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Towards site specific Greenhouse Gases (GHGs) emissions measurement: rice in Colombia

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Study overview: background

- Rice in Colombia is located in about 211 municipalities in Colombia, grouped into 5 production zones (Bajo Cauca, Centro, Costa Norte, Llanos and Santanderes). (IV Censo Nacional Arrocero)
- More than 500,000 hectares in Colombia.
- Annual production is approximately 1.7 million tons of rice.
- There are about 16,000 producers and 25,000 Agricultural Production Units (UPAs).


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Study overview: importance

- GHG emissions in Colombia are equivalent to 26% of the 258,8 million tonnes of CO_2 eq reported in the 2016 report of the national inventory of GHG of Colombia.

- Enteric fermentation, replanting of permanent crops, manure, fertilizers application, fuel burning, and rice cultivation.

- Our study seeks to implement measurement of GHG emissions at the farmer level in a statistically representative sample, seeking to obtain more specific results on the number of emissions.

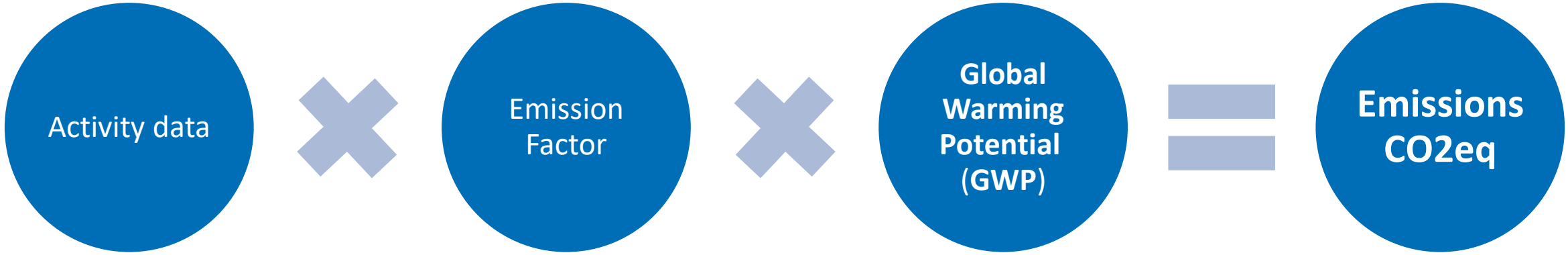
Categories used for GHG emission calculation

2006 IPCC Guidelines (AFOLU)	
3	**AGRICULTURE**
3.A	Enteric fermentation
3.B	Manure management
3.C	Rice cultivations
3.D	Agricultural soils
3.E	Prescribed burning of savannas
3.F	Field burning of agricultural residues
3.G	Liming
3.H	Urea application
3.I	Other carbon-containing fertilizers
3.J	Other

Source: Tubiello et al., 2015 (FAO and IPCC 2006)

Methodology: Green House Gas emissions (CO2e)

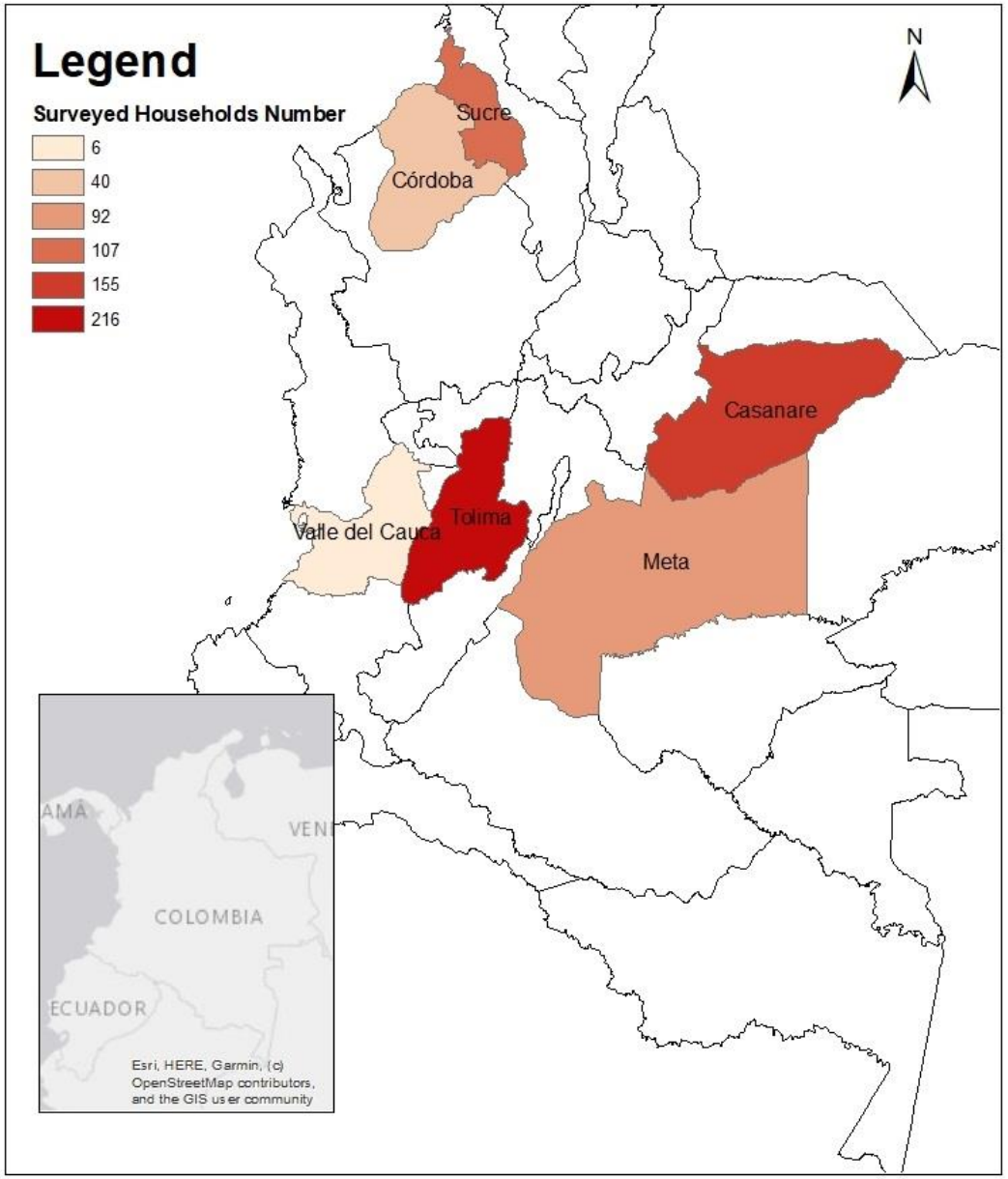
In order to calculate GHG emissions, it is necessary to know the level of activity, the emission factor related to such activity and the global warming potential of the gas emitted (IPCC, 2006).



e.g. Quantity of fertilizer, quantity of lime, management practices, irrigation.

Data: Sampling, sample distribution and data collection

- Data collected in the framework of an impact evaluation conducted by the Alliance and Insuco and Universidad del Rosario.
- Stratified sampling strategy with the number of Agricultural Productive Units (UPAS) in the IV National Rice Census of 2016 carried out by the National Federation of Rice Growers (FEDEARROZ) and the National Administrative Department of Statistics (DANE).
- Structured survey carried out face-to-face during November 2020.
- 616 farmers.
- The instrument used had 12 sections about socioeconomic characteristics, decision making, farm attributes, rice production and agronomic management, information and technical assistance, adverse climate events, and productive assets.



Data: Identification of key categories

Relevant available information in the database for GHG emissions calculation:

Used of Nitrogenous fertilizers

- Fertilizer composition
- Quantity applied to the plot
- Number of applications
- Used of urea
- Used of lime

Irrigation system

- 1=Irrigated rice
- 0=Rainfed rice
- Length of productive cycle (days)

Credit: ©2010CIAT/NeilPalmer

Pictures taken from **Alliance of Bioversity International and CIAT**

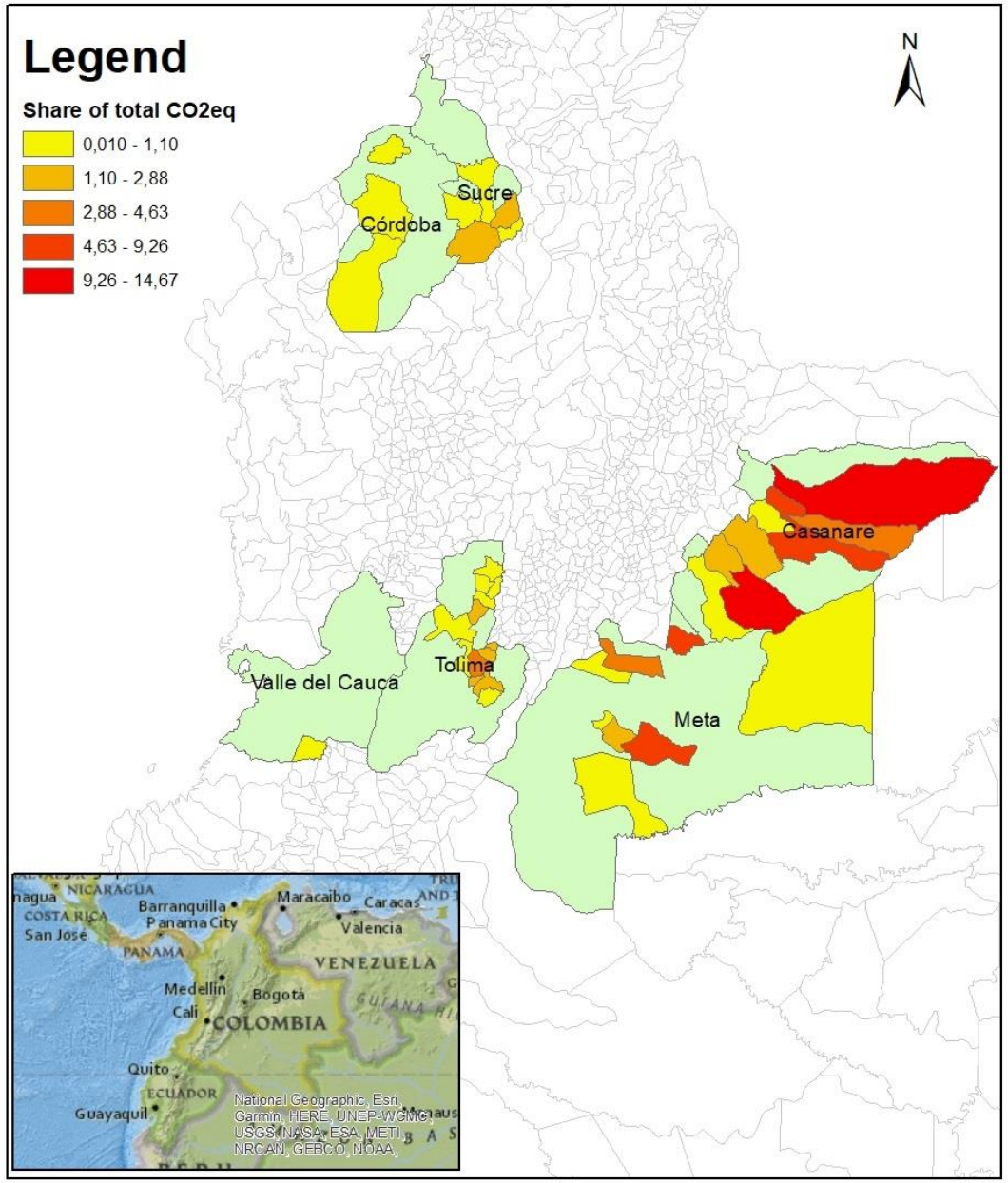
Calculation GHG : Emissions factors

Type of emission	Emission Factor
Fertilization	
Direct NO2 emissions	0.016
NO2 volatilization emissions	0.15*0.014
Emissions from NO2 leaching	0.24*0.011
Emissions from use of urea	0.2
Emissions from used of lime	0.13
Source: IPCC, 2019	
System (irrigated or rainfed)	
EFc	1.27
SFw	Rainfed: 0.16 Irrigated: depend of the department
SFp	0.89
Source: IDEAM, 2021	

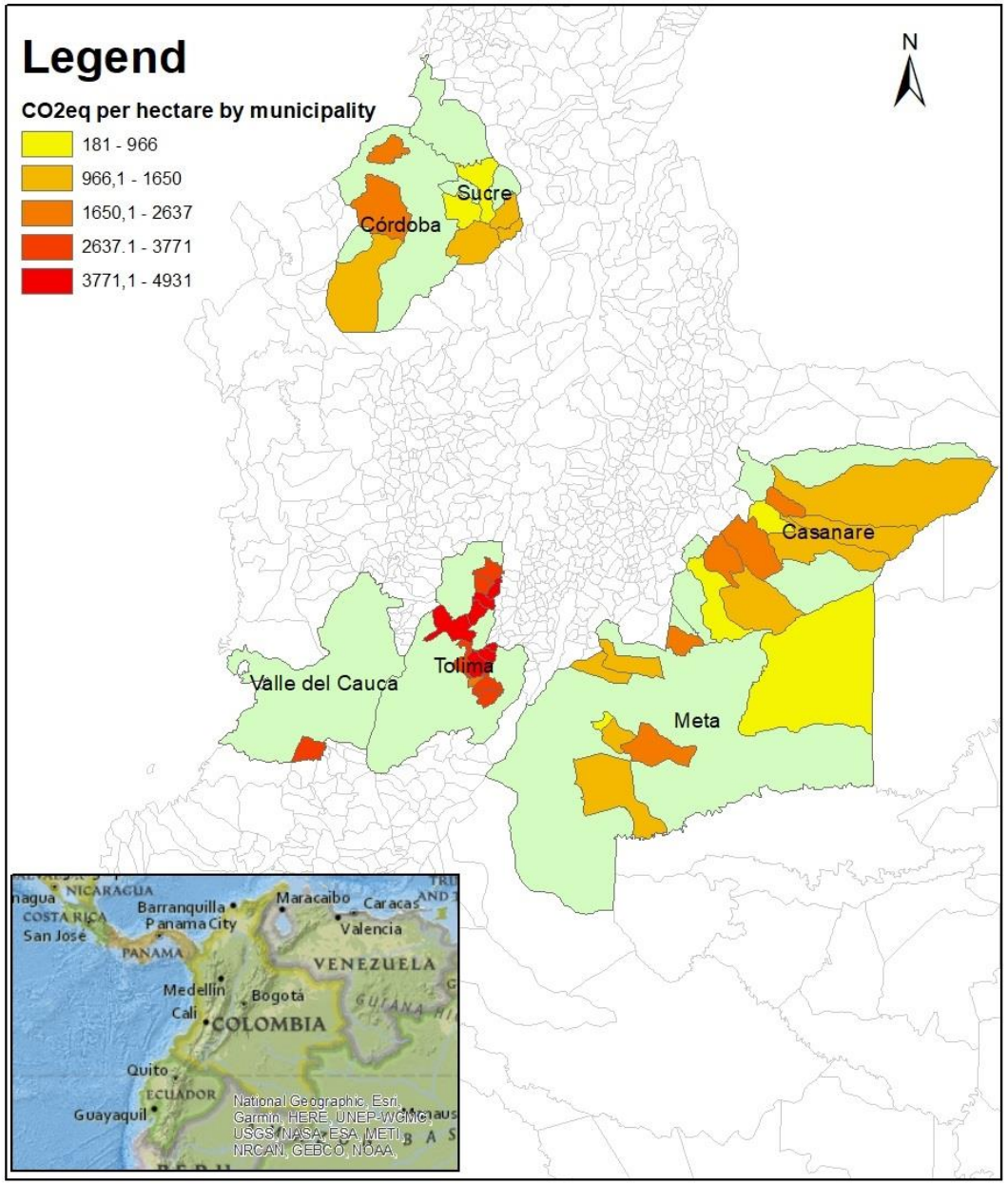
Results : General descriptives

Variable	Obs	Mean	Std. Dev.	Min	Max
System (1=irrigated rice)	616	**41**	0	0	1
Harvested area (hectares)	616	**22,1**	46,6	0	500
Production (tones)	606	**114,5**	239	0	2.550
Yield (tones/hectares)	604	**5,2**	2	0	14,4
CO2 eq total (Kg of CO2eq)	537	**44.785**	90.344	394	1.076.373
CO2 eq per ha (Kg of CO2eq/ha)	537	**2.540**	1.588	758	11.550
CO2 eq per ton (Kg of CO2eq/ton)	537	**528**	365	29	2.795

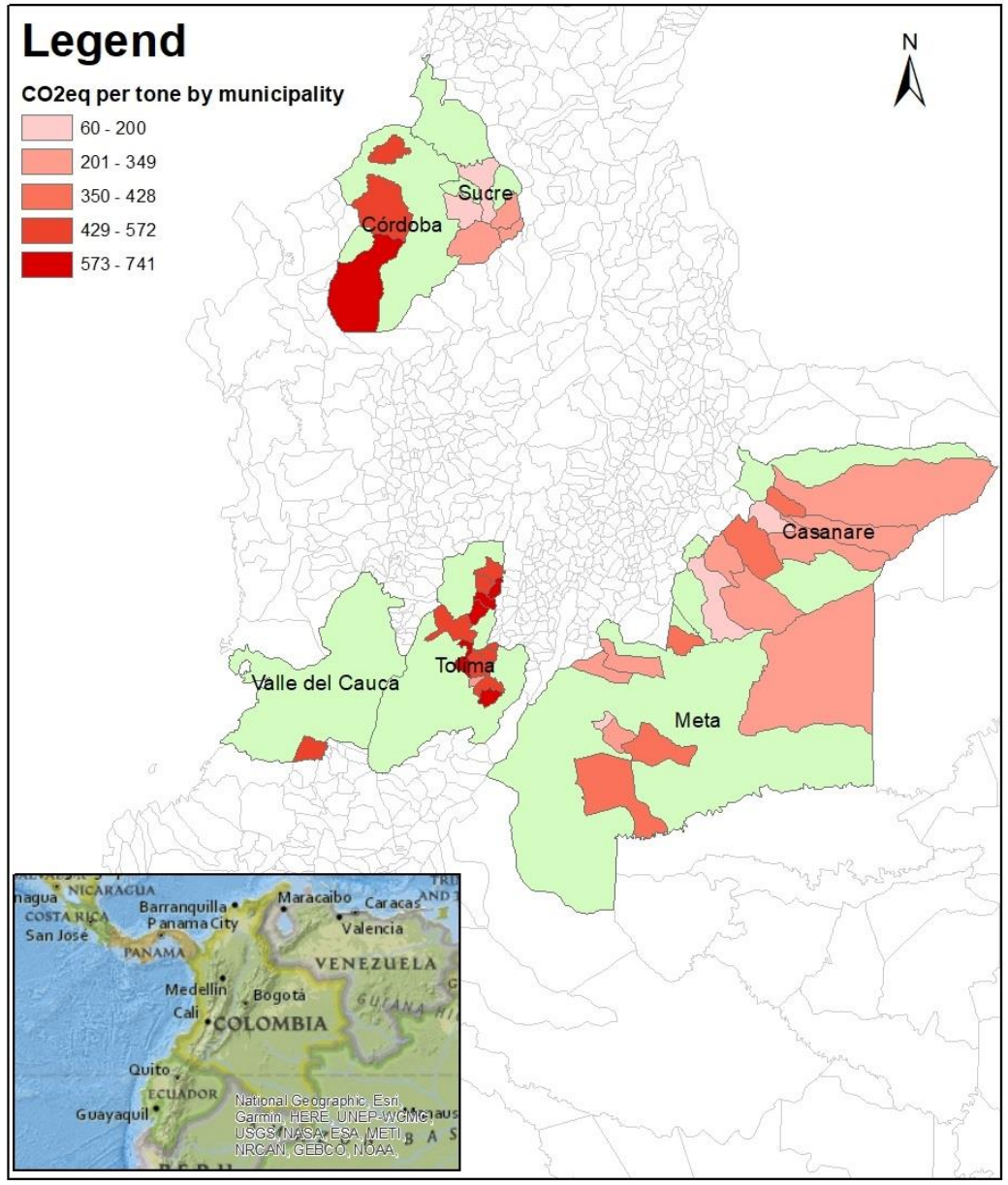
Map 1. Participation of each municipality in total emissions of CO2eq



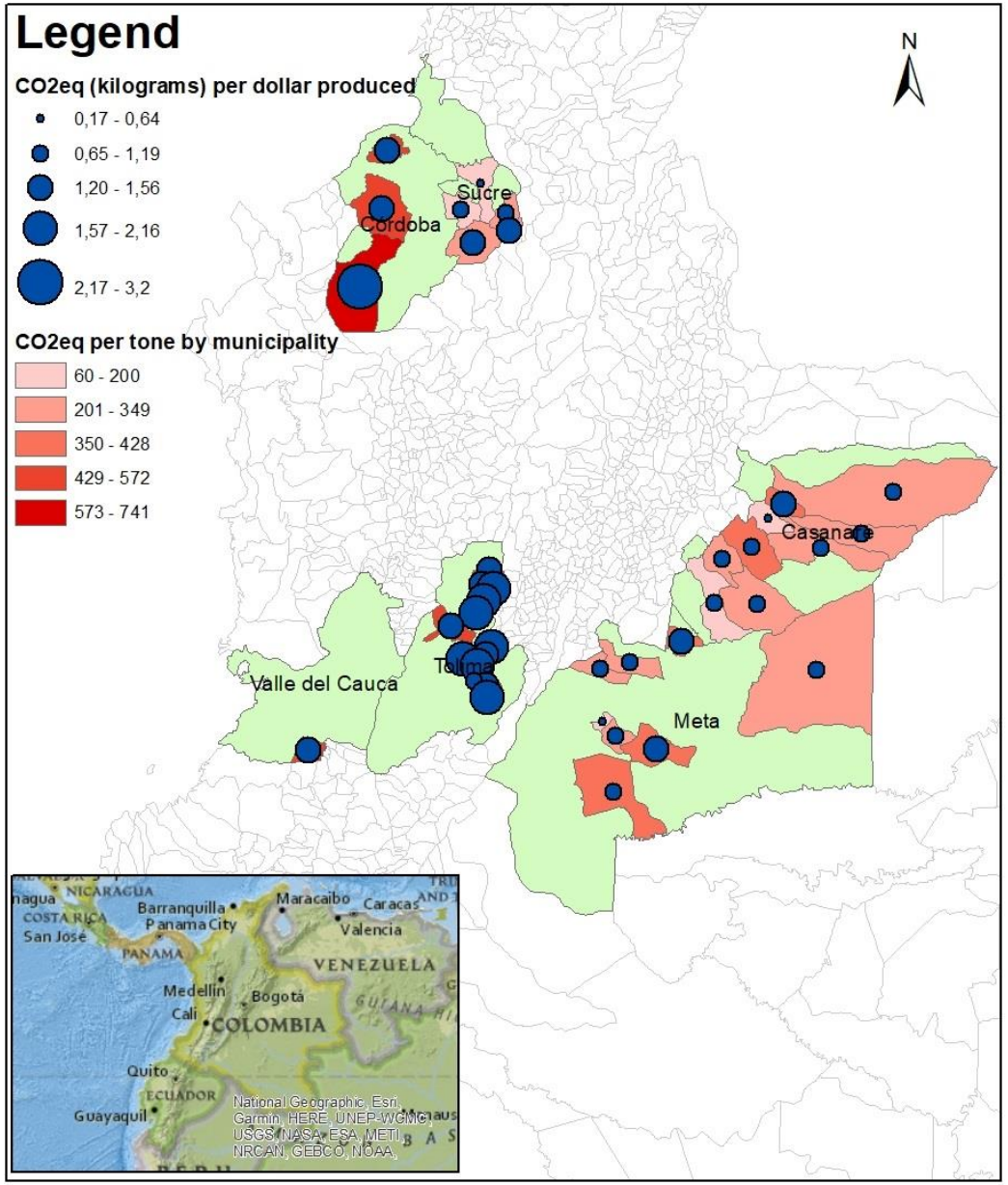
Map 2. CO2eq per hectare by municipality



Map 3. CO2eq per tone produced by municipality



Map 4. CO2eq (kilograms) per dollar produced



Discussion and next steps

- This measures corresponds to an approximation of the calculation due the lack of information. However, we want to establish a standardized information framework to replicate the exercise to other crops, facilitating the decision-making function of farmer's organizations and national entities involved to establish actions and technologies to mitigate the effects of climate change.

- Improving our analysis with primary or secondary information and remote sensing data.

- This monitoring system can be complementary to the requested MRV, as an alternative as long as we have enough field information from combining the experimental trials that measure GHG and socio-economic surveys.

- We hope continue improving the measurement and used for further analysis, where they can be combined with other variables of interest.

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Thank you for your attention!

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