Cecafé

Brazilian Coffee Exporters Council

Estimated GHG emissions and removals from the Brazilian coffee:

Carbon addition due to good practices on farms in Minas Gerais

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About CECAFÉ:

- ✓ 120 Members - 96% of Brazilian coffee shipments (39.350 million 60-kilogram bags in 2022).

- ✓ Through the Social Responsibility and Sustainability Pillar and with direct action by coffee exporters, efforts are made to continuously strengthen good agricultural and labor practices, the correct use of agrochemicals, digital inclusion and the development of programs aligned with global challenges, such as climate change.

Carbon Balance in Coffee Farming in Minas Gerais with Good Agricultural Practices

- **CECAFÉ PARTNERS:**

- **TEAM OF EXPERTS:**

Institute of Agricultural and Forest Management and Certification

Prof. Carlos Eduardo Cerri

- **GOALS**

- Quantify GHG emissions and removals resulting from coffee cultivation in Minas Gerais;
- Estimate Carbon addition due to good practices on farms in Minas Gerais.
- Estimate Carbon stored in native vegetation conservation areas within coffee farms.

Good Practices

Formation of soil aggregates

Soil porosity; aeration;
and water holding capacity

Resilience to periods of drought

+ Biodiversity

Nutrient cycling

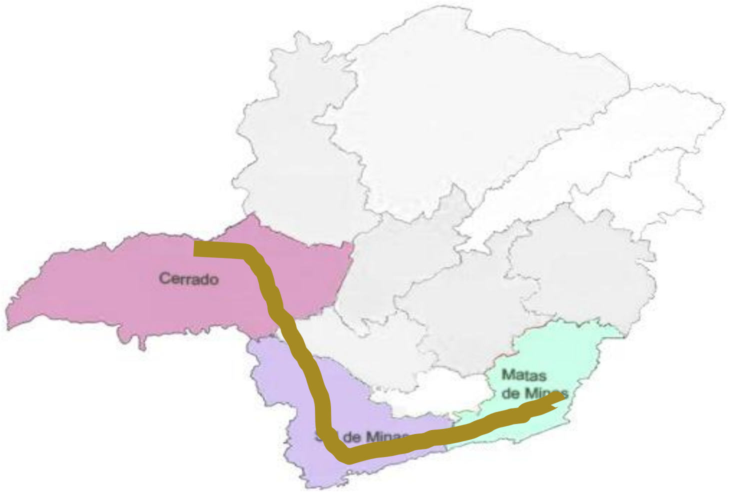
Positive impacts on fertility

CEC; < immobilization of P;
< variation of soil pH

Rational use of fertilizers;
Less GHG emissions

Methodology

- **40 coffee farms**, representative of the more common production systems of the **3 main producing regions of Minas Gerais,** according to technical criteria, and grouped in pairs: **good practices – traditional practices.**



- Good Practices
  - Semi-mechanized
  - Mechanized
- Traditional
  - Semi-mechanized
  - Mechanized

- **Standardized criteria:**
  - Planting density - 4 to 5 thousand plants/ha;
  - Catuaí variety;
  - Age of Plants: 10 years;
  - Plant height: 2 to 3 meters.

- **Emissions inventory:** GHG Protocol (scope 1 and 2).

- **Carbon Stock:** IPCC, ISO 18400; soil samples and coffee trees were extracted from 8 farms (same soil texture).

Carbon Balance: Components

N Fertilizer

Lime

Liquid Fuel

Agrochemicals

Dryer

Electricity

Carbon Balance = **GHG Emissions** - **C Removals**

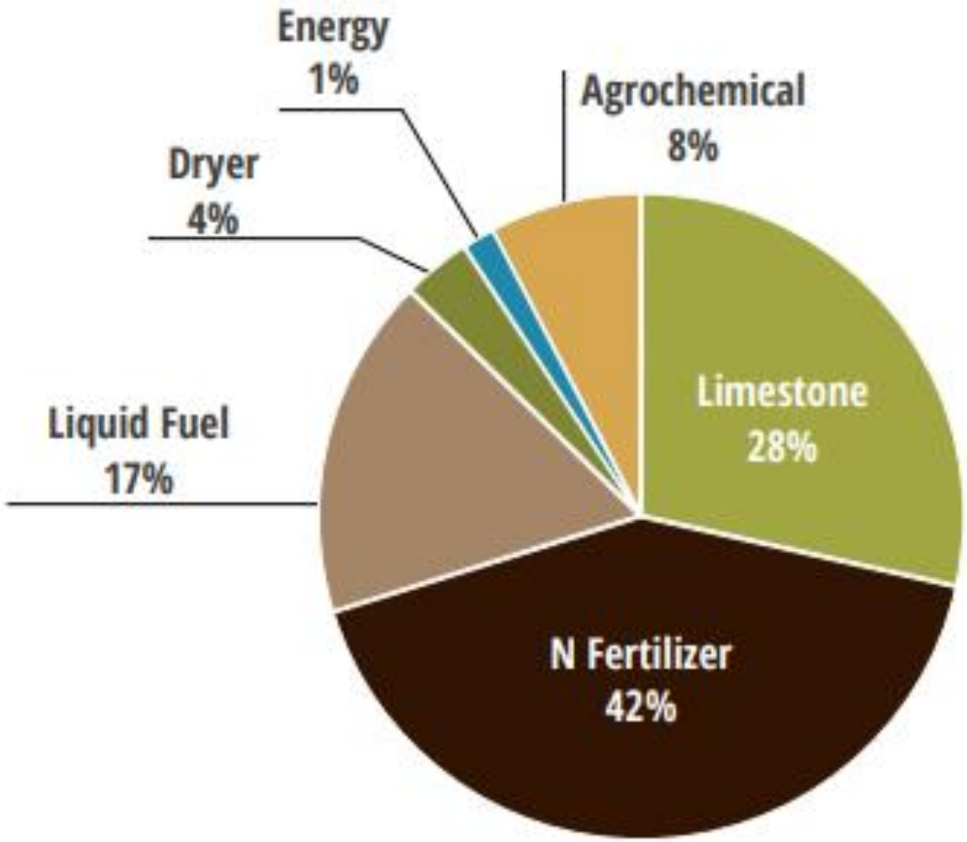
Mg CO_2e ha^{-1} $year^{-1}$

GHG Emissions in Minas Gerais Coffee Farms

Total GHG emission estimates ranged from 0.40 to 4.27 $tCO_2e\ ha^{-1}\ year^{-1}$,

Average: 1.74 $tCO_2e\ ha^{-1}\ year^{-1}$.

Nitrogen fertilizers are the main cause of the greenhouse effect in Minas Gerais coffee growing, followed by limestone, fuels and agrochemicals.



Carbon Balance: Components

N Fertilizer

Lime

Liquid Fuel

Agrochemicals

Dryer

Electricity

GHG Emissions

C Removals

Carbon Balance = -

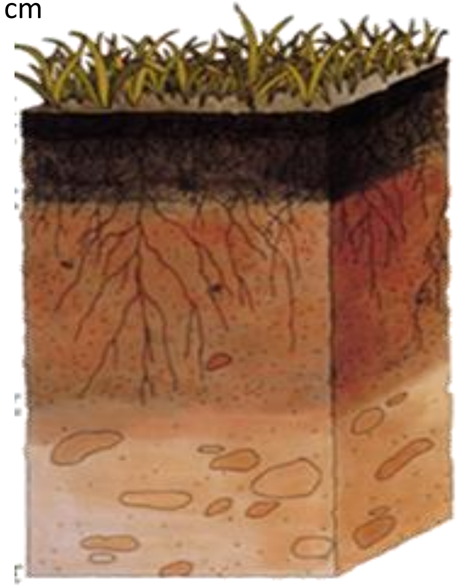
Mg CO_2e ha^{-1} year^{-1}

Soil **Biomass**

MEASUREMENT OF SOIL CARBON STOCK

<u>Data required:</u>

- Carbon content in soil layers;
- Density of soil layers;



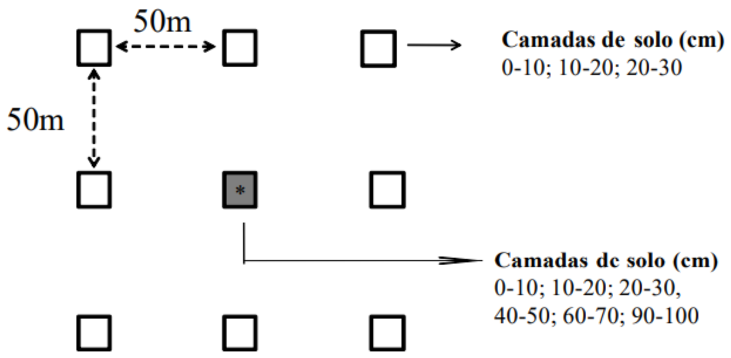
$$S = C \times SD \times layer$$

% C

$$d = \frac{m}{V}$$

Soil Carbon Stocks

- ✓ Soil collections in a grid scheme composed of nine points and a distance of 50m between them. At the central point was opened a trench 100 cm deep to collect samples every 10 cm.
- ✓ In the other eight points, three disturbed samples were collected at every 10cm depth up to 30cm.
- ✓ In total, 34 disturbed samples were collected for determining soil carbon contents and 10 undisturbed samples were collected for determining soil density at each site .



Biomass Carbon Stocks

8 Coffee Trees:

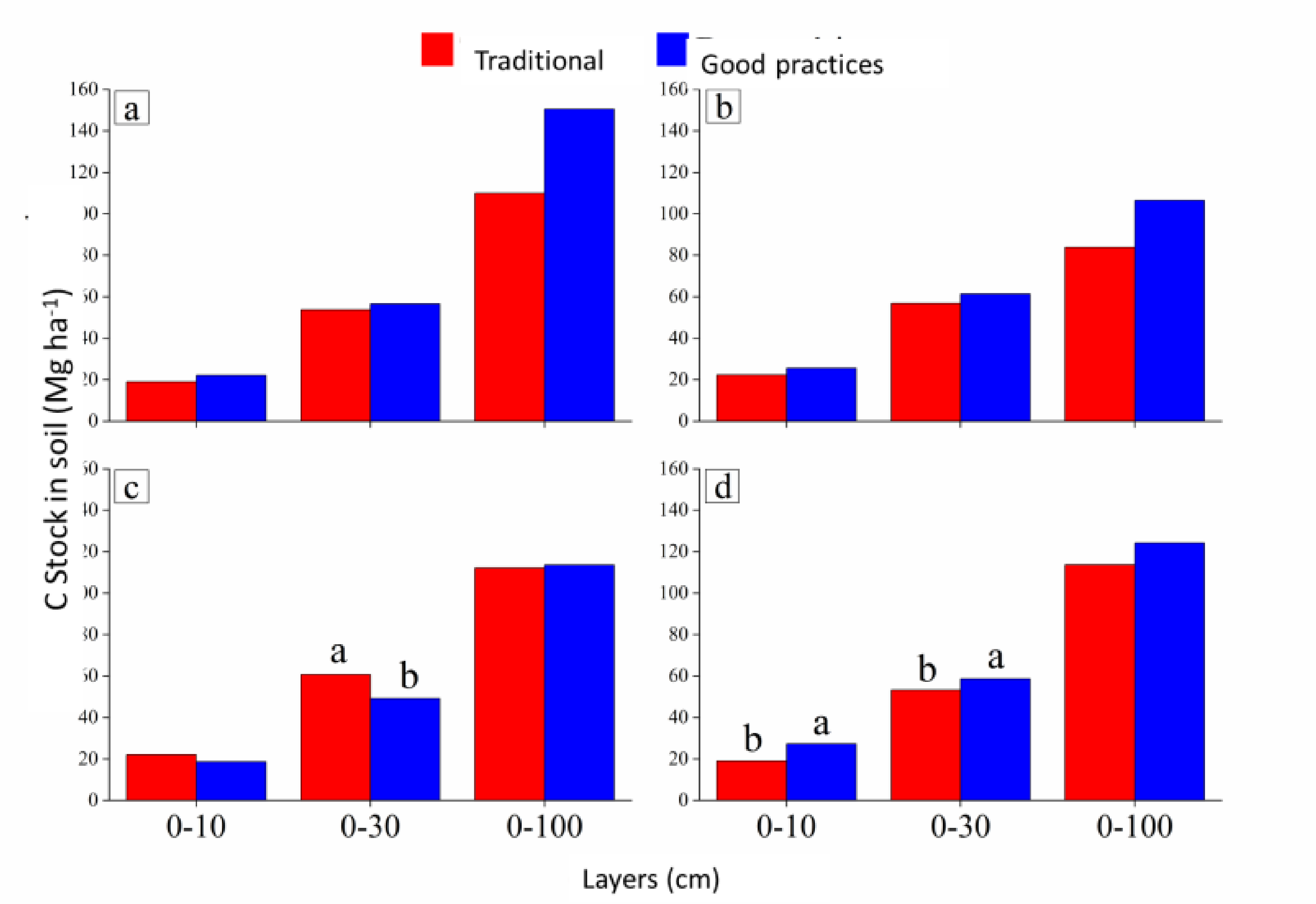
Trunk
Branches;
Leaves;
Litter;
Coarse root;
Fine root.

Biomass Quantification

Laboratory analysis: Carbon Contents

Soil and plant C contents were determined by the dry combustion method, using an elemental analyzer of the Leco brand.

Soil Carbon Stocks



SOIL CARBON STOCKS

Carbon Inventory
Good Practices Farms

-

Carbon Inventory
Conventional Farms

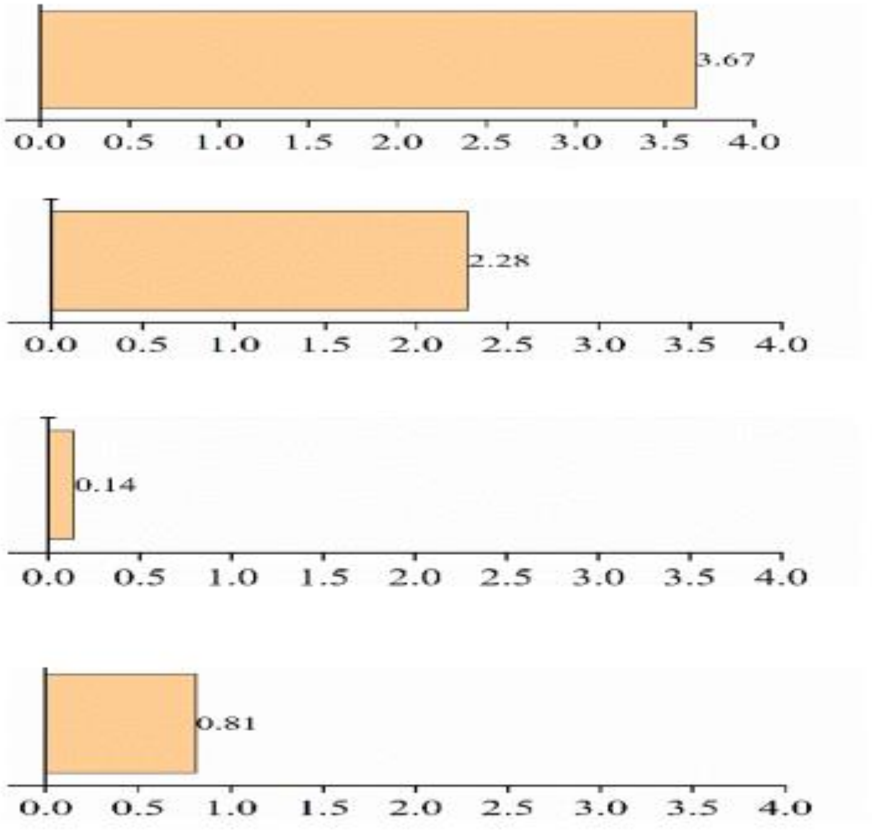
△C

Time of adoption

=

Annual Soil Carbon Sequestration rate (Mg C ha^{-1} $year^{-1}$)

Annual Soil Carbon Sequestration Rate (Mg C ha-1 year-1)



Mean rate
1.72
Mg C ha^{-1} $year^{-1}$

Mean rate
6.29
Mg CO_2e ha^{-1} $year^{-1}$

Carbon Stocks in Plant Biomass

C Stock
Good Practices Farms

\-

C Stock
Tradicional Farms

ΔC

Time of adoption

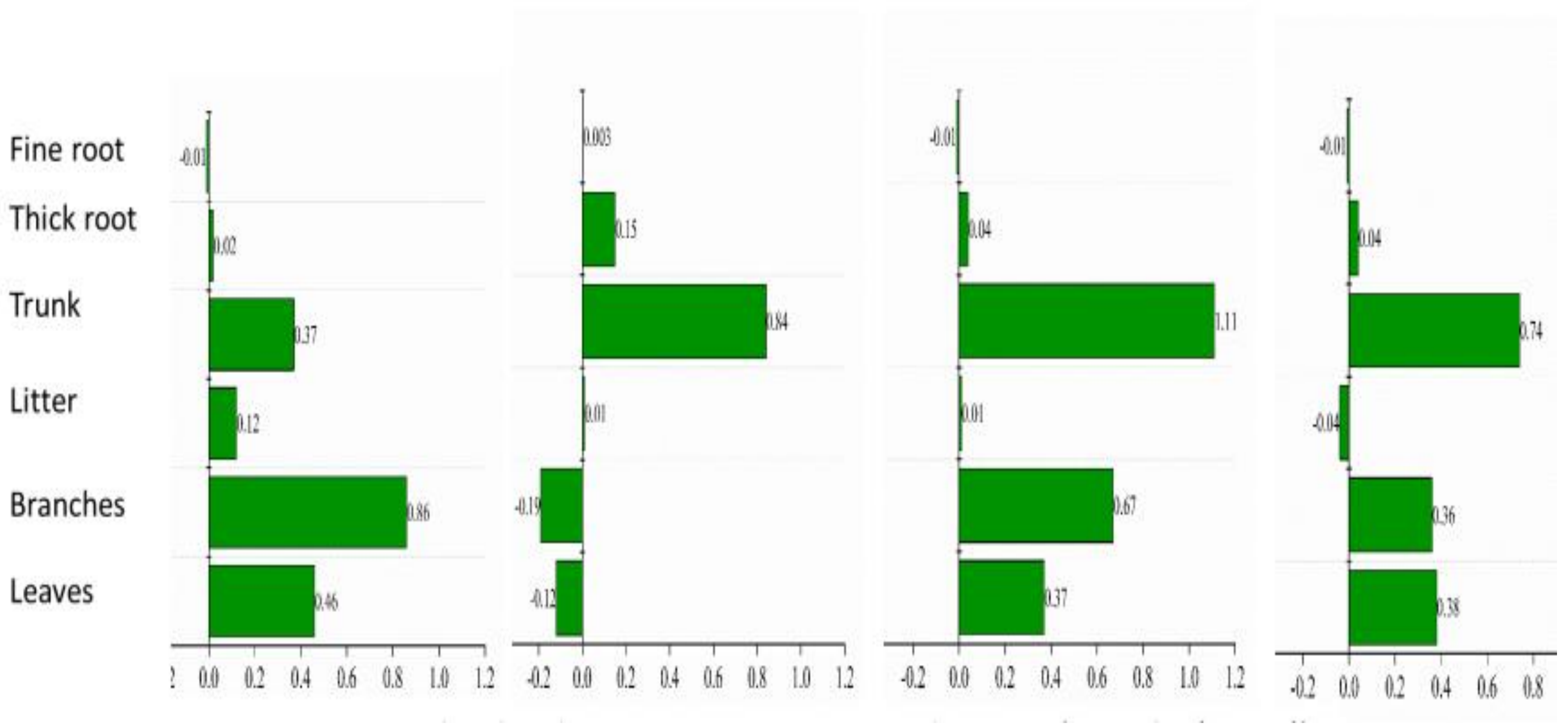
=

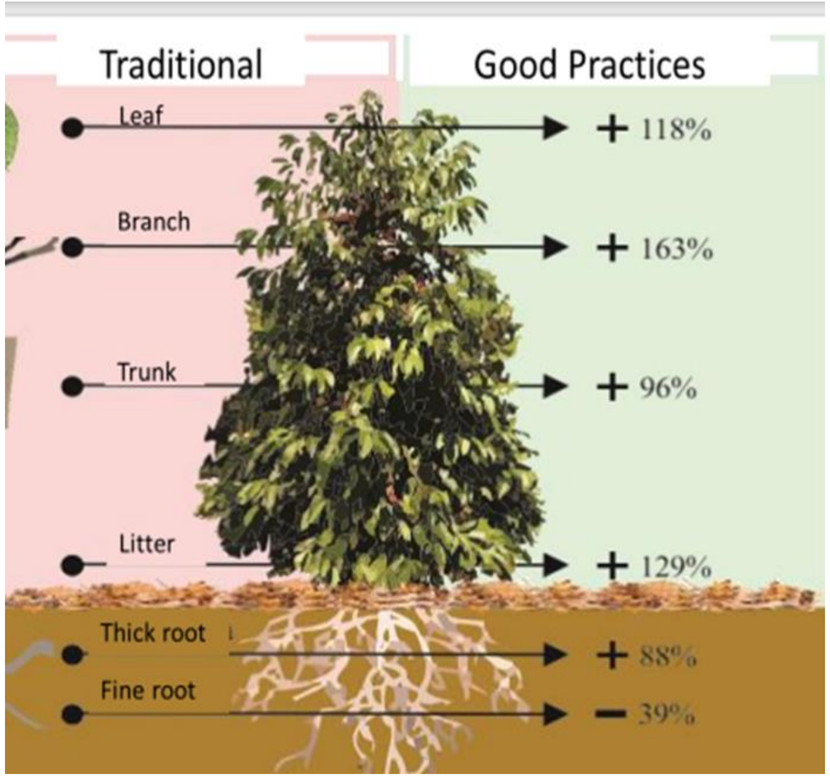
Annual Carbon Sequestration rate in plants (Mg C ha^{-1} $year^{-1}$)

Annual Rate of Carbon Sequestration in Biomass (Mg C ha-1 year-1)

Mean rate
1.63
Mg C ha^{-1} year^{-1}

Mean rate
5.96
Mg CO_2e ha^{-1} year^{-1}





Carbon Balance Due Adoption of Good Practices (Mg C ha-1 year-1)

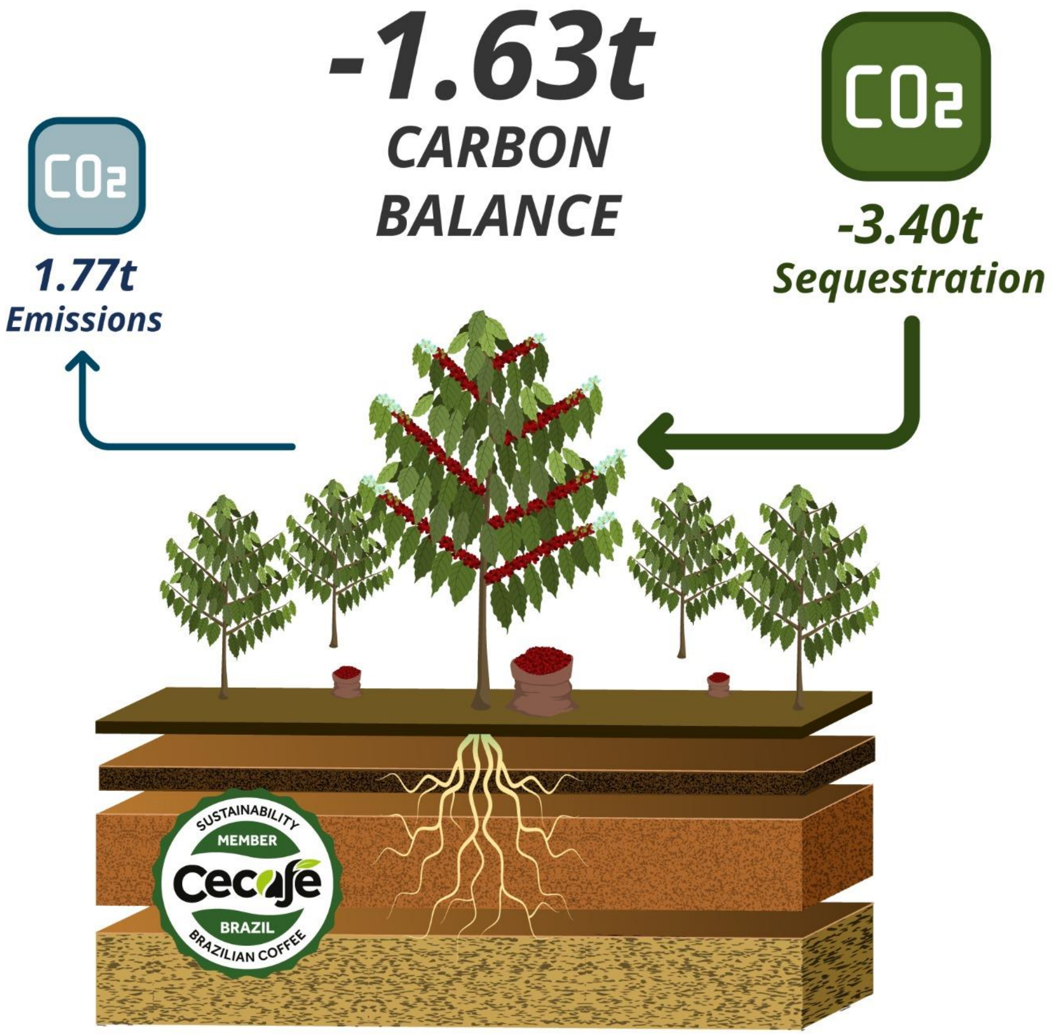
Carbon Balance Due Adoption of Good Practices (Mg C ha-1 year-1)

Traditional Coffee

- ✓ Carbon balance of traditional farms: GHG emissions (+1.77 t CO2 e ha-1 year-1) and the carbon stock accumulated **in the coffee biomass (3.40 tCO2e.ha^{1}year^{-1}).**

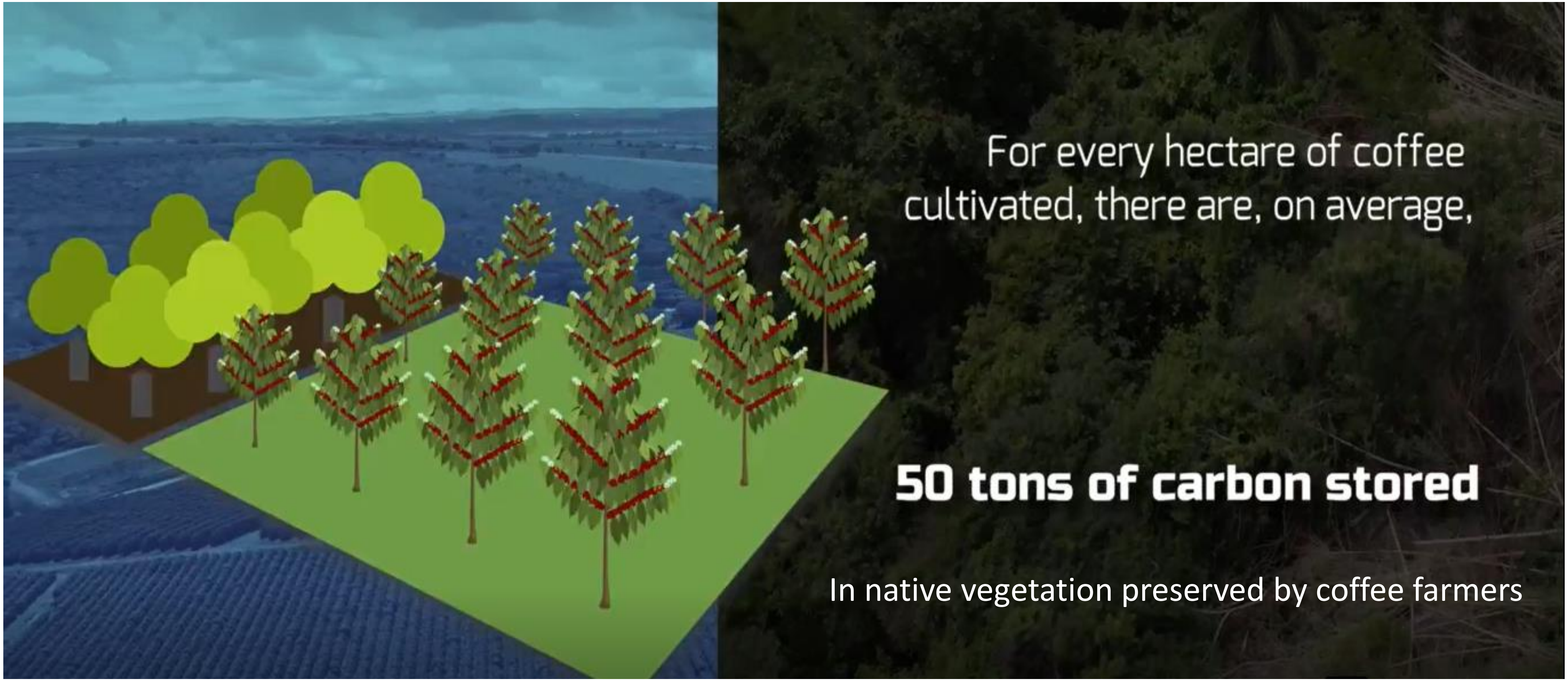
- ✓ To estimate the sequestration value of the coffee plant, Imaflora used the coffee tree growth model compared to the productivity per plant (Souza 2018)*.

-<u>Average productivity</u>: 34 bags ha-1 ;
-<u>Density</u>: 3500 plants ha-1;
-<u>Conversion rate</u>: 1 kg green coffee = 8.36 liters of coffee
- <u>Average of 50% C in plant dry matter</u>.



**Souza, L. T. Nutrient Demand for vegetation and fruiting of Coffea arabica L. dissertação (Mestrado em Fitotecnica) – Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo. p 33. 2018*

Estimation of Carbon stored in Forests within Coffee Farms



Recommendations to achieve lower emissions

- Alternative nitrogen source. In traditional farms, the most used N source was urea. Despite being a fertilizer of low investment, it is an important source of GHG emissions. Whenever possible opt for a fertilizer whose application is associated with lower emissions, e.g. organominerals;

- Return of coffee husk from processing is an alternative for the increase of carbon in the soil. In addition, it can be used for the production of the farm's organic compost, mixed with nitrogen sources reducing the consumption of inputs such as potassium fertilizers;

- Maintenance of cultural residues from pruning helps to keep the soil always covered, increase the carbon in the superficial layers of the soil, reducing the compaction of agricultural machinery, and reduces the losses of soil and inputs via surface runoff. (may increase volatilization, due to increased soil moisture);

- Brazilian coffee farmers adopt a variety of management practices, such as the use of perennial inter-row crops, systematic pruning management, and fertilizer sources. More in-depth evaluations with a broad scope and "in loco" analysis are options for improving results and making more assertive decisions for GHG emissions reductions.

Full Report: https://www.cecafe.com.br/site/wp-content/uploads/2022/05/Cecafe-RelatorioImaflora-CarbononTrack-INGLES.pdf

Next Steps

✓ **Carbon Balance in Espirito Santo's Conilon Coffee Farming with Good Agricultural Practices**

- **26 Coffee Farms**;
- Quantify GHG emissions and removals resulting from Conilon coffee cultivation in Espírito Santo;
- Estimate Carbon addition due to land use change to conilon coffee cultivation and also carbon addition due to good practices adopted in Espírito Santo farms.
- Estimate Carbon stored in native vegetation conservation areas within coffee farms.

✓ **Results by November 2023.**

Thank you!

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