GOALS

- Provide the **accurate** value for SPC carbon footprint

- Ensure Accountability and Transparency

- Sensitivity analysis: Primary data vs Ecoinvent database

- Measure the real scenario of CJ Selecta operations

- Take strategic decisions

- Promote CLIMATE RESILIENCE

CJ Selecta STUDY

Encourage the adoption of best agricultural practices to reduce greenhouse gas (GHG) emissions at the farm level and throughout the value chain

Functional unit: 1 ton SPC

PEFCR Guidelines for animal feed

Primary data collection from **100% of farms**

Economic Allocation

STANDARDS & SCOPE

OpenLCA
software version
2.0

Impact assessment
method "IPCC 2021
GWP 100 years

Ecoinvent
database version
3.10

BRLUC and
ICVCALC

MAPBIOMAS

PAS 2050-1:2012
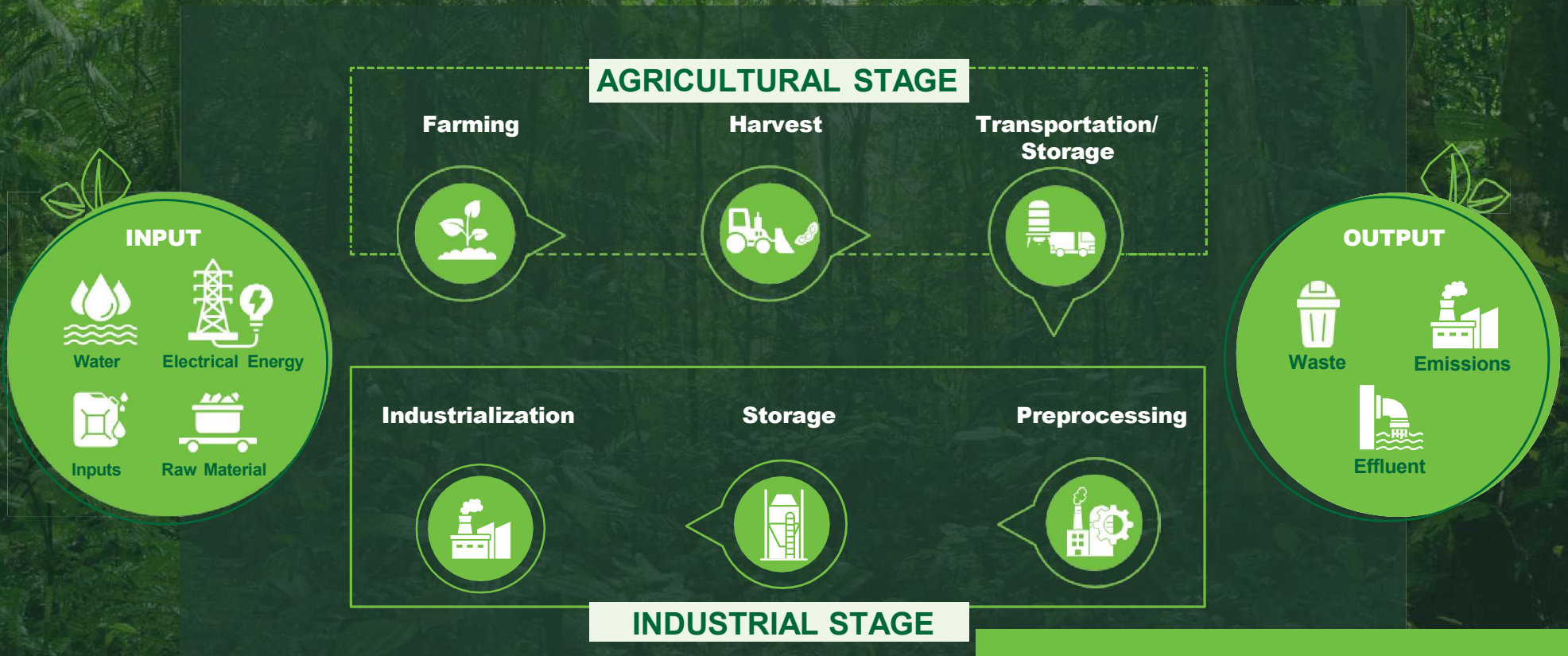
ISO 14067

BORDERS OF THE SYSTEM

Borders of the systems for the production of SPC

AGRICULTURAL STAGE

Farming — Harvest — Transportation/Storage

INPUT

- Water
- Electrical Energy
- Inputs
- Raw Material

OUTPUT

- Waste
- Emissions
- Effluent

Industrialization — Storage — Preprocessing

INDUSTRIAL STAGE

The carbon footprint of a product quantifies greenhouse gas (GHG) emissions throughout its life cycle, from raw material extraction to final disposal

INDUSTRIAL STAGE

Major contribution

ELECTRIC POWER

ENERGY -STEAM

INPUTS IN THE PRODUCTION OF SPC, LECITHIN AND REFINED OIL

The energy used comes from the boiler, which generates electricity and steam used in the processes

AGRICULTURAL STAGE
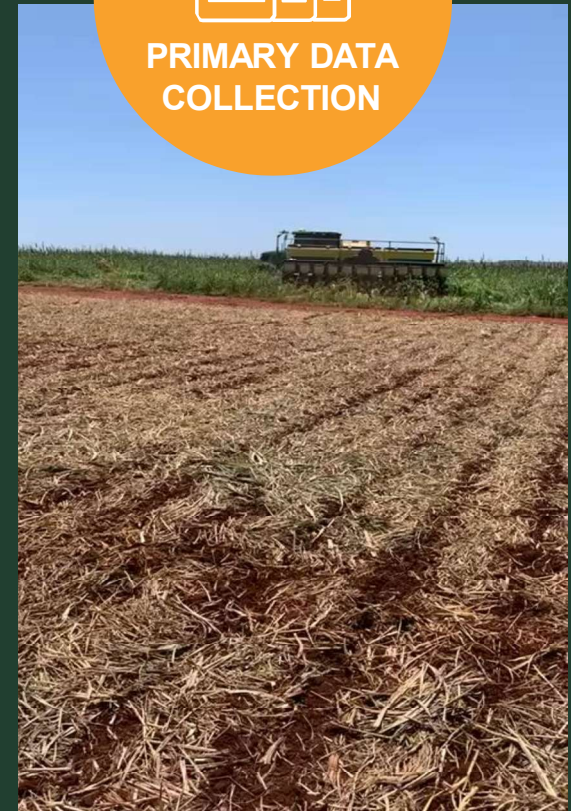
Crop Season: 2020, 2021, 2022 , 2023

Farmer assessment:

TECHNOLOGY PROFILE

- No-Till Farming
- Second crop planting
- Integrated Pest Control
- Use of Inoculants
- Fuel consumption
- Technology in Pesticide Application

- Technologies in Fertilizer Biological pesticides
- Biofertilizers
- Irrigation

PRIMARY DATA COLLECTION

OVERALL RESULTS

Carbon footprints of products (tCO$_2$e/t of product)

SPC
NGMO
(tCO$_2$eq/t)

With LUC
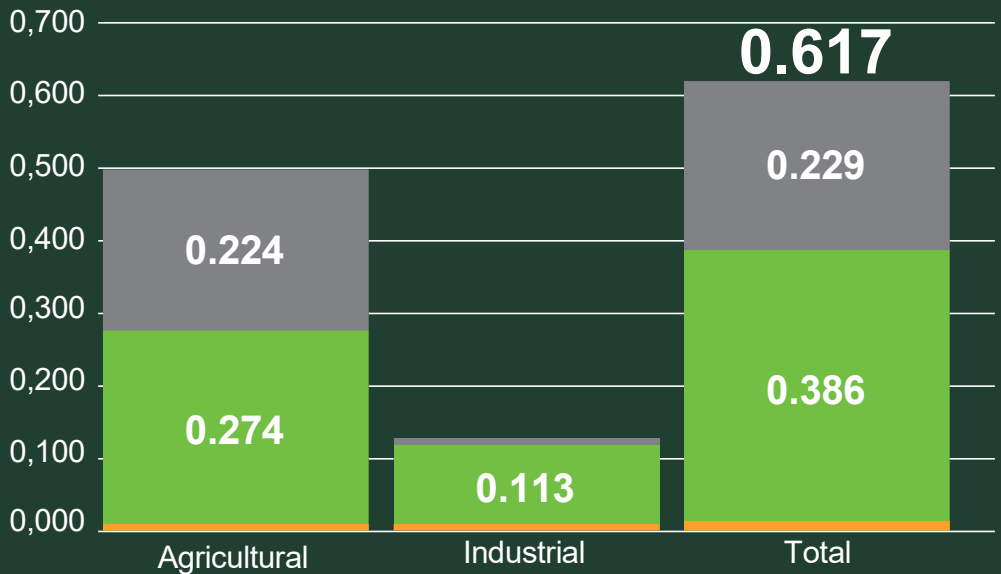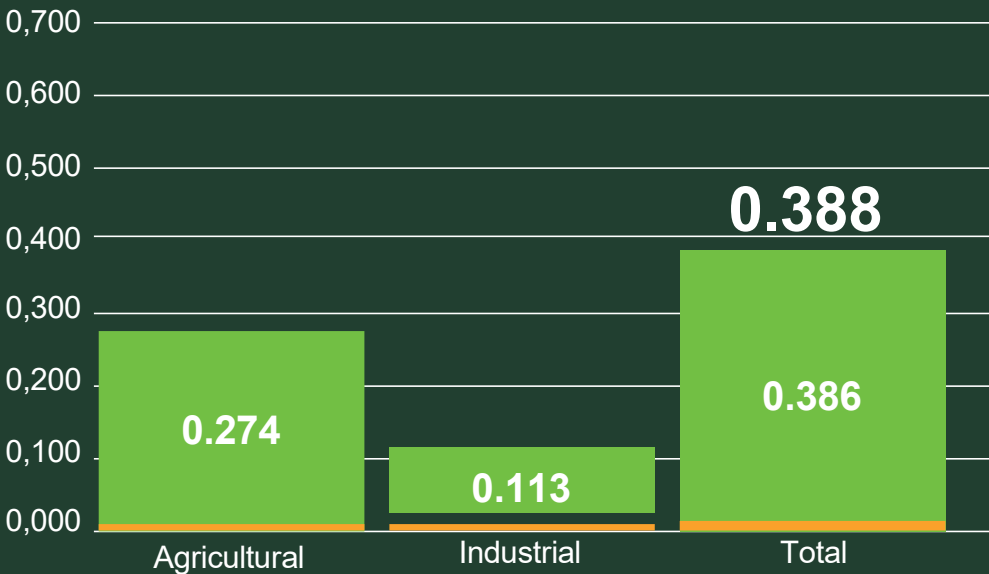
0.617

Without LUC

0.388

Emissions per each stage of life cycle
and impact category

With LUC

Without LUC

Biogenic (tCO$_2$e) Fossil (tCO$_2$e) LUC - Land Use Change (tCO$_2$e)

Emissions per each stage of life cycle
and impact category

Item	tCO$_2$e		
	Biogenic	Fossil	Land Use Change
Agricultural	0.001	0.273	0.224
Industrial	0.001	0.113	0.005
Sum	**0.002**	**0.386**	**0.229**

80.7%

TOTAL

0.617

VERIFICATION STATEMENT

Bureau Veritas Certification, established at Avenida Angélica, 2546 Floors 14th, 15th, and 16th, Consolação, São Paulo/SP, registered in the National Registry of Legal Entities under number 72.368.012/0002-65, hereby declares that CJ SELECTA S.A., established at Av. Rondon Pacheco, 4600, Uberlândia/MG, Zip Code: 38405-142, registered in the National Registry of Legal Entities under number 00.969.790/0001-18, is authorized to publish in all its titles and websites the excerpt of the Verification Statement as follows:

"Bureau Veritas Certification, based on the processes and procedures described in its Verification Report, declares that for the methodology described in the document "*Pegada de carbono do SPC (Soy Protein Concentrate), do óleo refinado e da lecitina*" of CJ SELECTA S.A., there is no evidence that it is not materially correct, is not a fair representation of the data and information on the Product's Carbon Footprint, or has not been prepared in accordance with the specifications of NBR ISO 14067:2023".

Scope Verified:

- **Products:** Soy Protein Concentrate (SPC), refined oil, and lecithin;
- **Reference year:** July 1, 2022, to June 30, 2023;
- **Manufacturing Process:**
  - Soya protein concentrate: Reception and preparation of soybeans, hexane extraction, desolventisation of soybeans, roasting;
  - Refined oil: Reception and preparation of soybeans, hexane extraction, refining;
  - Lecithin: Reception and preparation of soybeans, hexane extraction, degumming, drying;
- **Boundary:** cradle-to-gate;
- **Modeling:** attributional;
- **Declared units:** 1 ton of product;
- **Data sources:**
  - Agricultural phase: Primary data on input consumption collected through a questionnaire applied to a representative sample of producers. Emissions from land-use change and fertilizer application were estimated using secondary data (BRLUC, MapBiomas, ICVCalc);
  - Industrial phase: Primary data on input consumption and waste generation provided by the company itself;
  - Transportation of inputs: Distances estimated through the supplier's location using Google Maps for road transportation and Sea Rates for maritime transportation. Transport emissions and infrastructure impacts were estimated based on ecoinvent 3.10;
- **Impact assessment method:** IPCC 2021 GWP 100a;
- **Software:** OpenLCA v.2.0;
- **Database:** ecoinvent 3.10.

Results:

Table 1. Carbon Footprint of Products (tCO2e/t de product).

Produtos	Non-GMO/ (tCO2e/t)
SPC	0.617

Verification conclusions:

CJ Selecta S.A. and GSS submitted the document "*Pegada de carbono do SPC (Soy Protein Concentrate), do óleo refinado e da lecitina*" to Bureau Veritas Certification for verification. This CFP study was developed to calculate the potential contribution of three CJ Selecta products to global warming in kg of CO2 equivalent.

The document was reviewed by Bureau Veritas' verification team based on the NBR ISO 14067:2023 standard and the recommendations of the RCP "*PEFCR Food for producing animals*". It was confirmed that the methodology meets the requirements specified in Clause 7.3 of NBR ISO 14067:2023 "Information necessary for the CFP study report", in addition to complying with the requirements of the RCP "*PEFCR Food for producing animals*" with regard to the objectives for assessing the impact of climate change. Conclusions can be seen in Table 1 below:

Table 2. Conclusions regarding the mandatory information for a CFP study report according to NBR ISO 14067: 2023

Information Required for CFP Study Report	Verification conclusions
a) functional or claimed unit and reference flow	Declared units are shown in Table 1.
b) system limit	The Organization has restricted the limit of its CFP quantification from cradle-to-gate (Section 1). Justification for the adoption of this limit was considered sufficient.
c) list of important elementary processes	Elementary processes were presented in Figure 1 (Section 2) and the main elementary processes in terms of contribution to global warming impact were explained for all products in Section 5 (Tables 21, 23, 25, 27, 29 and 31).
d) data collection information, including data sources	Information is contained in Section 3 in a detailed and clear manner.
e) list of GHGs taken into account	Information present in "Table A" of the Annexes.
f) selected characterization factors	Information present in "Table A" of the Annexes.
g) cut criteria and selected cuts	The Organization did not use any criteria or cut-off rules for the analysis of the product system. All identified processes were included. This premise was clearly defined in the document.
h) selected allocation procedures	The allocation procedures were detailed in Sections 2 and 3 of the report.
i) GHG emission time and removals, if applicable;	The methodology provides for the consideration of emissions resulting from one year of the product systems in operation. The IPCC method used to assess the impact on Climate Change considers a time horizon of 100 years.
j) description of the data, including — decisions regarding data, and — evaluation of data quality;	The Organization described the data and decisions for the construction of the CFP study inventory in Section 3.

LAND USE CHANGE

LAND USE

🟠 Annual crop

🟢 Native Vegetation

⚪ Pasture

⚪ Land Use Changesin 2021

🔴 Areas with CO_2 emissions

A) Land use in 2001

B) Land use in 2021
(end polygons with changes)

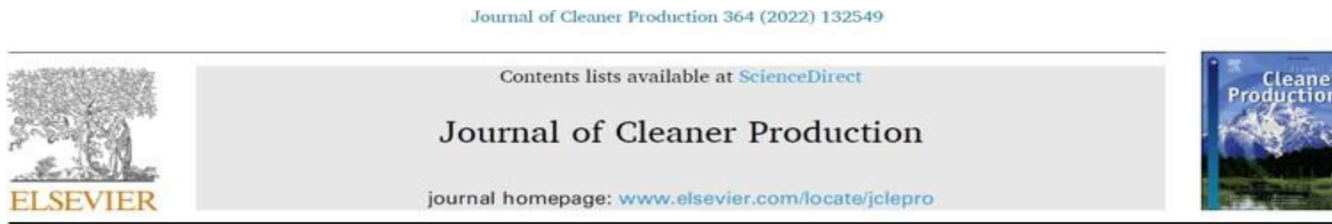**C)** Polygons with CO_2 emissions

LAND USE

CHANGE

Land use 20 Years
Satelite analyses of
100% of NGMO farms

~700,000ha

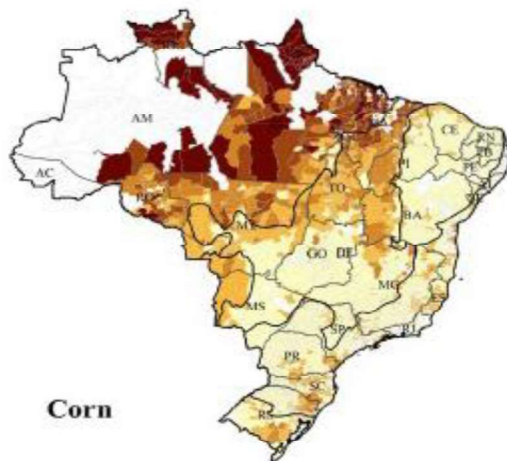| FARM NUMBE	ÁREA (H	UF	MUNICIPALITY	Soil NET EMISSION (tCO$_2$)	VEGETATION EMISSION(tCO$_2$)	VEGETATAION REMOVALS (tCO$_2$)	TOTAL NET EMISSION (tCO$_2$)
83	137	MG	Água Comprida	556	1.330	-40	1.847
84	363	MG	Água Comprida	3.607	8.304	-1.135	10.775
85	13	MG	Água Comprida	-3	33	-62	-32
86	1.273	MG	Araguari	361	2.156	-5.644	-3.127
87	193	MG	Araguari	-24	292	-1.351	-1.083
88	697	MG	Araguari	144	1.627	-824	947
89	22	MG	Araguari	5	22	0	28
90	242	MG	Araguari	337	2.347	170	2.513
91	668	MG	Araguari	20	746	-880	-115
92	305	MG	Araguari	55	329	-907	-523
93	75	MG	Araxá	236	1.171	-728	680
94	32	MG	Bonfinópolis de Minas	0	0	0	0
95	346	MG	Bonfinópolis de Minas	122	311	-508	-75
96	32	MG	Bonfinópolis de Minas	0	0	0	0
97	309	MG	Cabeceira Grande	2.038	6.790	-374	8.454
98	174	MG	Cabeceira Grande	115	528	-516	127
99	89	MG	Cabeceira Grande	257	1.246	-476	1.027
100	49	MG	Cabeceira Grande	11	50	-1	61
101	383	MG	Cabeceira Grande	22	435	-498	-42
102	0	MG	Chapada Gaúcha	1	2	0	2

Land Use Change

Brazilian reality

Source: Garofalo et al. 2022
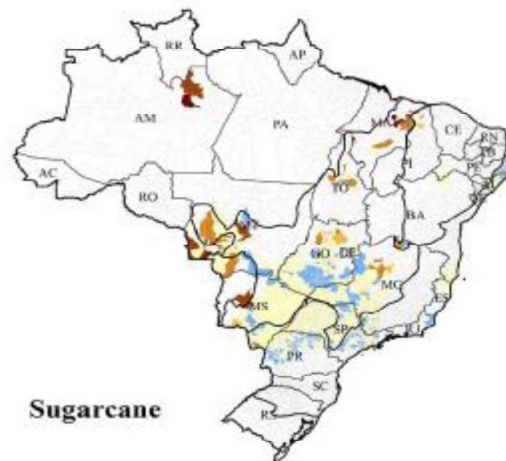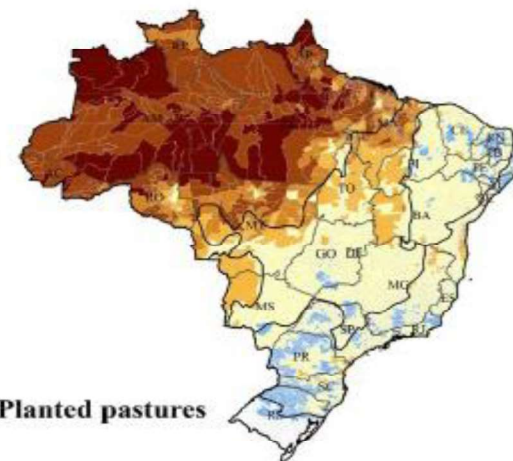
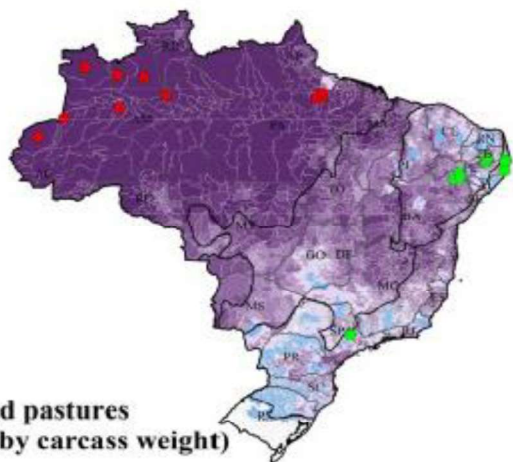**Soybean** **Corn** **Sugarcane** **Planted pastures**
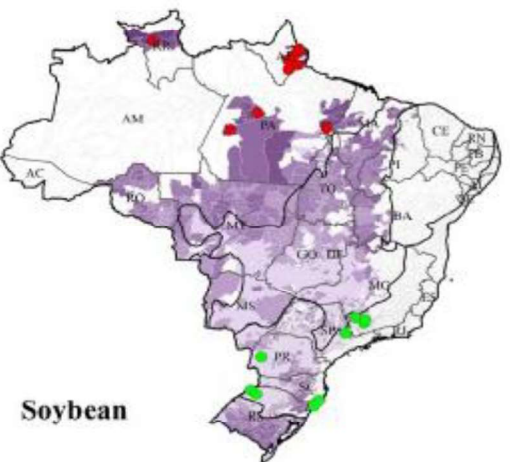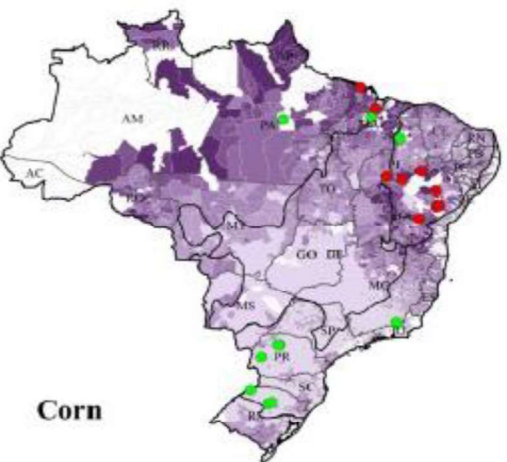
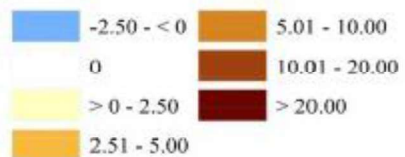**Soybean** **Corn** **Sugarcane** **Planted pastures (meat by carcass weight)**

LUC emission (tCO₂ ha⁻¹year⁻¹)

-2.50 - < 0	5.01 - 10.00
0	10.01 - 20.00
> 0 - 2.50	> 20.00
2.51 - 5.00	

LUC emission per t of product (tCO₂)

-12.89 - -5.00	0.1 - 1.00	7.01 - 10.00
-4.99 - < 0	1.01 - 2.50	> 10.0
0	2.51 - 5.00	● 10 largest emissions per production
>0 - 0.50	5.01 - 7.00	● 10 lowest emission/sequestration per production

0 400 800 1.200 km

SCG - Datum SIRGAS 2000
Source: Maps of state and municipal divisions
(IBGE, 2017)

Amazon
Caatinga
Cerrado
Pantanal
Atlantic Forest
Pampa

Brazil BR LUC

Soybean

Garofalo et al, submetido

RESTRITO

LUC emission per t of product (tCO₂)

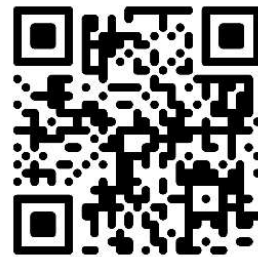|		
-12.89 - -5.00	0.1 - 1.00	7.01 - 10.00
-4.99 - < 0	1.01 - 2.50	> 10.0
0	2.51 - 5.00	● 10 largest emissions per production
>0 - 0.50	5.01 - 7.00	● 10 lowest emission/sequestration per production

BRLUC - Embrapa

Source: Garofalo et al. 2022

SOIL HEALTH
SANTA HELENA FARM
SÃO PAULO State - BRAZIL

SOIL HEALTH
ANTAGORDENSE FARM
MINAS GERAIS State - Brazil

Cover Crops
Santa Helena Farm

SÂO PAULO - Brazil

FINAL CONSIDERATIONS

- The study reveals that the agricultural stage accounts for most of the emissions

80.7%

due to the burning of fuel in agricultural machinery and LUC (Land Use Change).

- A third-party conducted sensitivity analysis revealed notable discrepancies in results for the agricultural stage. This analysis compared the primary data collected from soybean producers to that from the Ecoinvent database and LUC data sourced from satellite images.

- These findings highlight the critical significance of collecting primary data for accurate assessments.

SPC
NGMO
(tCO$_2$eq/t)

With LUC

0.617

Without LUC

0.388

FINAL CONSIDERATIONS

FUTURE DIRECTIONS

Encourage the adoption of best agricultural practices to reduce greenhouse gas (GHG) emissions at the farm level and throughout the value chain

Implementing regenerative agriculture practices can lead to further reductions in carbon emissions and enhanced carbon sequestration.

MEASUREMENT THAT METTERS

www.cjselecta.com.br

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