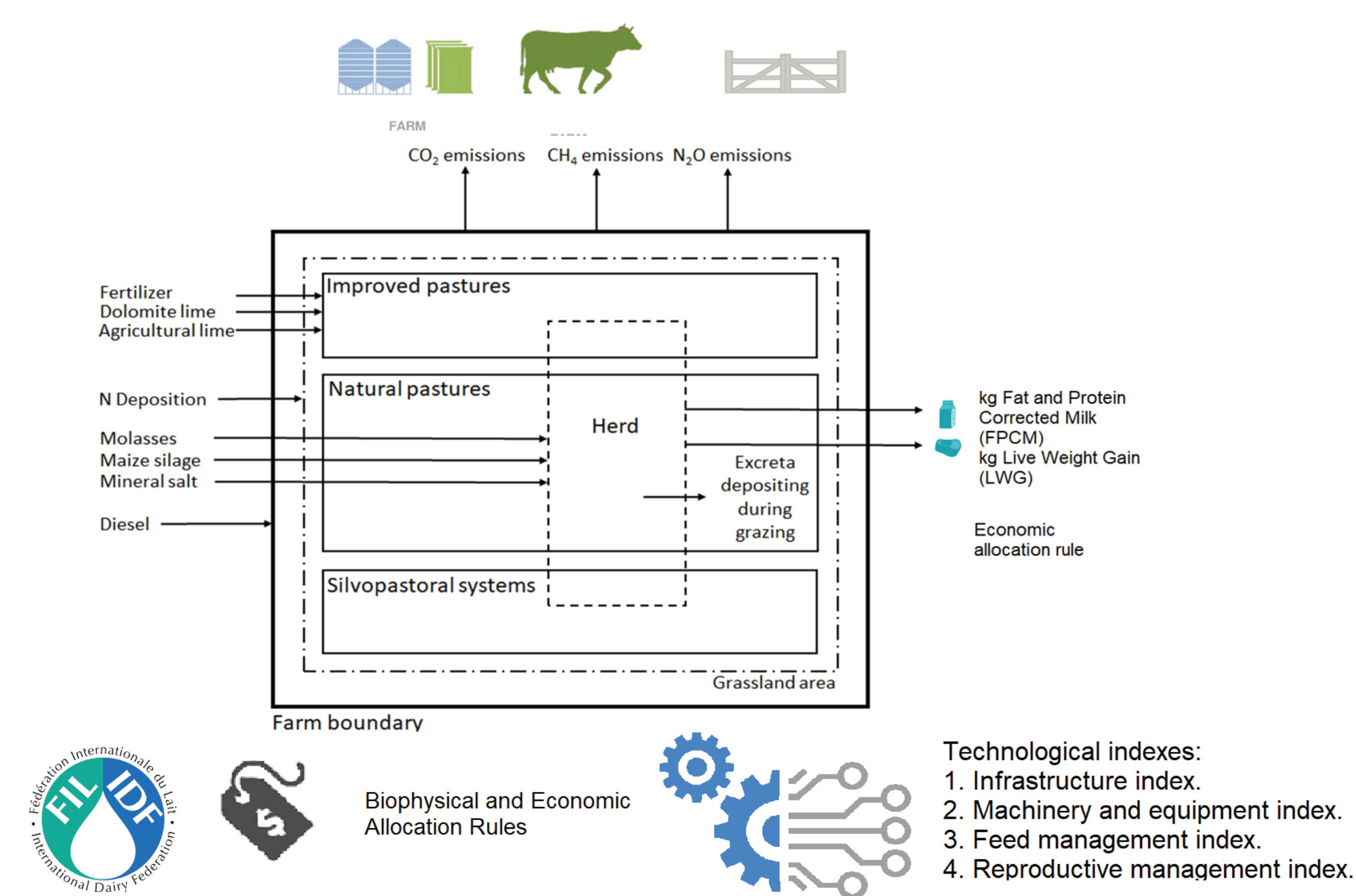
The objective of this study was three-fold:

- » To calculate the gap between attainable and actual milk and meat yields for specialized dairy, dual-purpose, cow-calf, and fattening production systems in 3 agro-ecological zones (AEZ) in Colombia.
- » To identify the main aspects that restrict the meat and milk yields in these production systems.
- » To analyze how closing yield gaps affect the carbon footprint (CF) of meat and milk.

## Methodology

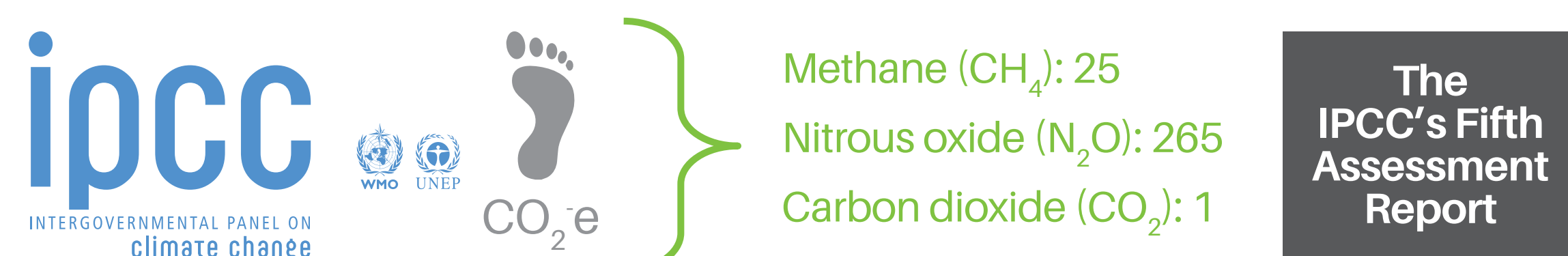
- » Environmental, climatic, edaphic and land characteristics from 1505 surveyed farms in Colombia were used to identify AEZ.
- » Farms were classified according to location/AEZ and production system type: *cow-calf, fattening, dual-purpose, and specialized dairy systems*.

- » A **benchmarking analysis** was used for estimating the potential to increase meat and milk yields in each of the identified AEZ.
  - » The most productive farms were included in the “best farms” category while the rest of the farms grouped into the “farms operating below potential” category.
- Life cycle assessment approach, system boundary definition, functional unit, and allocation rule*
- » The CF of representative farms was evaluated by using the Life Cycle Assessment (LCA) methodology.
  - » The system boundary was defined by the environmental impacts related to cattle systems in Colombia from a “cradle to farm-gate” perspective.
  - » Three scenarios were proposed for closing the yield gaps by 50, 75, and 100%, between the two groups of farms.

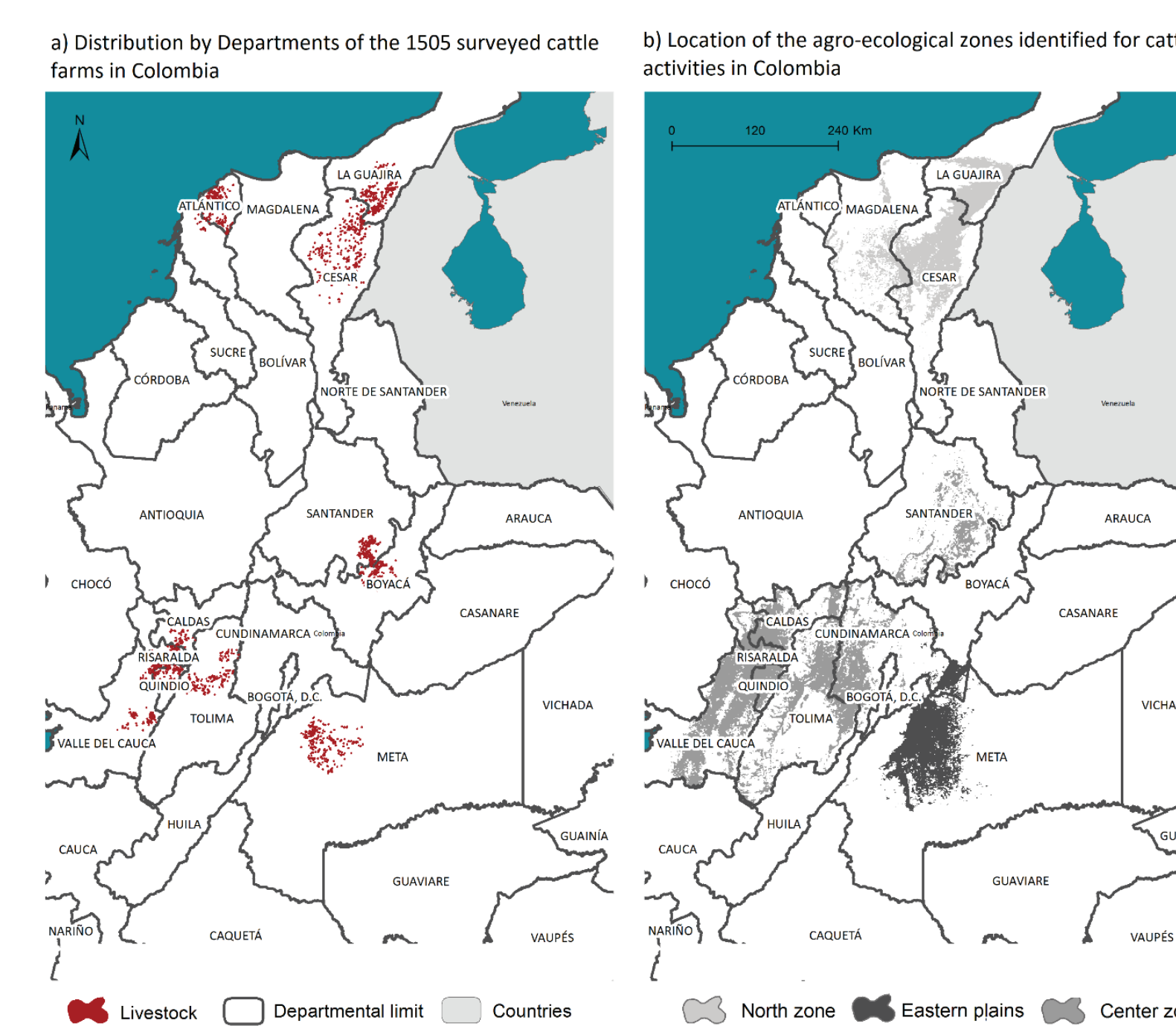


**Figure 1.** System boundaries, functional units, allocation rules, technological indexes and flows accounted for in the estimation of CF in the cattle systems in a “cradle to farm-gate” approach.

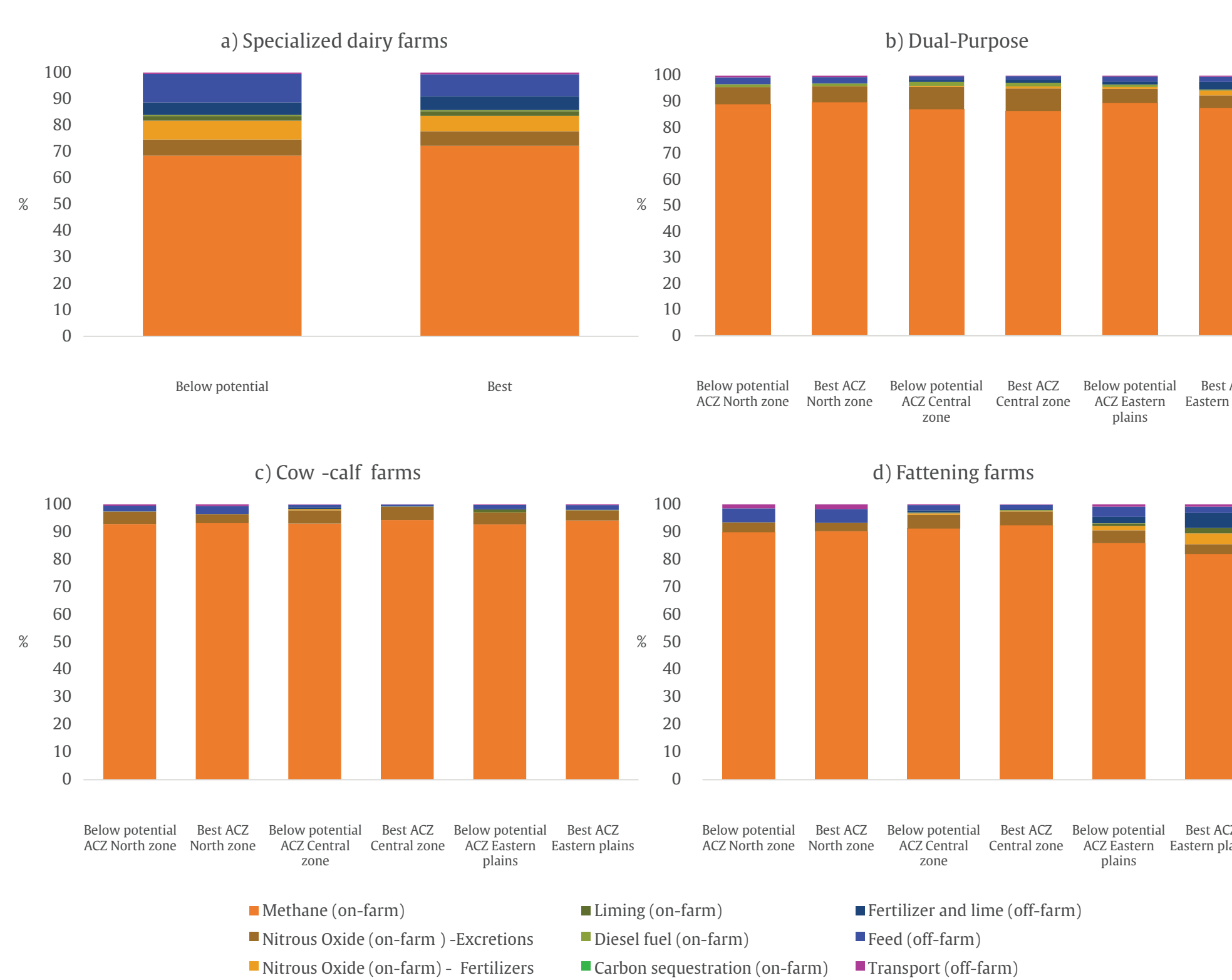
### Estimation of emissions



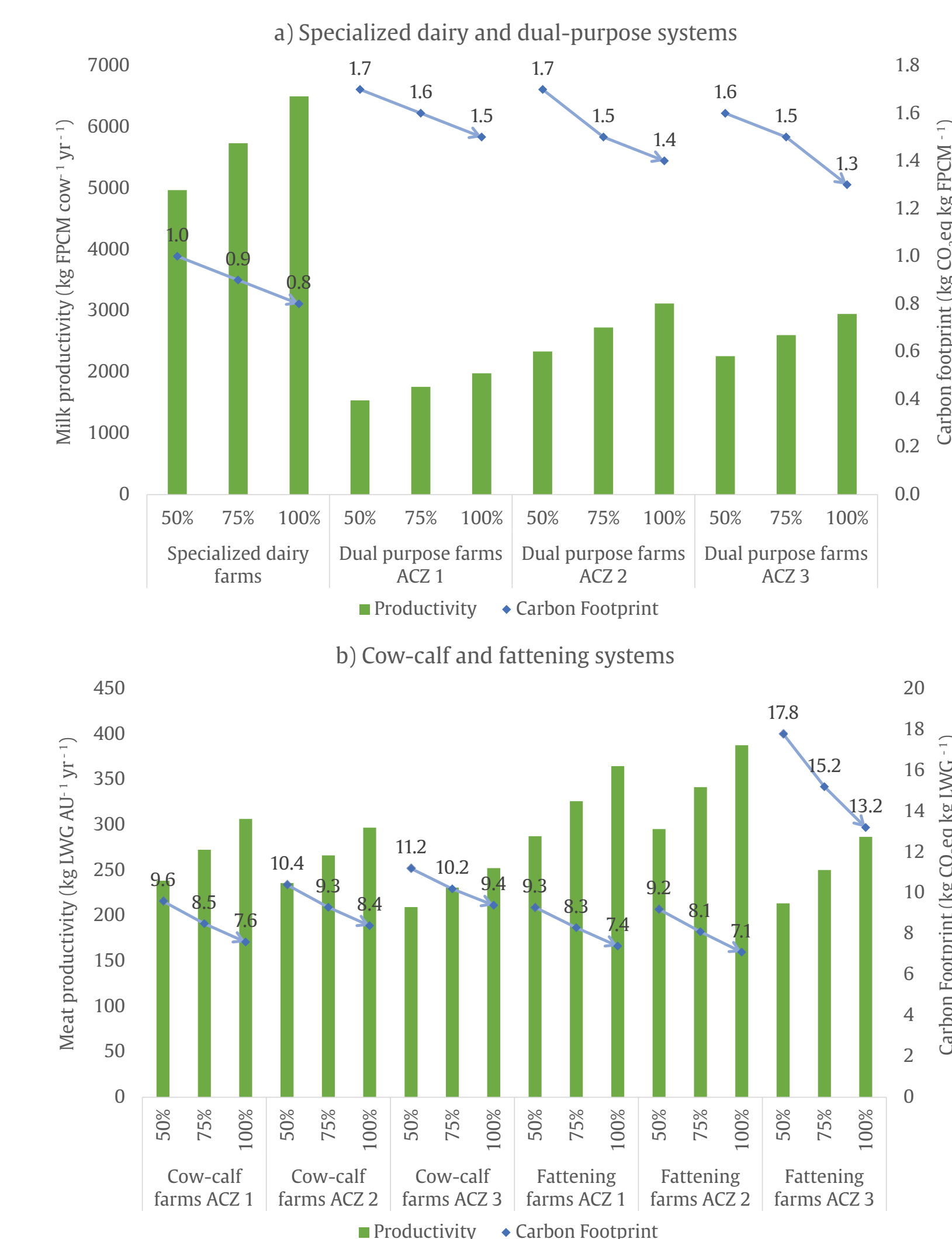
## Results



**Figure 2.** a) Distribution by Departments of the 1505 surveyed cattle farms in Colombia; b) Location of the AEZs identified for cattle activities in Colombia.



**Figure 3.** Contributions of different primary and secondary processes to total greenhouse gas emissions from (a) Specialized dairy farms; (b) dual-purpose farms; (c) Cow-calf farms; and (d) Fattening farms; divided by AEZ. Below potential = farms operating below potential; Best = best farms.



**Figure 4.** Effect of closing the yield gaps of meat and milk by 50, 75, and 100% on the CF for a) Specialized dairy and dual-purpose systems, and for b) Cow-calf and fattening systems.

## Conclusions

- » The best farms showed better implementation and adoption of: infrastructure, machinery and equipment, and feed, reproductive, and pasture management practices.
- » Substantial yield gaps for beef and milk in Colombian cattle systems exist, and there is considerable scope for improving yields and environmental performance with technological options and practices already adopted by farmers.
- » The meat and milk productivities were negatively associated to the carbon footprint, which suggests that closing the yield gaps by increasing production can be an important mitigation strategy of climate change in the Colombian context.

## Acknowledgements

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