Contabilidade de carbono e desempenho ambiental na Produção Animal

Marília Folegatti
Embrapa Meio Ambiente

Sumário

- Cenário: compromissos do setor produtivo no combate às Mudanças Climáticas
- Contabilidade ambiental: protocolos e metodologias
- Avaliação de Ciclo de Vida
- Pegada de Carbono
- Exemplos

Cenário

Cenário

Compromissos do setor produtivo no combate às Mudanças Climáticas

ADM AMAGGI BUNGE Cargill COFCO INTL gar agribusiness and food JBS

LDC Louis Dreyfus Company Marfrig MUSIM MAS ofi make it real Olam Agri VITERRA wilmar

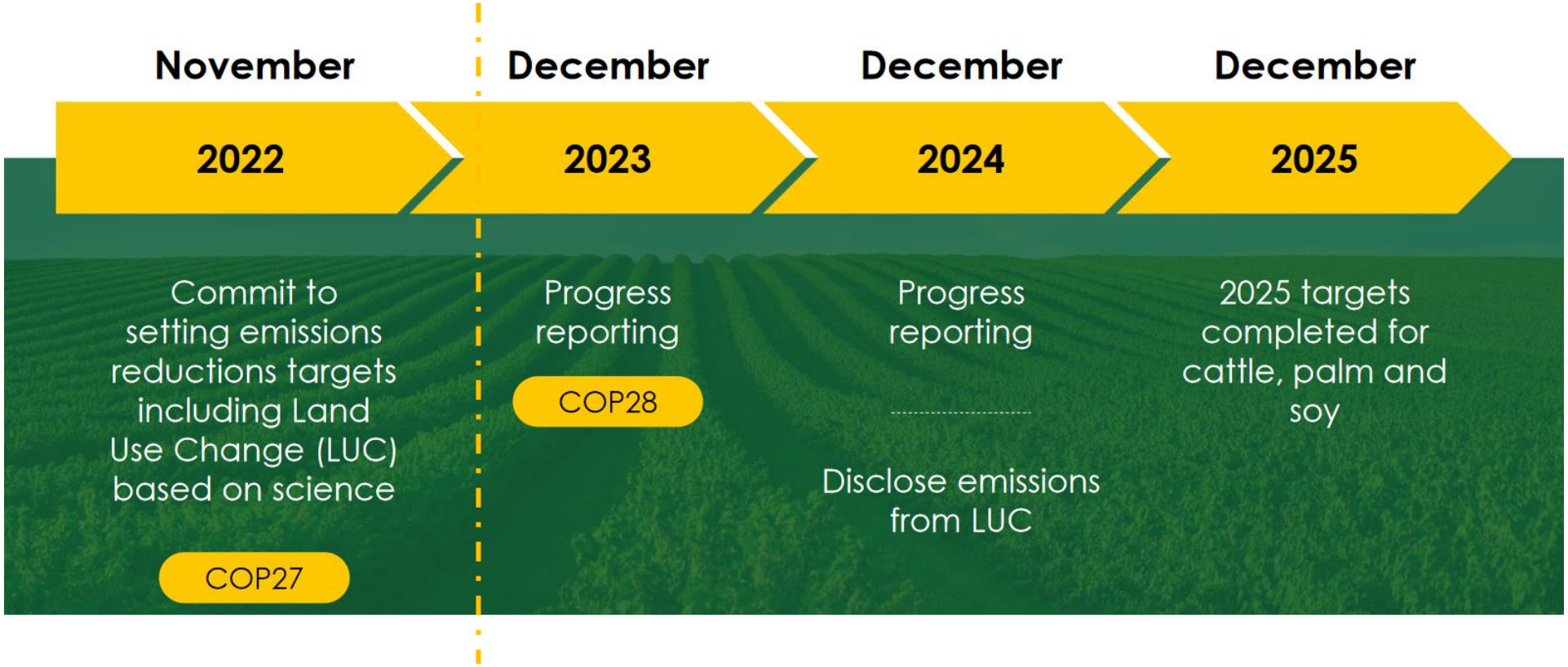
Cenário

Pilares

	1	2	3
	Accelerate supply chain action to reduce emissions from land use change	**Drive transformation of commodity producing landscapes**	**Support forest positive sector transformation**
Objective	This pillar focuses on sectoral and individual company action to reduce emissions from land use change	Companies will play a key role in supporting the transition to forest positive land use management and commodity production	Companies will strive to break down barriers and drive sector transformation through dialogue and collaboration with governments, other value chain actors and the finance sector

Cenário

Marcos



Cenário

Métrica e Cadeias produtivas

Companies will measure and publicly disclose emissions from land use change as part of a corporate-level GHG emissions inventory and will set emissions reductions targets based on science

Inventário Corporativo

Mudança de Uso da Terra

Contabilidade ambiental

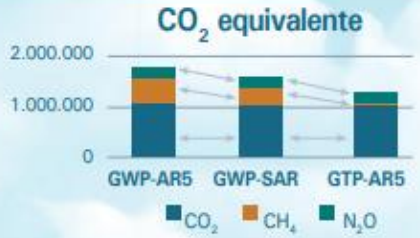
INVENTÁRIO NACIONAL

DE EMISSÕES DE GASES DE EFEITO ESTUFA

Atende ao COMPROMISSO DE REPORTE das emissões à Convenção do Clima – UNFCCC

Principais GEE inventariados

CO_2 CH_4 N_2O HFCs PFCs



Setores

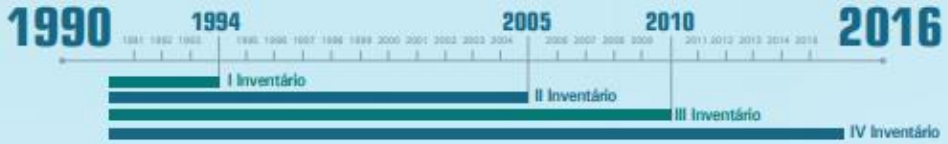
Uso de metodologias internacionais para contabilização → ipcc (Painel Intergovernamental sobre Mudanças Climáticas)

Coordenação-Geral do Clima do Ministério da Ciência, Tecnologia e Inovações (MCTI) → Responsável no Brasil

É importante para:

É importante para definir as ESTRATÉGIAS DE MITIGAÇÃO (redução de emissões) apropriadas para o país.

Série histórica das emissões anuais de GEE



Para saber mais acesse:

SIRENE

http://sirene.mctic.gov.br/

MUDANÇA DO CLIMA

PNUD

GLOBAL ENVIRONMENT FACILITY

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÕES

PÁTRIA AMADA BRASIL GOVERNO FEDERAL

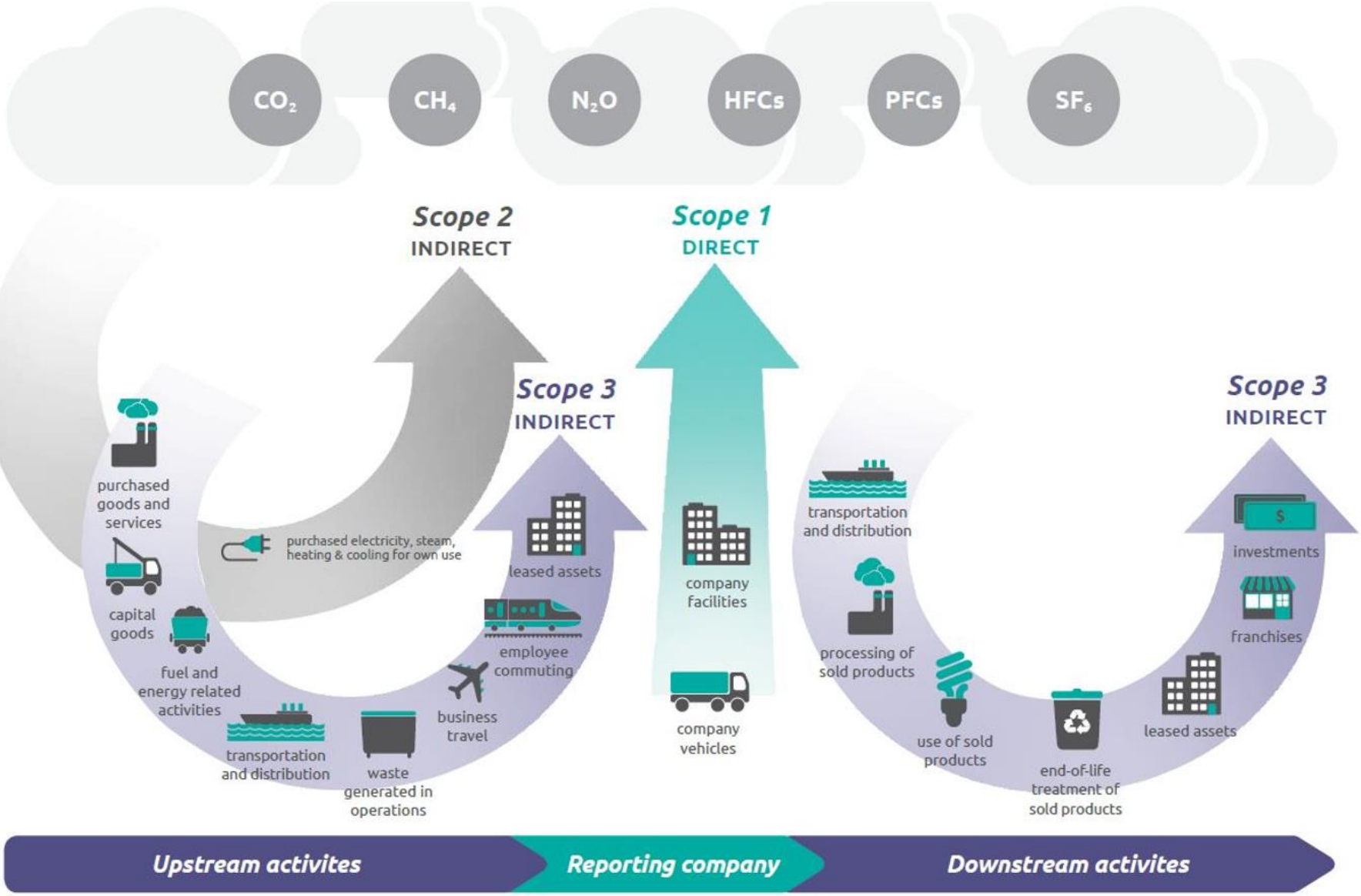
Inventário Nacional de Emissões de GEE

Inventário Nacional de Emissões de GEE

- Estimativas setoriais
- Abrangência nacional
- Tier 1, 2, 3

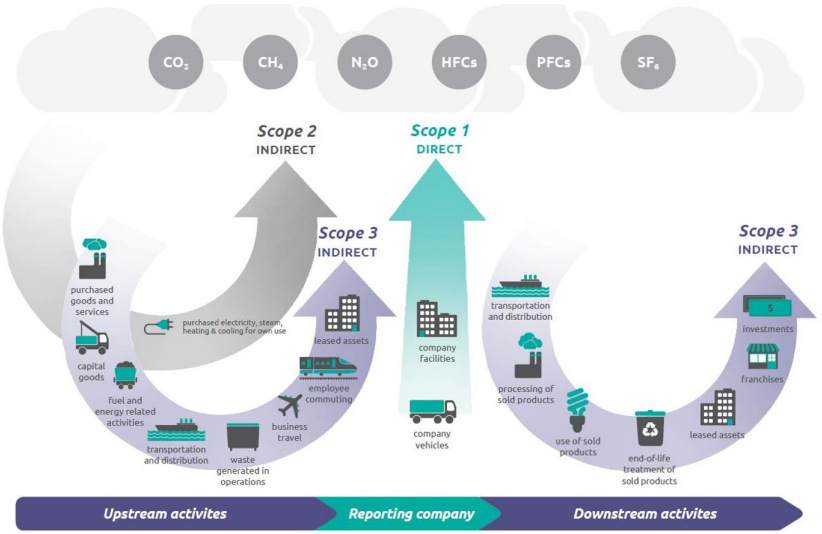
A Quarta Comunicação Nacional do Brasil à Convenção-Quadro das Nações Unidas sobre Mudança do Clima (UNFCCC, na sigla em inglês), documento oficial cuja elaboração é coordenada pelo Ministério da Ciência, Tecnologia e Inovações (MCTI) por meio da Coordenação-Geral de Ciência do Clima e Sustentabilidade, registra um número significativo de instituições participantes. Ao longo dos quatro anos de desenvolvimento, contabiliza o envolvimento direto de mais de 400 especialistas de cerca de 100 instituições nacionais, o que fortalece a articulação institucional. O documento apresenta à comunidade internacional um panorama das principais ações do Brasil para implementar a Convenção do Clima, e também é uma fonte referencial no âmbito nacional.

GHG Protocol: organização



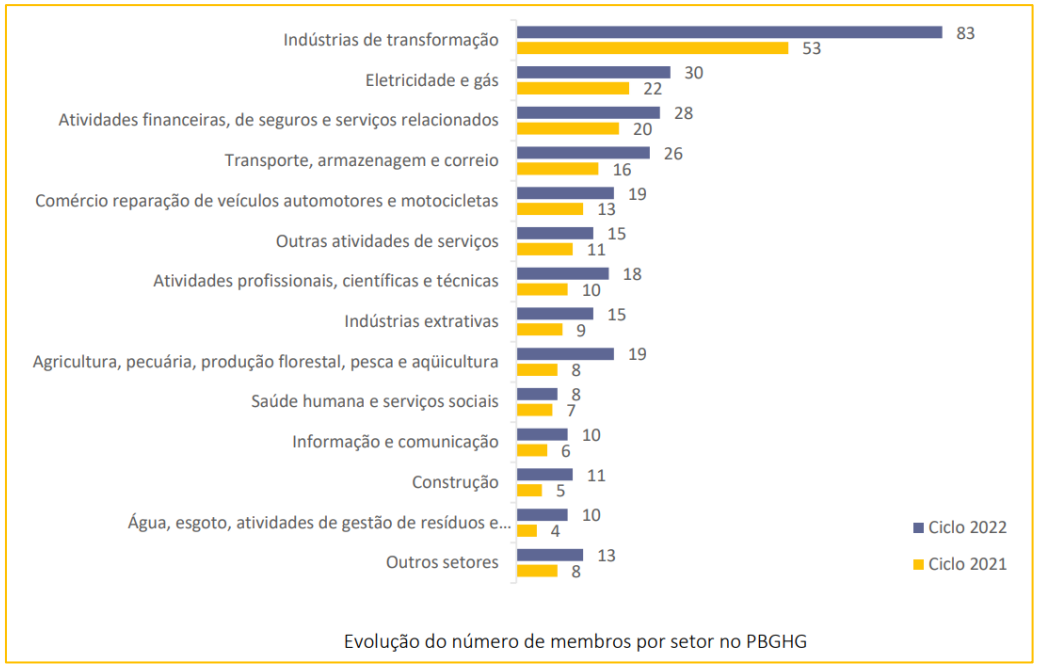
GHG Protocol: organização

GHG Protocol

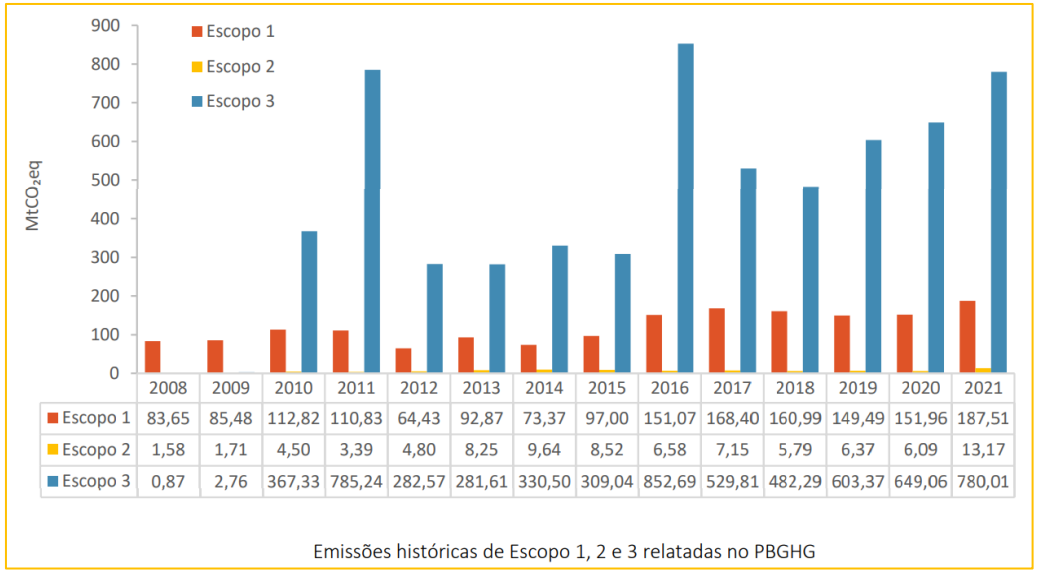


- Foco na organização
- Escopos 1, 2, 3
- Escopo 3 abrange a cadeia de valor

GHG Protocol: organização



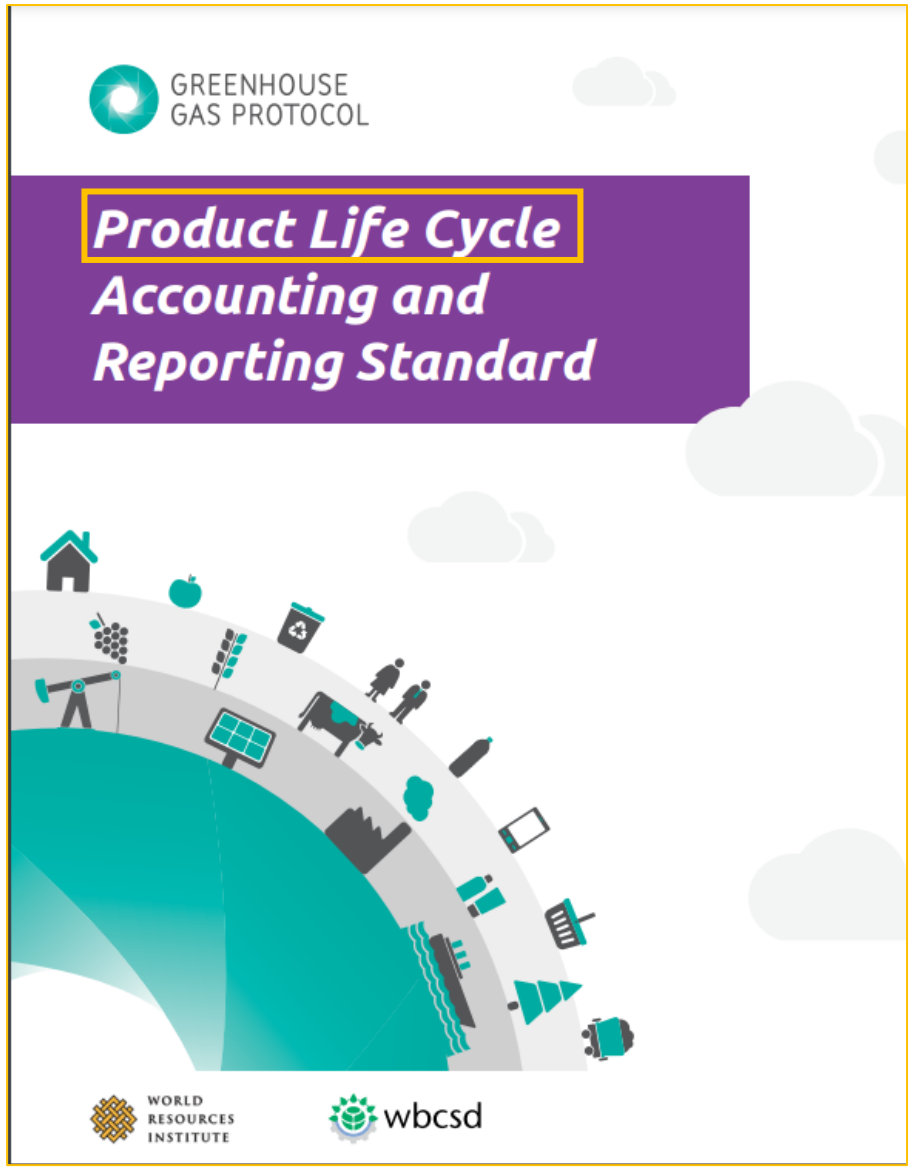
Evolução do número de membros por setor no PBGHG



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Escopo 1	83,65	85,48	112,82	110,83	64,43	92,87	73,37	97,00	151,07	168,40	160,99	149,49	151,96	187,51
Escopo 2	1,58	1,71	4,50	3,39	4,80	8,25	9,64	8,52	6,58	7,15	5,79	6,37	6,09	13,17
Escopo 3	0,87	2,76	367,33	785,24	282,57	281,61	330,50	309,04	852,69	529,81	482,29	603,37	649,06	780,01

Emissões históricas de Escopo 1, 2 e 3 relatadas no PBGHG

GHG Protocol: produto

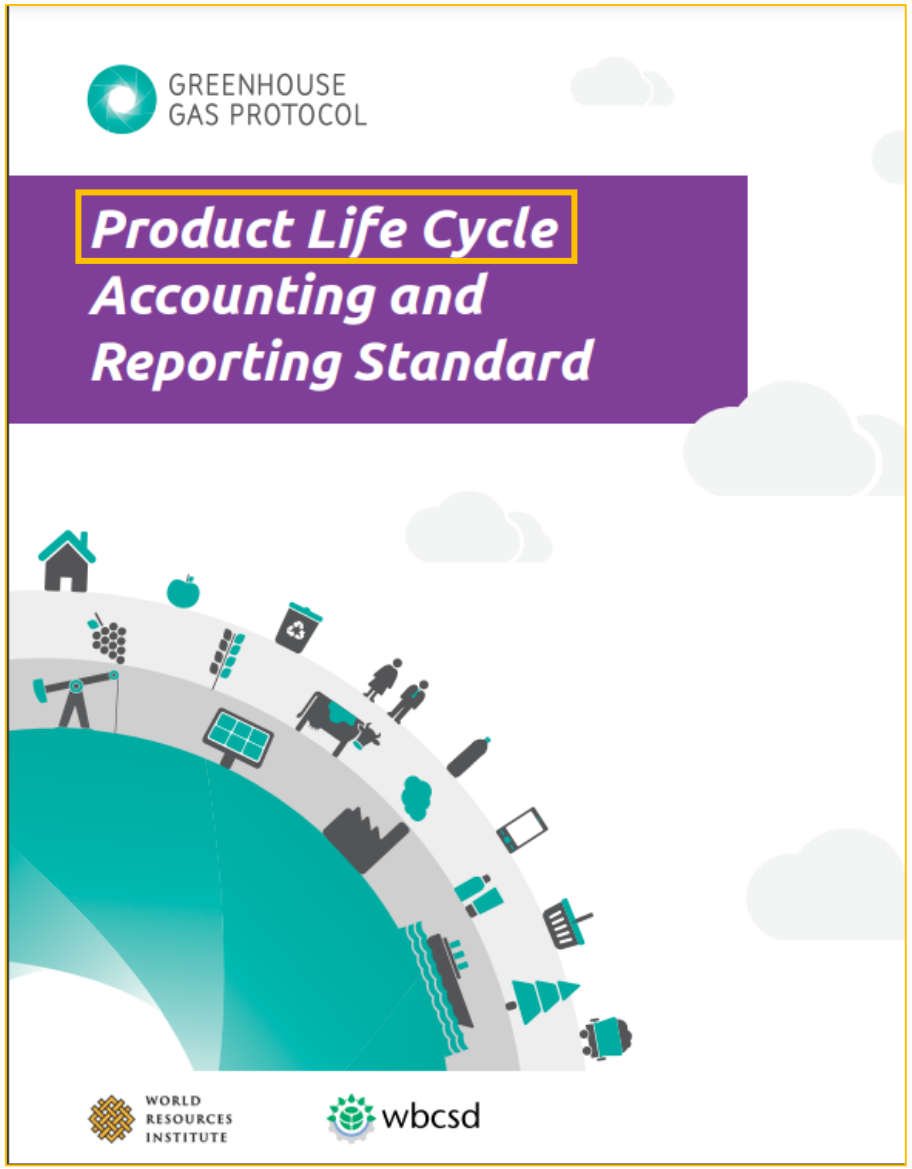


2011

Table of Contents

CHAPTERS

GHG Protocol: produto



Purpose of the GHG Protocol Product Life Cycle Accounting and Reporting Standard

The *GHG Protocol Product Life Cycle Accounting and Reporting Standard* (referred to as the *Product Standard*) provides requirements and guidance for companies and other organizations to quantify and publicly report an inventory of GHG emissions and removals[2] associated with a specific product. The primary goal of this standard is to provide a general framework for companies to make informed choices to reduce greenhouse gas emissions from the products (goods or services) they design, manufacture, sell, purchase, or use. In the context of this standard, public reporting refers to product GHG-related information reported publicly in accordance with the requirements specified in the standard.

GHG Protocol: land sector and removals

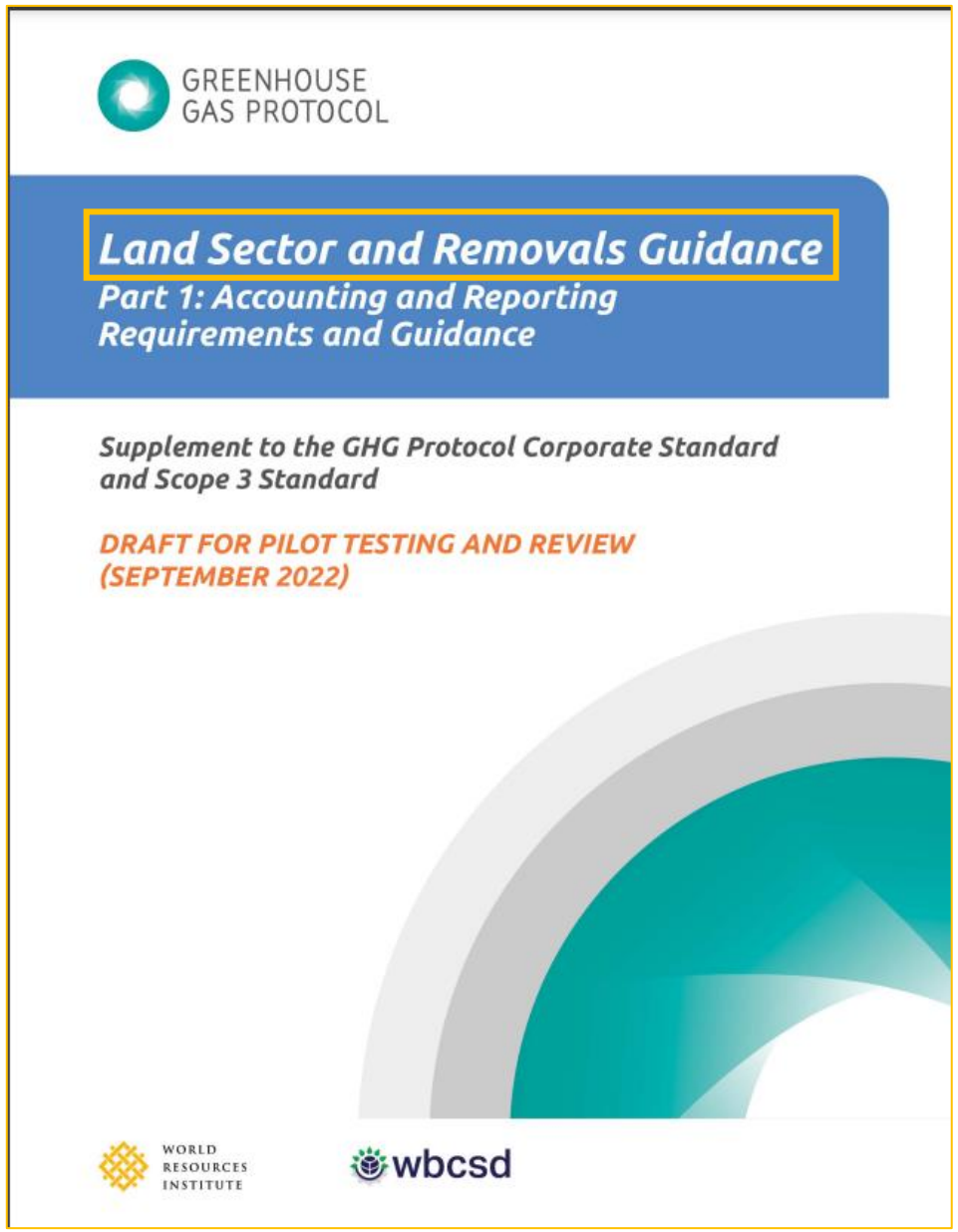


Table of Contents

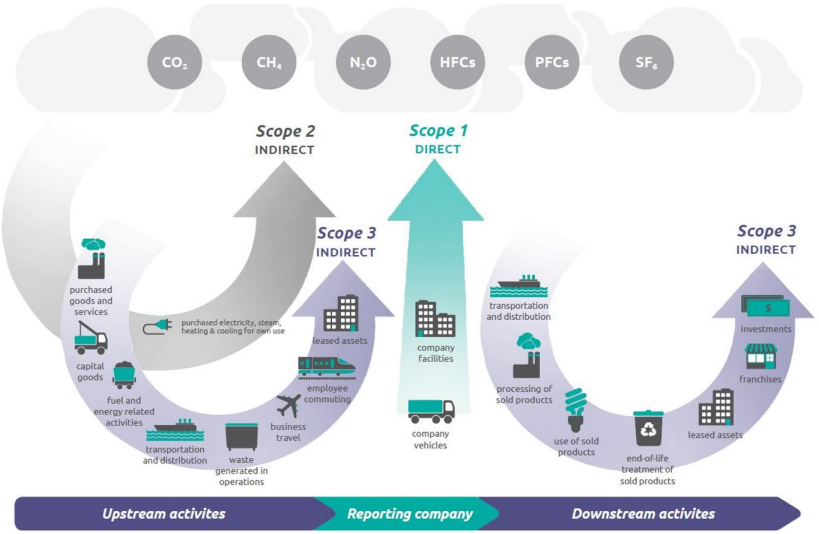
Contabilidade ambiental

Inventário Nacional de Emissões de GEE

- Estimativas setoriais
- Abrangência nacional
- Tier 1, 2, 3

Governo

GHG Protocol



- Foco na organização
- Escopos 1, 2, 3
- Escopo 3 abrange a cadeia de valor

- **Organização**
- Produto
- Uso da Terra
- Outros

ACV

- Foco no produto
- Contabilidade no CV
- Várias categorias de impacto ambiental

- **Produto**
- Pegada de C
- CCV
- ACVS
- ACV-sustent.
- ACV organ.

Referência IPCC

Avaliação de Ciclo de Vida

O que é ACV?

Técnica de gestão ambiental que envolve a ***compilação e avaliação das entradas, saídas e dos impactos ambientais potenciais*** de um ***sistema de produto ao longo do seu ciclo de vida*** (“do berço ao túmulo”) – ISO 14040:2014

- **Foco no produto**

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- **<u>Foco no produto</u>**

2,65 t CO_2 eq/**t soja** BR (EI, 2016)

O que é ACV?

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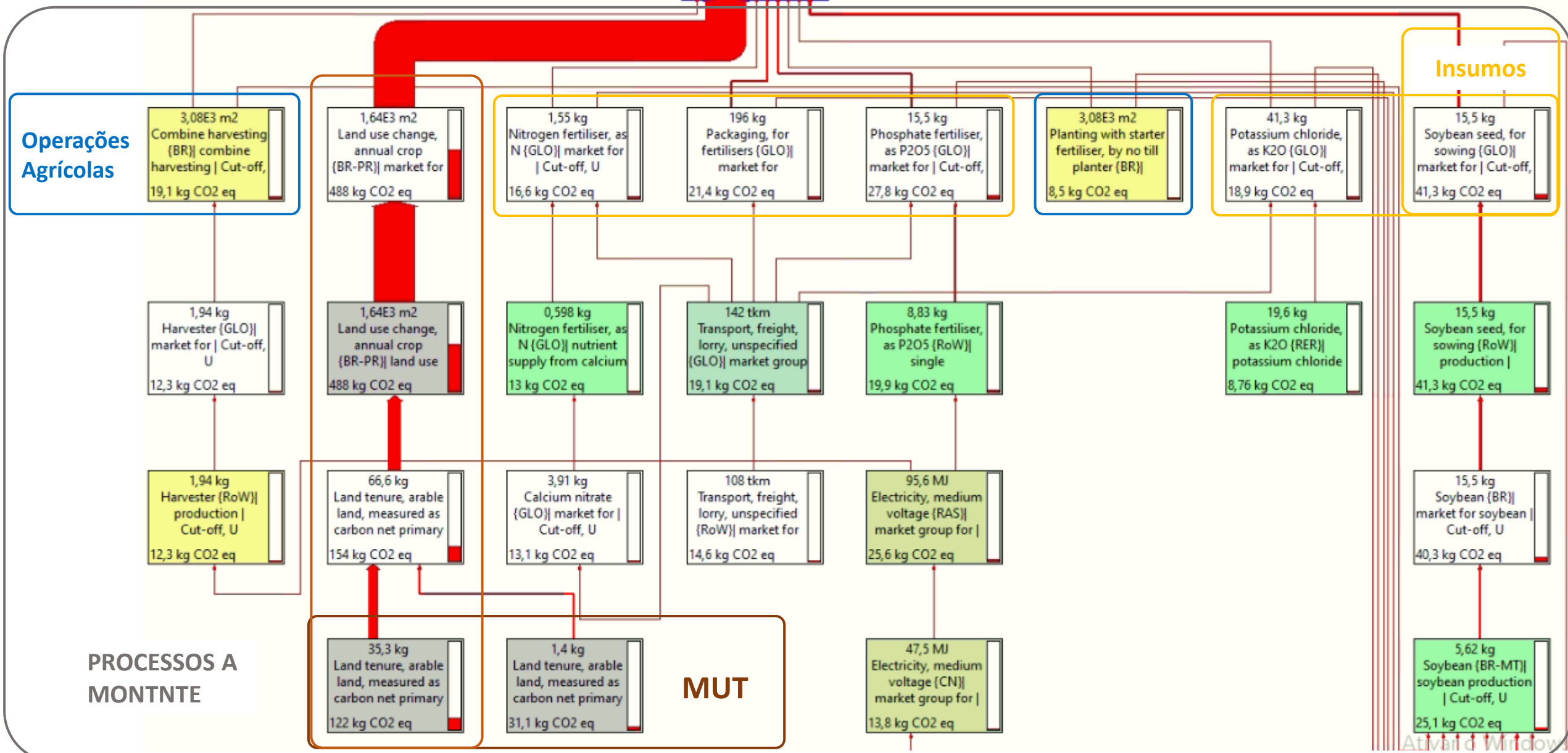
- Foco no produto
- **Contabilidade de material e energia no ciclo de vida**

Contabilidade no ciclo de vida

1 t soja
(PR, EI 2016, cut-off 0,95%)

FASE AGRÍCOLA



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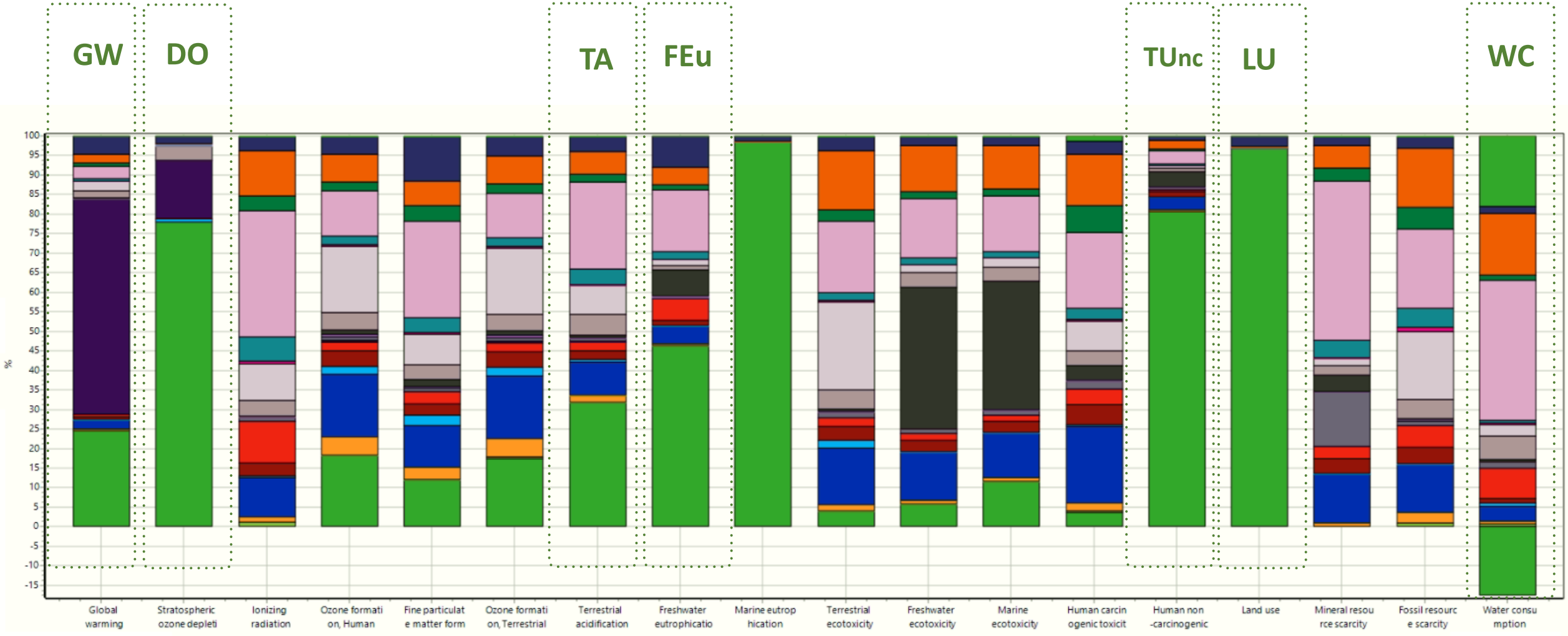
- Foco no produto
- Contabilidade de material e energia no ciclo de vida
- **Várias categorias de impacto ambiental**

Várias categorias de impacto ambiental

1 t soja PR
EI 2016



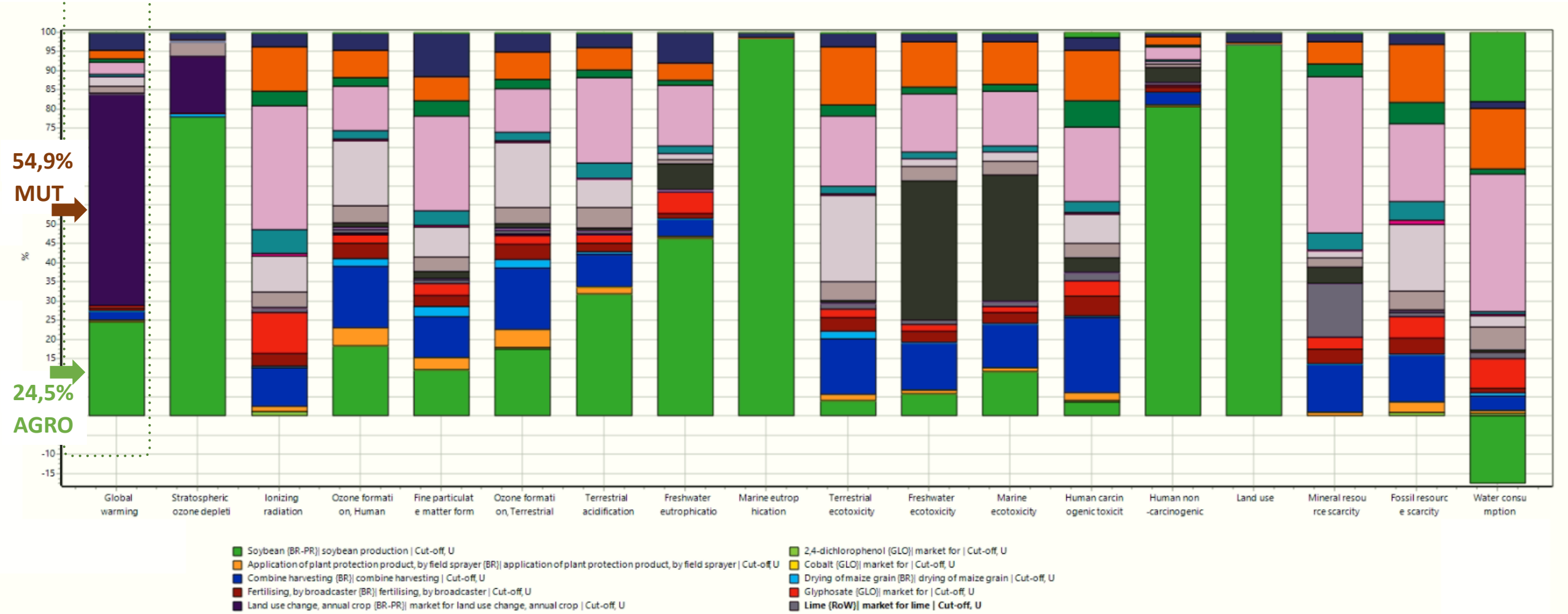
- Soybean {BR-PR}| soybean production | Cut-off, U
- Application of plant protection product, by field sprayer {BR}| application of plant protection product, by field sprayer | Cut-off, U
- Combine harvesting {BR}| combine harvesting | Cut-off, U
- Fertilising, by broadcaster {BR}| fertilising, by broadcaster | Cut-off, U
- Land use change, annual crop {BR-PR}| market for land use change, annual crop | Cut-off, U
- 2,4-dichlorophenol {GLO}| market for | Cut-off, U
- Cobalt {GLO}| market for | Cut-off, U
- Drying of maize grain {BR}| drying of maize grain | Cut-off, U
- Glyphosate {GLO}| market for | Cut-off, U
- **Lime {RoW}| market for lime | Cut-off, U**

Method: ReCiPe 2016 Midpoint (H) V1.04 / World (2010) H / Characterization
Analyzing 1 ton 'Soybean {BR-PR}| soybean production | Cut-off, U';

Várias categorias de impacto ambiental

1 t soja PR
EI 2016

GW ➡ Mudanças Climáticas = pegada de carbono



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Analyzing 1 ton 'Soybean {BR-PR}| soybean production | Cut-off, U';

Pegada de Carbono

O que significa “Pegada de Carbono” de produto?

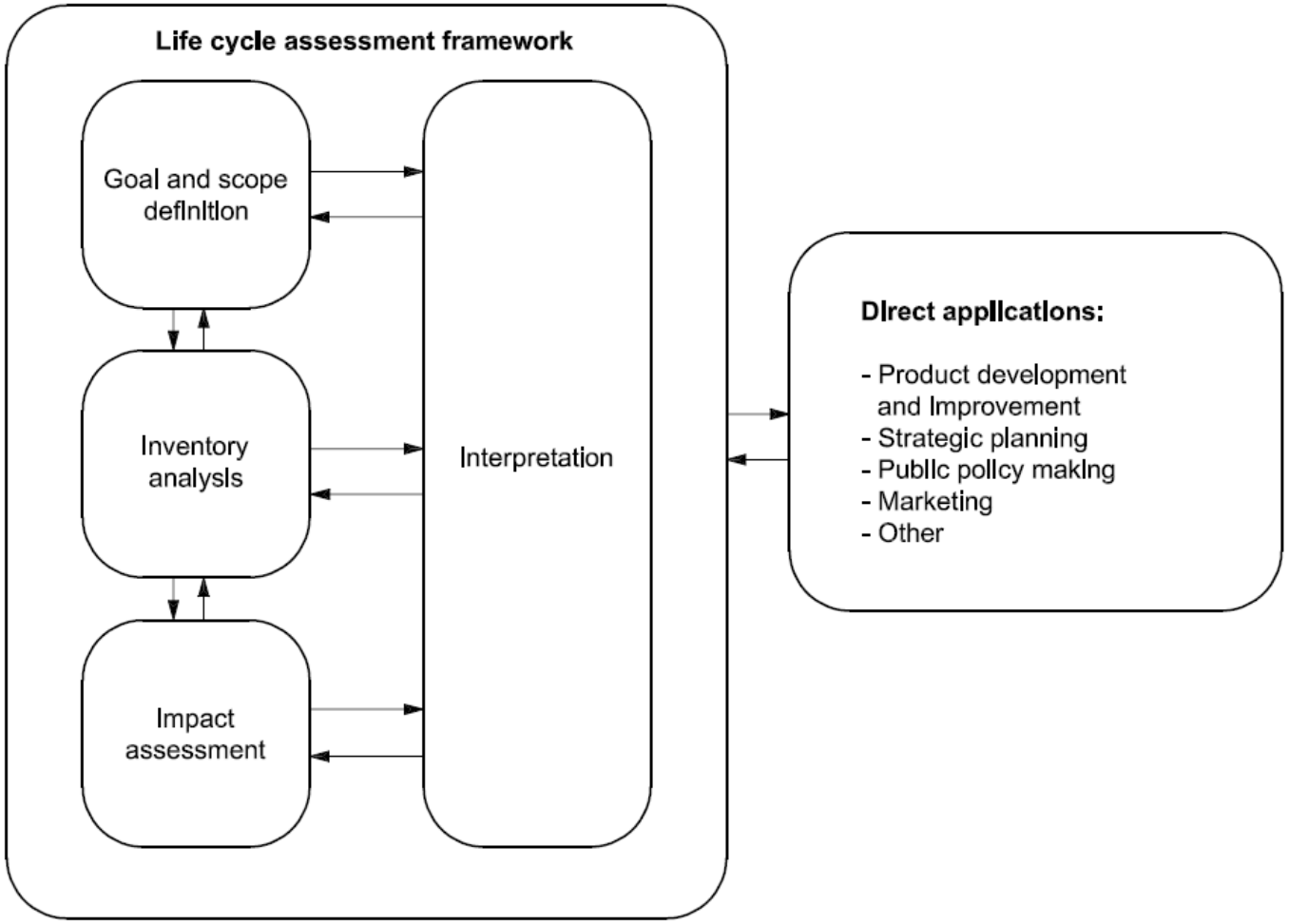
A **pegada de carbono** representa a quantidade, expressa em CO_2 **eq**, de emissões de **gases de efeito estufa** gerados no **ciclo de vida** de um produto

Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification

Gaz à effet de serre — Empreinte carbone des produits — Exigences et lignes directrices pour la quantification

Reference number
ISO 14067:2018(E)

Como se chega à “Pegada de Carbono”?



INTERNATIONAL STANDARD

ISO 14040

Second edition
2006-07-01

Environmental management — Life cycle assessment — Principles and framework

Management environnemental — Analyse du cycle de vie — Principes et cadre

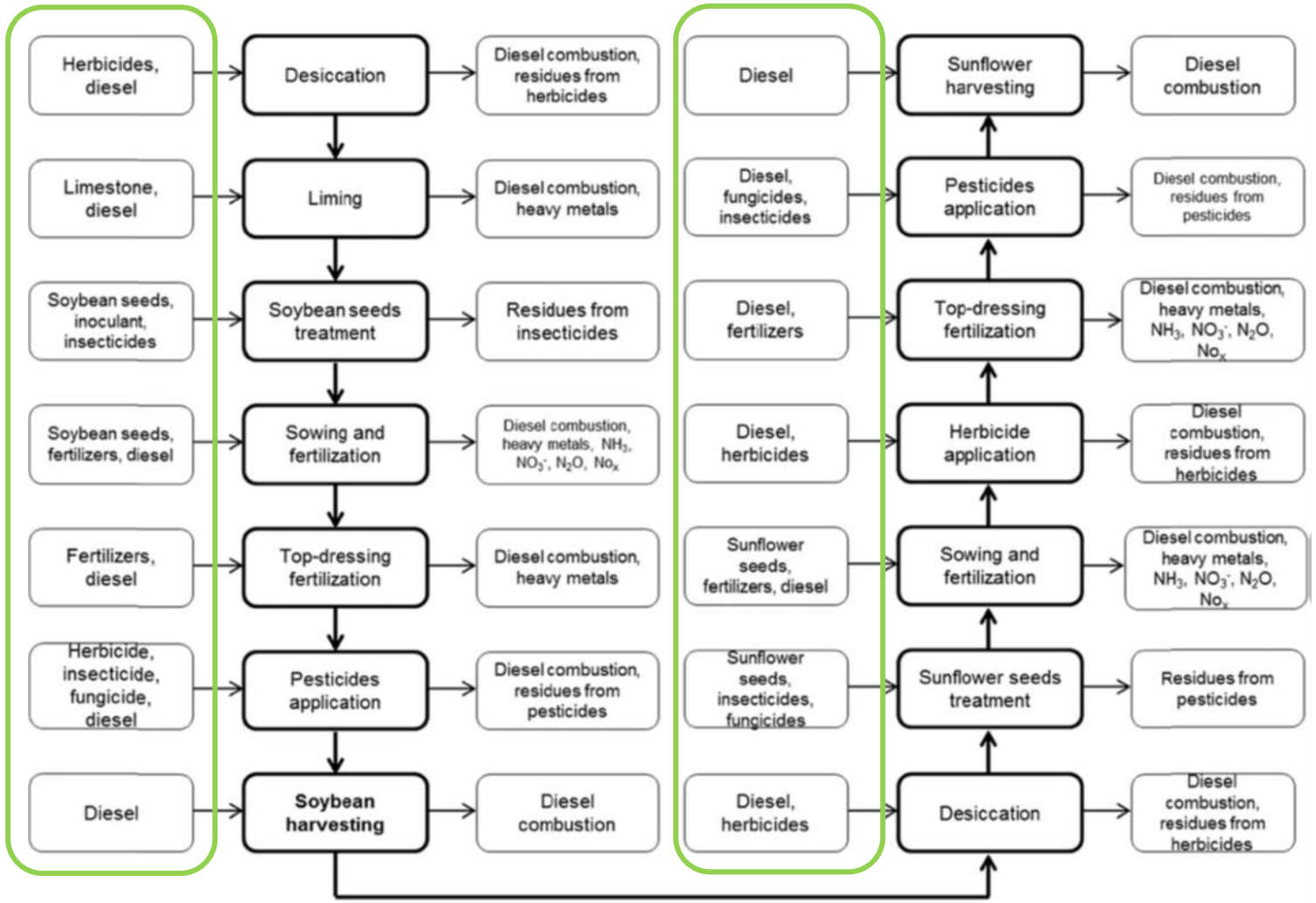
Como se chega à “Pegada de Carbono”?

- **Descrição do processo de produção de soja**

Como se chega à “Pegada de Carbono”?

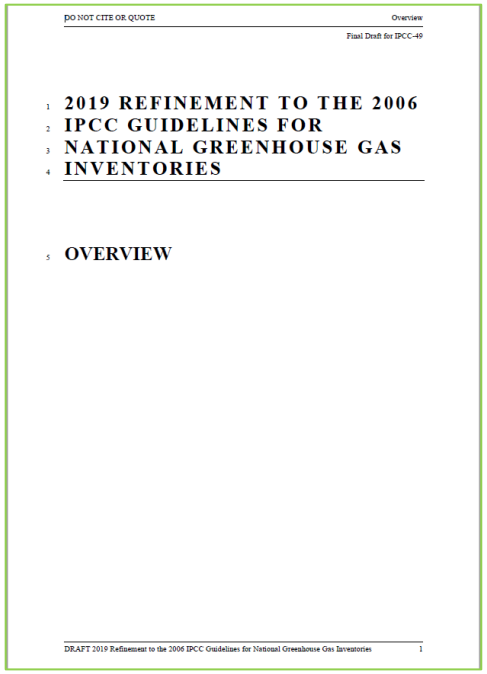
- **Descrição do processo de produção de soja**
- **Quantificação de fluxos de entrada** (recursos naturais e insumos)

- Dados primários, amostra
- Painel de especialistas
- Dados secundários, estatísticos



Como se chega à “Pegada de Carbono”?

- **Descrição do processo de produção de soja**
- **Quantificação de fluxos de entrada** (recursos naturais e insumos)
- **Quantificação dos fluxos de saída** (produtos, coprodutos, resíduos, emissões)



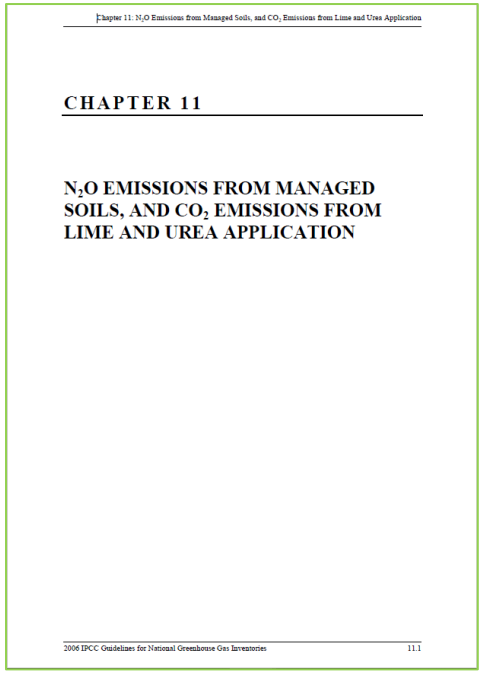
DO NOT CITE OR QUOTE Overview

Final Draft for IPCC-49

2019 REFINEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES

OVERVIEW

DRAFT 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories 1

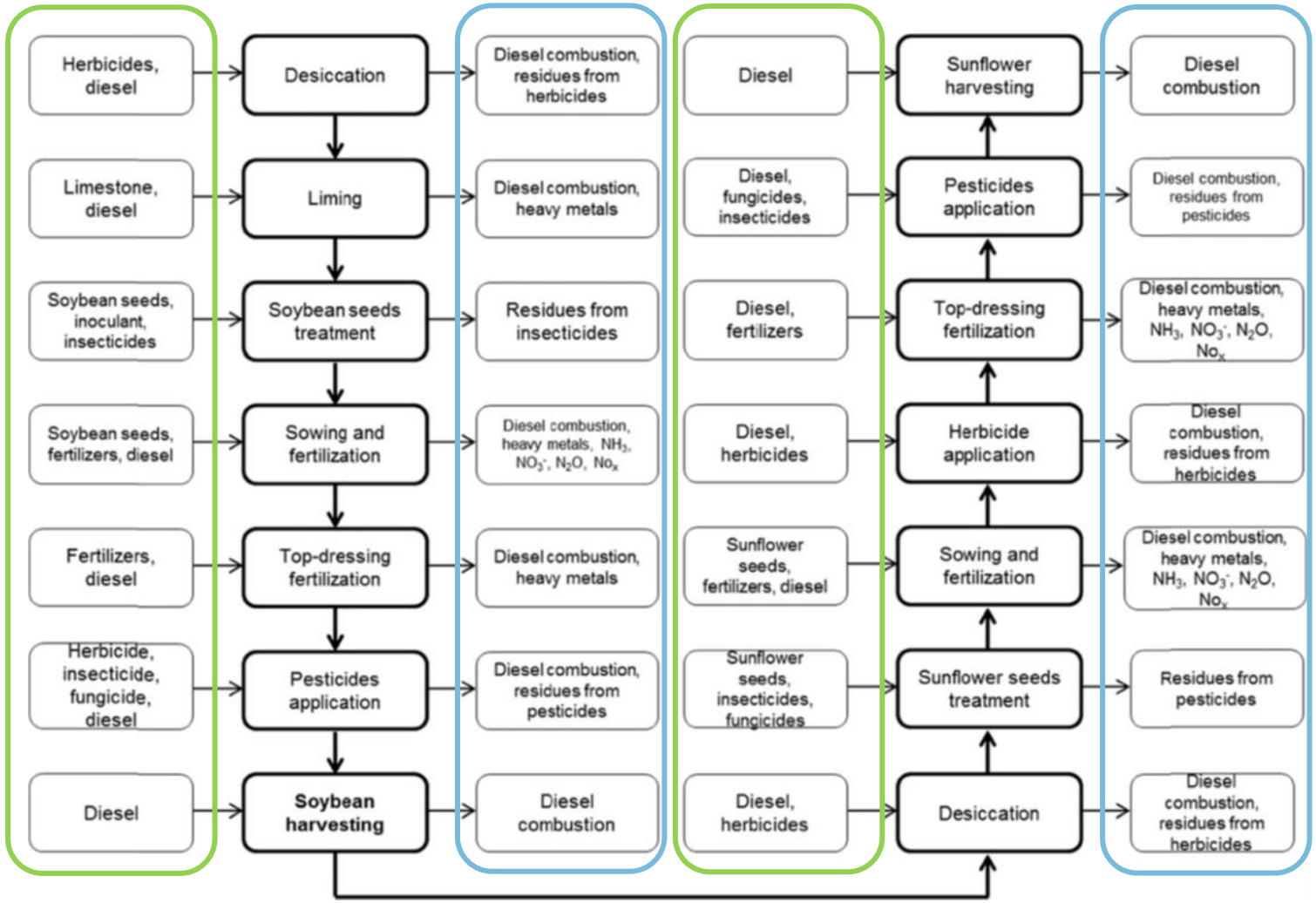


Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application

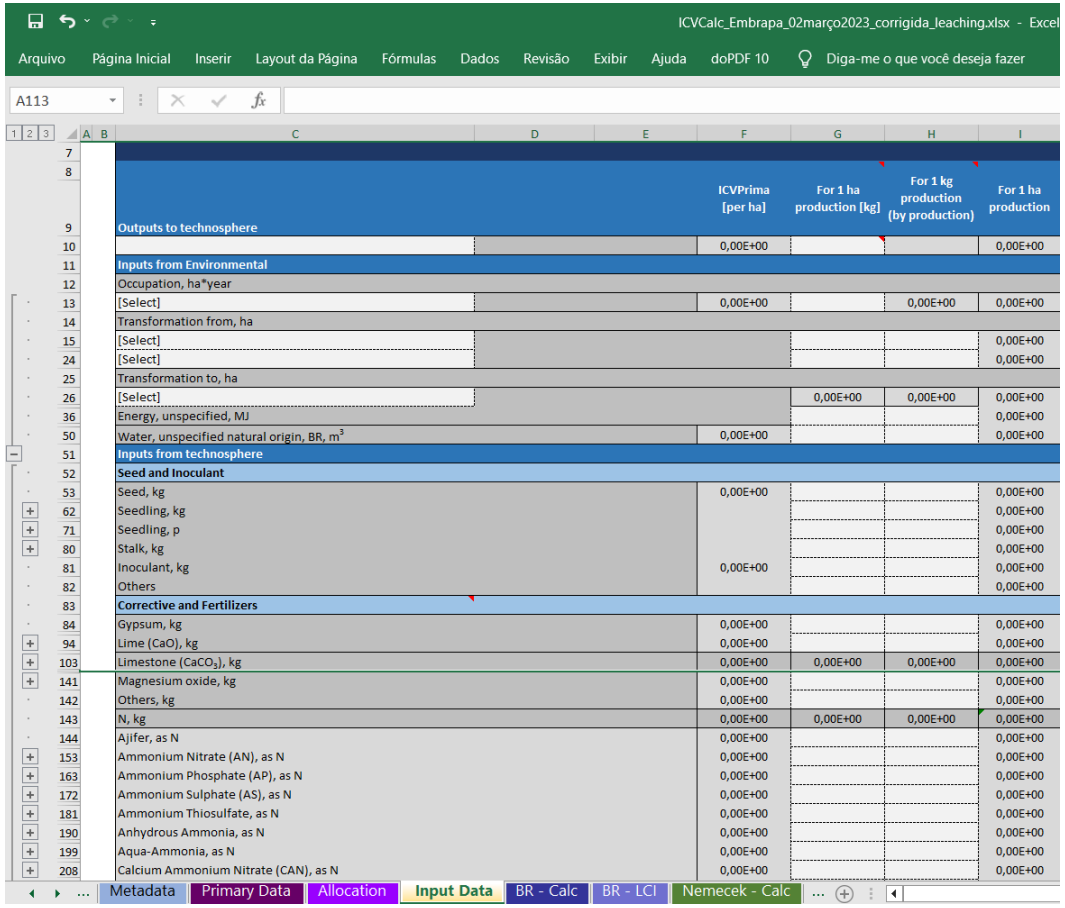
CHAPTER 11

N_2O EMISSIONS FROM MANAGED SOILS, AND CO_2 EMISSIONS FROM LIME AND UREA APPLICATION

2006 IPCC Guidelines for National Greenhouse Gas Inventories 11.1

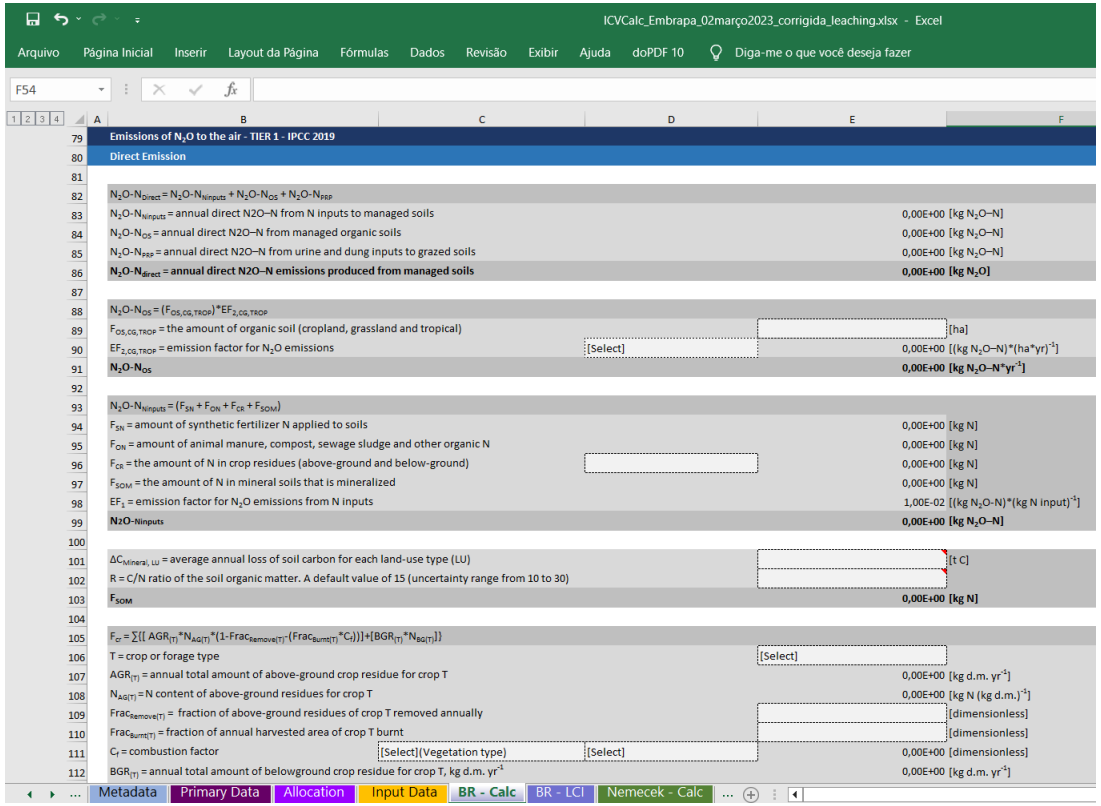


Estimação das emissões de GEE



	ICVPrima [per ha]	For 1 ha production [kg]	For 1 kg production (by production)	For 1 ha production
Outputs to technosphere				
	0,00E+00			0,00E+00
Inputs from Environmental				
Occupation, ha*year				
[Select]	0,00E+00		0,00E+00	0,00E+00
Transformation from, ha				
[Select]				0,00E+00
[Select]				0,00E+00
Transformation to, ha				
[Select]		0,00E+00	0,00E+00	0,00E+00
Energy, unspecified, MJ				0,00E+00
Water, unspecified natural origin, BR, m^3	0,00E+00			0,00E+00
Inputs from technosphere				
Seed and Inoculant				
Seed, kg	0,00E+00			0,00E+00
Seedling, kg				0,00E+00
Seedling, p				0,00E+00
Stalk, kg				0,00E+00
Inoculant, kg	0,00E+00			0,00E+00
Others				0,00E+00
Corrective and Fertilizers				
Gypsum, kg	0,00E+00			0,00E+00
Lime (CaO), kg	0,00E+00			0,00E+00
Limestone ($CaCO_3$), kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Magnesium oxide, kg	0,00E+00			0,00E+00
Others, kg	0,00E+00			0,00E+00
N, kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Ajifer, as N	0,00E+00			0,00E+00
Ammonium Nitrate (AN), as N	0,00E+00			0,00E+00
Ammonium Phosphate (AP), as N	0,00E+00			0,00E+00
Ammonium Sulphate (AS), as N	0,00E+00			0,00E+00
Ammonium Thiosulfate, as N	0,00E+00			0,00E+00
Anhydrous Ammonia, as N	0,00E+00			0,00E+00
Aqua-Ammonia, as N	0,00E+00			0,00E+00
Calcium Ammonium Nitrate (CAN), as N	0,00E+00			0,00E+00

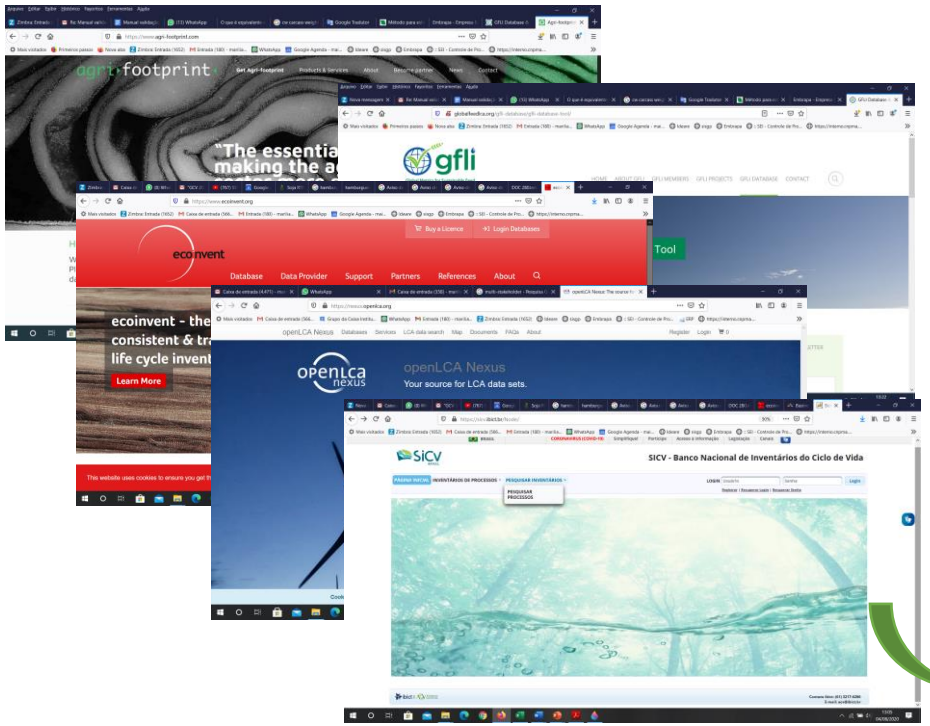
ICVCalc - Embrapa

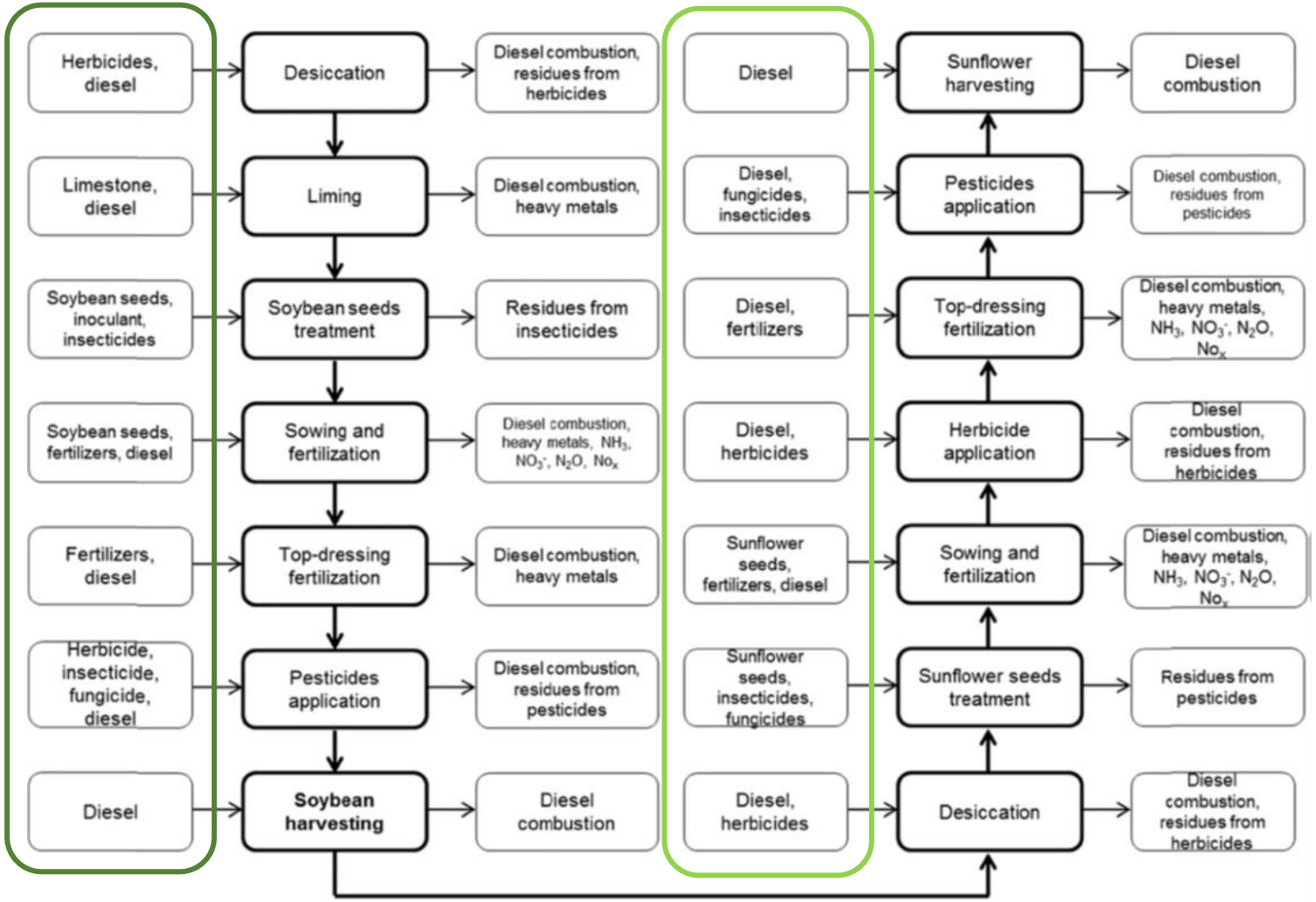


Emissions of N_2O to the air - TIER 1 - IPCC 2019				
Direct Emission				
$N_2O\text{-}N_{Direct} = N_2O\text{-}N_{Ninputs} + N_2O\text{-}N_{OS} + N_2O\text{-}N_{PRP}$				
$N_2O\text{-}N_{Ninputs}$ = annual direct N2O–N from N inputs to managed soils			0,00E+00	[kg N_2O–N]
$N_2O\text{-}N_{OS}$ = annual direct N2O–N from managed organic soils			0,00E+00	[kg N_2O–N]
$N_2O\text{-}N_{PRP}$ = annual direct N2O–N from urine and dung inputs to grazed soils			0,00E+00	[kg N_2O–N]
$N_2O\text{-}N_{direct}$ = annual direct N2O–N emissions produced from managed soils			**0,00E+00**	**[kg N_2O]**
$N_2O\text{-}N_{OS} = (F_{OS,CG,TROP})*EF_{2,CG,TROP}$				
$F_{OS,CG,TROP}$ = the amount of organic soil (cropland, grassland and tropical)				[ha]
$EF_{2,CG,TROP}$ = emission factor for N_2O emissions	[Select]		0,00E+00	[(kg N_2O–N)*(ha*yr)$^{-1}$]
$N_2O\text{-}N_{OS}$			**0,00E+00**	**[kg N_2O–N*yr^{-1}]**
$N_2O\text{-}N_{Ninputs} = (F_{SN} + F_{ON} + F_{CR} + F_{SOM})$				
F_{SN} = amount of synthetic fertilizer N applied to soils			0,00E+00	[kg N]
F_{ON} = amount of animal manure, compost, sewage sludge and other organic N			0,00E+00	[kg N]
F_{CR} = the amount of N in crop residues (above-ground and below-ground)			0,00E+00	[kg N]
F_{SOM} = the amount of N in mineral soils that is mineralized			0,00E+00	[kg N]
EF_1 = emission factor for N_2O emissions from N inputs			1,00E-02	[(kg N_2O-N)*(kg N input)$^{-1}$]
$N_2O\text{-}N_{Ninputs}$			**0,00E+00**	**[kg N_2O–N]**
$\Delta C_{Mineral,\ LU}$ = average annual loss of soil carbon for each land-use type (LU)				[t C]
R = C/N ratio of the soil organic matter. A default value of 15 (uncertainty range from 10 to 30)				
F_{SOM}			**0,00E+00**	**[kg N]**
$F_{cr} = \sum\{[AGR_{(T)}*N_{AG(T)}*(1-Frac_{Remove(T)}-(Frac_{Burnt(T)}*C_f))]+[BGR_{(T)}*N_{BG(T)}]\}$				
T = crop or forage type		[Select]		
$AGR_{(T)}$ = annual total amount of above-ground crop residue for crop T			0,00E+00	[kg d.m. yr^{-1}]
$N_{AG(T)}$ = N content of above-ground residues for crop T			0,00E+00	[kg N (kg d.m.)$^{-1}$]
$Frac_{Remove(T)}$ = fraction of above-ground residues of crop T removed annually				[dimensionless]
$Frac_{Burnt(T)}$ = fraction of annual harvested area of crop T burnt				[dimensionless]
C_f = combustion factor	[Select](Vegetation type)	[Select]	0,00E+00	[dimensionless]
$BGR_{(T)}$ = annual total amount of belowground crop residue for crop T, kg d.m. yr^{-1}			0,00E+00	[kg d.m. yr^{-1}]

Como se chega à “Pegada de Carbono”?

- **Descrição do processo de produção de soja**
- **Quantificação de fluxos de entrada** (recursos naturais e insumos)
- **Quantificação dos fluxos de saída** (produtos, coprodutos, resíduos, emissões)
- Associação aos **processos a montante**



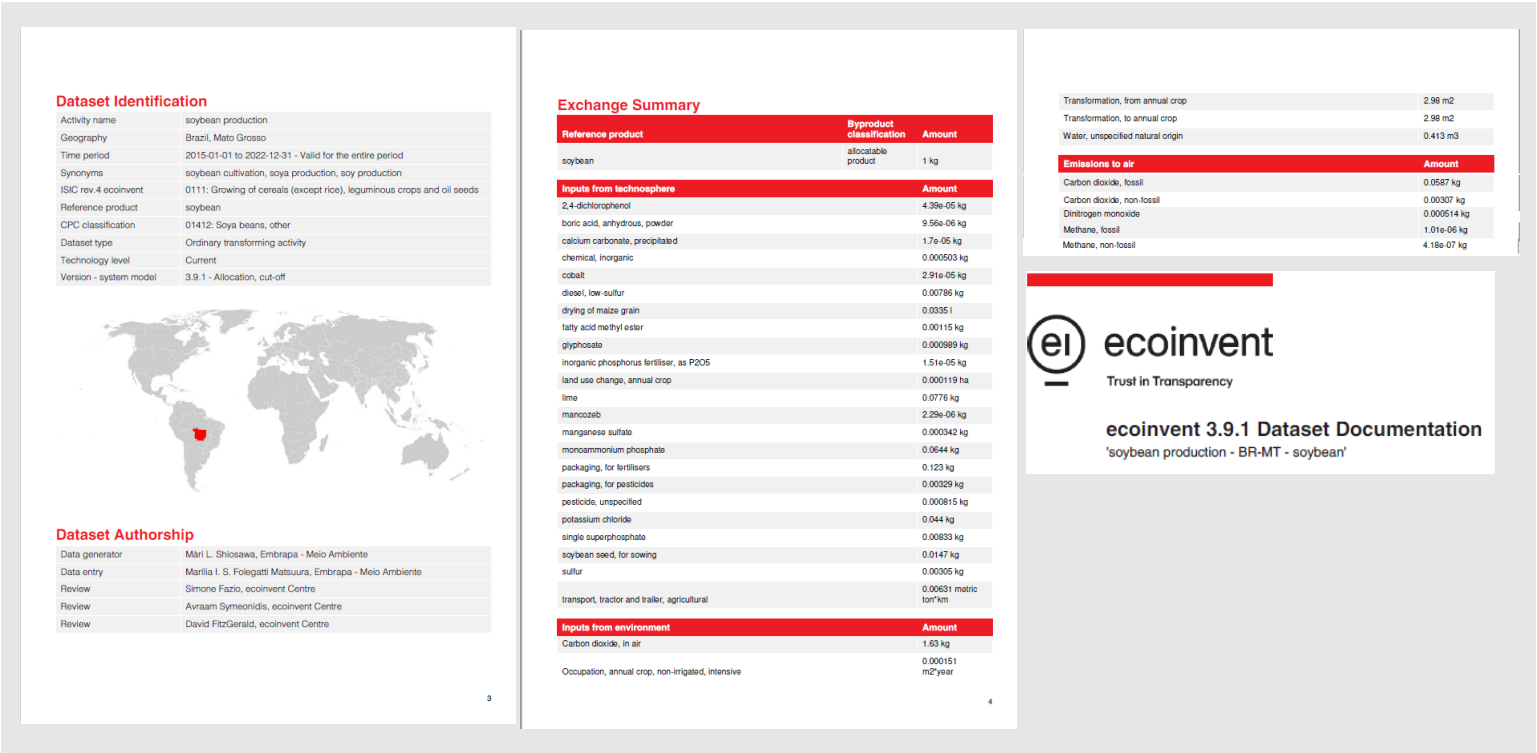


Como se chega à “Pegada de Carbono”?

- **Descrição do processo de produção de soja**
- **Quantificação de fluxos de entrada** (recursos naturais e insumos)
- **Quantificação dos fluxos de saída** (produtos, coprodutos, resíduos, emissões)
- Associação aos **processos a montante**

Inventário de processo

Inventário de Ciclo de Vida



Dataset Identification

Activity name	soybean production
Geography	Brazil, Mato Grosso
Time period	2015-01-01 to 2022-12-31 - Valid for the entire period
Synonyms	soybean cultivation, soya production, soy production
ISIC rev.4 ecoinvent	0111: Growing of cereals (except rice), leguminous crops and oil seeds
Reference product	soybean
CPC classification	01412: Soya beans, other
Dataset type	Ordinary transforming activity
Technology level	Current
Version - system model	3.9.1 - Allocation, cut-off

Dataset Authorship

Data generator	Mári L. Shiosawa, Embrapa - Meio Ambiente
Data entry	Marília I. S. Folegatti Matsuura, Embrapa - Meio Ambiente
Review	Simone Fazio, ecoinvent Centre
Review	Avraam Symeonidis, ecoinvent Centre
Review	David FitzGerald, ecoinvent Centre

3

Exchange Summary

Reference product	Byproduct classification	Amount
soybean	allocatable product	1 kg

Inputs from technosphere	Amount
2,4-dichlorophenol	4.39e-05 kg
boric acid, anhydrous, powder	9.56e-06 kg
calcium carbonate, precipitated	1.7e-05 kg
chemical, inorganic	0.000503 kg
cobalt	2.91e-05 kg
diesel, low-sulfur	0.00786 kg
drying of maize grain	0.0335 l
fatty acid methyl ester	0.00115 kg
glyphosate	0.000989 kg
inorganic phosphorus fertiliser, as P2O5	1.51e-05 kg
land use change, annual crop	0.000119 ha
lime	0.0776 kg
mancozeb	2.29e-06 kg
manganese sulfate	0.000342 kg
monoammonium phosphate	0.0644 kg
packaging, for fertilisers	0.123 kg
packaging, for pesticides	0.00329 kg
pesticide, unspecified	0.000815 kg
potassium chloride	0.044 kg
single superphosphate	0.00833 kg
soybean seed, for sowing	0.0147 kg
sulfur	0.00305 kg
transport, tractor and trailer, agricultural	0.00631 metric ton*km

Inputs from environment	Amount
Carbon dioxide, in air	1.63 kg
Occupation, annual crop, non-irrigated, intensive	0.000151 m2*year

4

Transformation, from annual crop	2.98 m2
Transformation, to annual crop	2.98 m2
Water, unspecified natural origin	0.413 m3

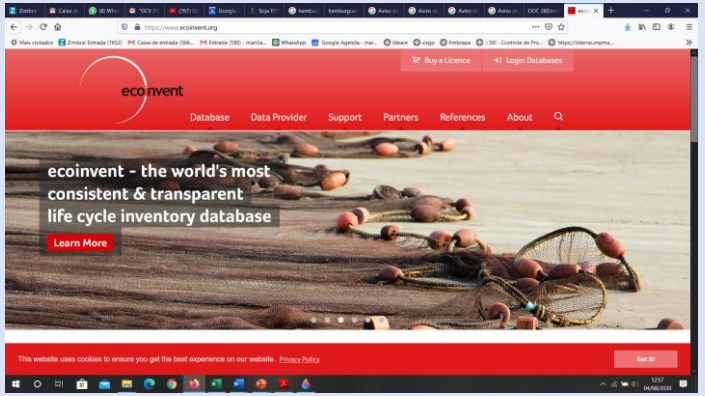
Emissions to air	Amount
Carbon dioxide, fossil	0.0587 kg
Carbon dioxide, non-fossil	0.00307 kg
Dinitrogen monoxide	0.000514 kg
Methane, fossil	1.01e-06 kg
Methane, non-fossil	4.18e-07 kg

ecoinvent

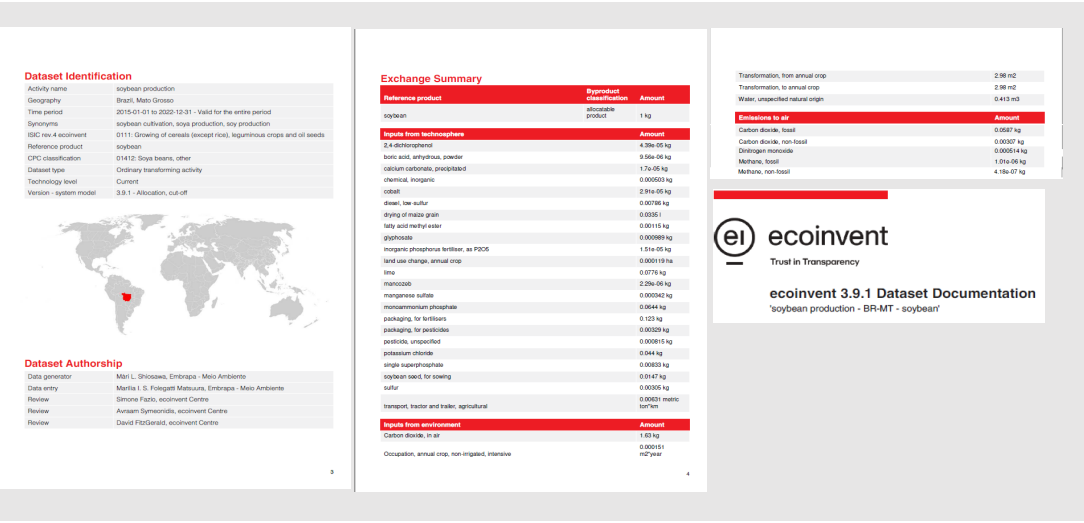
Trust in Transparency

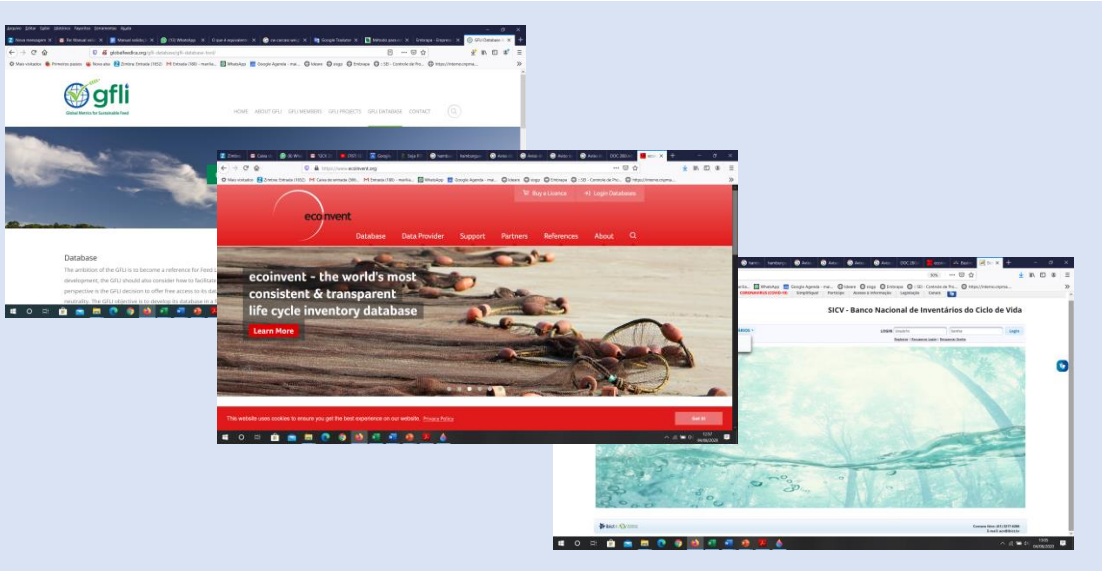
ecoinvent 3.9.1 Dataset Documentation

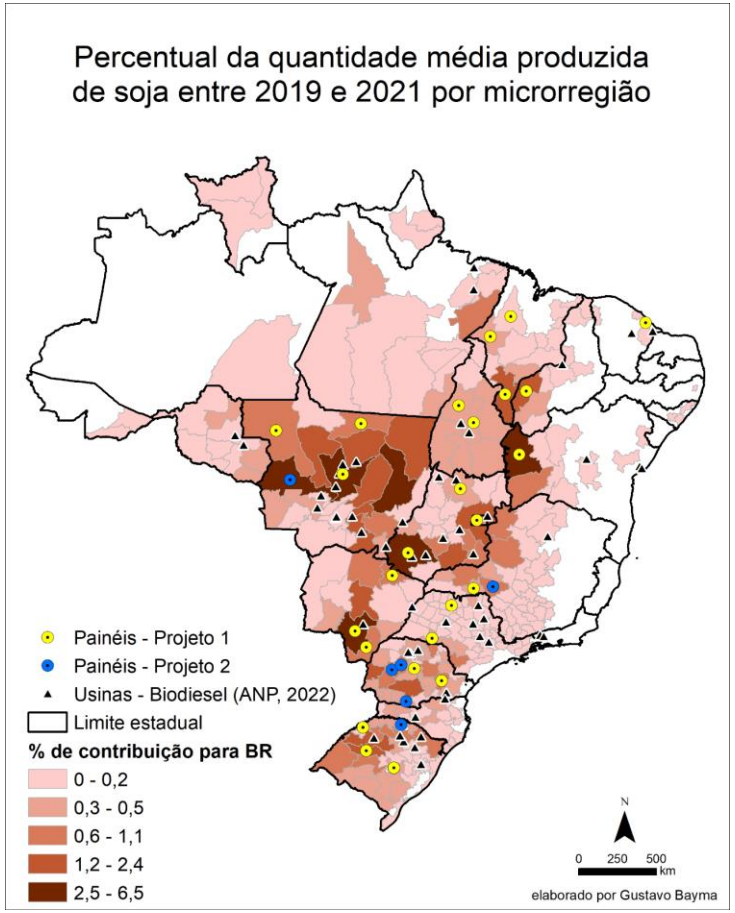
'soybean production - BR-MT - soybean'



Como se chega à “Pegada de Carbono”?







95% da produção BR

Estado	% de contribuição da soja do estado para a soja BR
Mato Grosso	27,65
Paraná	15,21
Rio Grande do Sul	13,54
Goiás	10,12
Mato Grosso do Sul	8,59
Minas Gerais	4,96
Bahia	4,92
São Paulo	3,11
Tocantins	2,50
Maranhão	2,47
Piauí	2,02

ABIOVE Associação Brasileira das Indústrias de Óleos Vegetais

ABPA Associação Brasileira de Proteína Animal

Sindirações

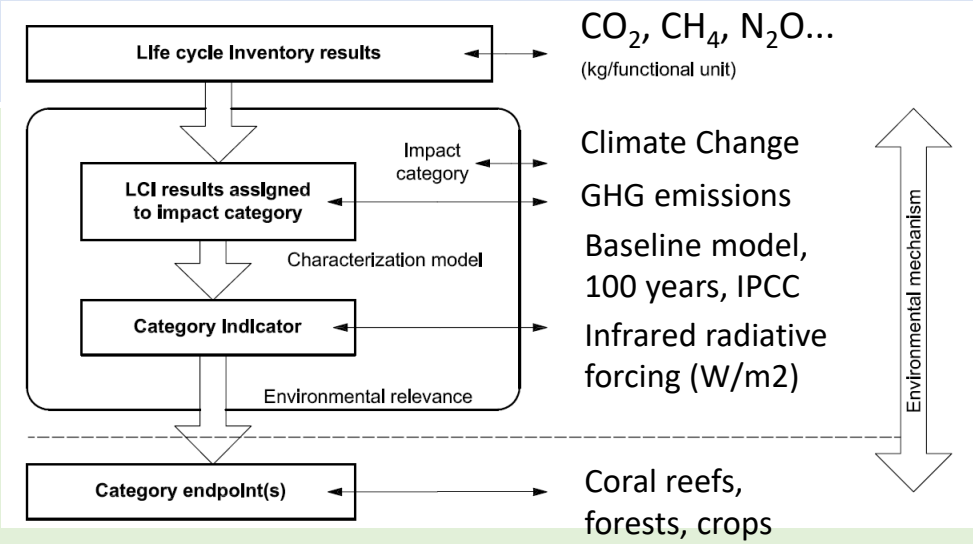
APROSOJA BRASIL

Como se chega à “Pegada de Carbono”?

- **Descrição do processo de produção de soja**
- **Quantificação de fluxos de entrada** (recursos naturais e insumos)
- **Quantificação dos fluxos de saída** (produtos, coprodutos, resíduos, emissões)
- Associação aos **processos a montante**
- **Avaliação do Impacto do Ciclo de Vida**

ICV

AICV

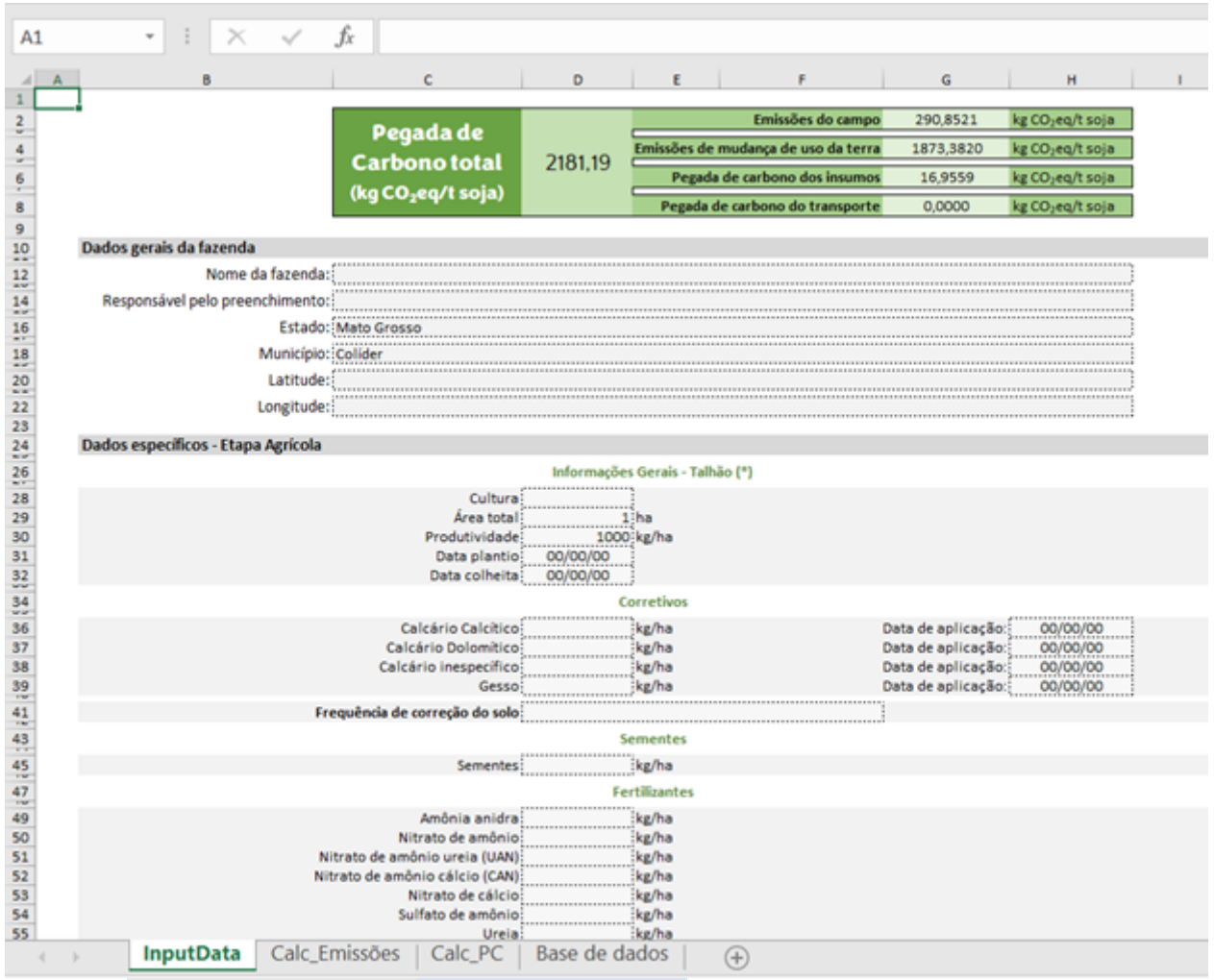


ICV

AICV

Fator de caracterização:	Global Warming Potential (GWP100) para cada GEE (kg CO2 eq./kg gás)
Indicador de categoria:	kg CO2-equivalentes por unidade funcional

Como se chega à “Pegada de Carbono”?



Pegada de Carbono total (kg CO_2eq/t soja)	2181,19			
		Emissões do campo	290,8521	kg CO_2eq/t soja
		Emissões de mudança de uso da terra	1873,3820	kg CO_2eq/t soja
		Pegada de carbono dos insumos	16,9559	kg CO_2eq/t soja
		Pegada de carbono do transporte	0,0000	kg CO_2eq/t soja

Dados gerais da fazenda

Nome da fazenda:	
Responsável pelo preenchimento:	
Estado:	Mato Grosso
Município:	Colider
Latitude:	
Longitude:	

Dados específicos - Etapa Agrícola

Informações Gerais - Talhão (*)

Cultura		
Área total	1	ha
Produtividade	1000	kg/ha
Data plantio	00/00/00	
Data colheita	00/00/00	

Corretivos

Calcário Calcítico		kg/ha	Data de aplicação:	00/00/00
Calcário Dolomítico		kg/ha	Data de aplicação:	00/00/00
Calcário inespecífico		kg/ha	Data de aplicação:	00/00/00
Gesso		kg/ha	Data de aplicação:	00/00/00
Frequência de correção do solo				

Sementes

Sementes		kg/ha

Fertilizantes

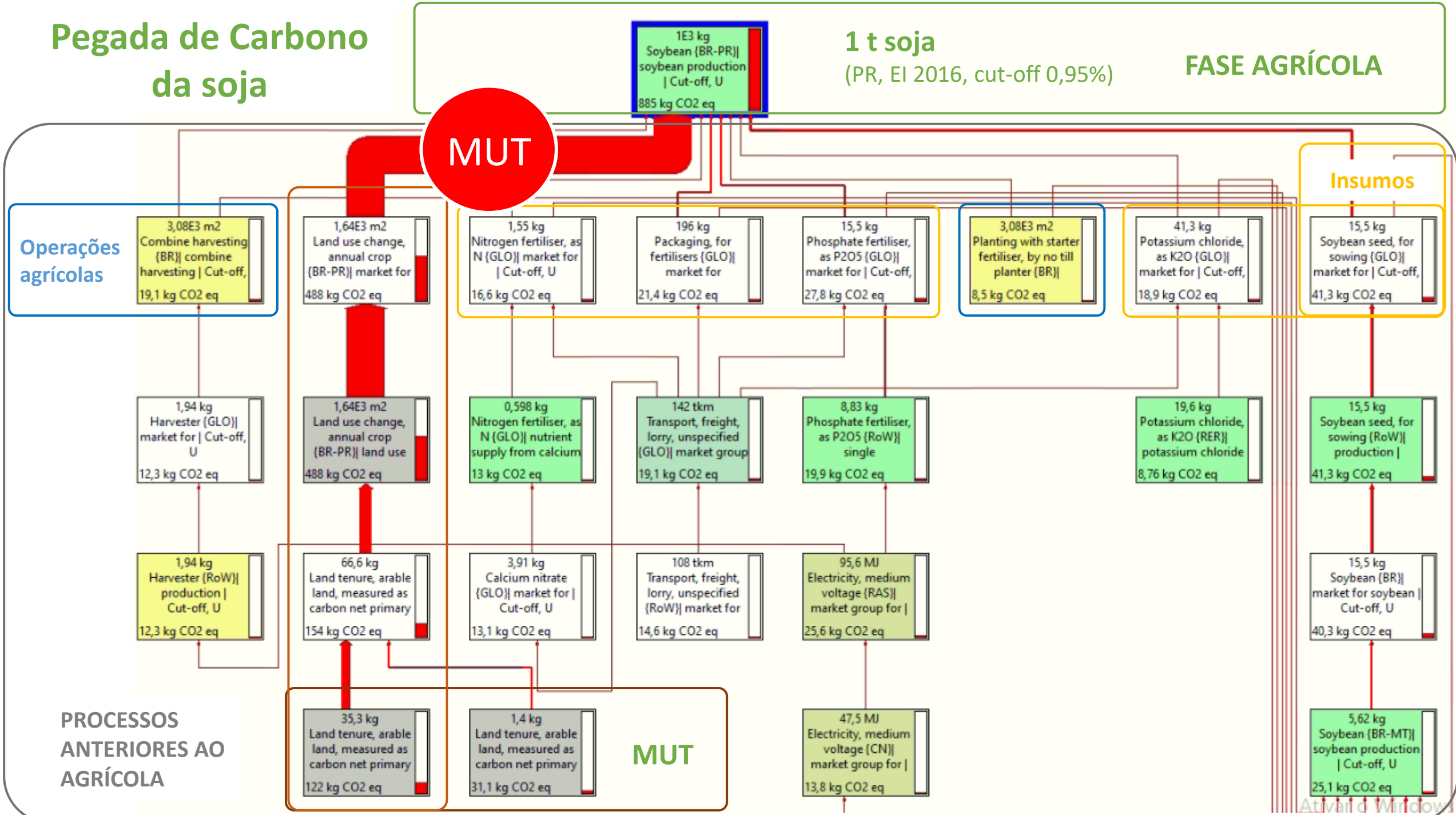
Amônia anidra		kg/ha
Nitrato de amônio		kg/ha
Nitrato de amônio ureia (UAN)		kg/ha
Nitrato de amônio cálcio (CAN)		kg/ha
Nitrato de cálcio		kg/ha
Sulfato de amônio		kg/ha
Ureia		kg/ha

InputData | Calc_Emissões | Calc_PC | Base de dados

Inventário de processo

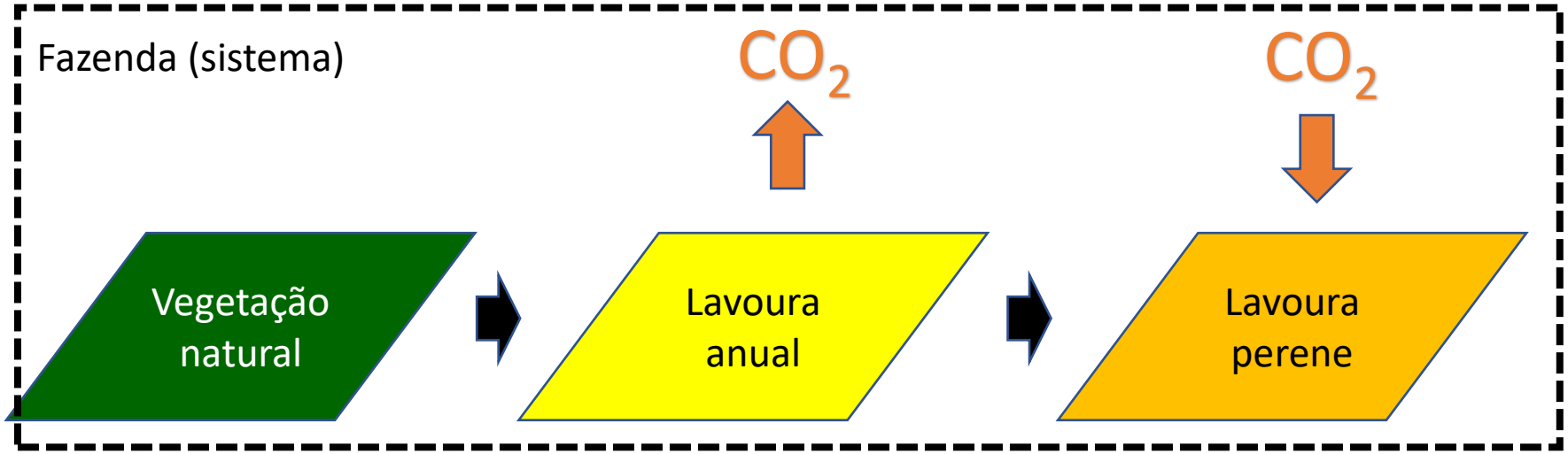
Pegada de Carbono

Pegada de Carbono da soja



O que é mudança de uso da terra?

- Mudança no propósito no uso da terra pelo homem
  - Direta = dentro dos limites do sistema
  - Indireta = fora dos limites do sistema



ISO14067
PAS2050

Modelo e ferramenta para MUT

Received: 16 November 2016 | Revised: 24 February 2017 | Accepted: 27 February 2017
DOI: 10.1111/gcb.13708

PRIMARY RESEARCH ARTICLE

WILEY Global Change Biology

Estimating 20-year land-use change and derived CO_2 emissions associated with crops, pasture and forestry in Brazil and each of its 27 states

Renan M. L. Novaes[1] | Ricardo A. A. Pazianotto[1] | Miguel Brandão[2,3] | Bruno J. R. Alves[4] | André May[5] | Marília I. S. Folegatti-Matsuura[1]

[1]Embrapa Meio Ambiente, Jaguariúna, SP, Brazil
[2]KTH Royal Institute of Technology, Stockholm, Sweden
[3]Institute of Soil Science and Plant Cultivation, Puławy, Poland
[4]Embrapa Agrobiologia, Seropédica, RJ, Brazil
[5]Embrapa Milho e Sorgo, Sete Lagoas, MG, Brazil

Correspondence
Renan M. L. Novaes, Embrapa Meio Ambiente, Jaguariúna, SP, Brazil.
Email: renan.milagres@embrapa.br

Funding information
Embrapa (Project number 02.12.01.026.00.00)

Abstract
Land-use change (LUC)
ecosystem services and
in this process. Concern
magnitude and impacts
environmental assessme
which methods are mo
regionalized estimates a
production (e.g. food, fi
scenarios of past 20-ye
crops, pasture and fores
time-series statistics ar
dards. The scenarios a
rates of CO_2 emission
transitions, which can h
multiple cropping and h
highest CO_2 emission
with the highest rates a
states and crops show
especially in southern a
tural expansion are the
implications on LUC es
policies are discussed.

KEYWORDS
Amazon, beef, BRLUC, cart
sugarcane

1 | INTRODUCTION

Land-use change (LUC) emissions represent an important share of global CO_2 emissions, and agriculture plays a key role in this process (IPCC, 2014; Tilman, Balzer, Hill, & Befort, 2011). Accounting for

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journal homepage: www.elsevier.com/locate/jclepro

Land-use change CO_2 emissions associated with agricultural products at municipal level in Brazil

Danilo F. Trovo Garofalo [a,**], Renan Milagres L. Novaes [a,*], Ricardo A.A. Pazianotto [a], Vinícius Gonçalves Maciel [a], Miguel Brandão [b], Julia Zanin Shimbo [c], Marília I.S. Folegatti-Matsuura [a]

[a] Embrapa Meio Ambiente, Rodovia SP 340, km 127,5, CEP, 13918-110, Jaguariúna, SP, Brazil

UC) accounted for approximately 66% of CO_2 emissions in Brazil in 2020, with significant
bon footprint of Brazilian agricultural products. Accurate LUC estimates associated with
cal to carbon footprint (CF) and life cycle assessment (LCA) studies and derived measures
supply chains. The aim of the study was to provide direct LUC (dLUC) estimates of CO_2
l with a comprehensive set of agricultural products in Brazil at municipal-level and based on
d conversion data, appropriate for CF and LCA studies. The effect of different dLUC modeling
lts are also presented. The modeling followed IPCC guidelines and improved the BRLUC
spatially-explicit data, municipality-level statistics, regionalized carbon stocks and a shared
ach were combined to obtain dLUC emission rates for 64 crops, plus forestry and plante
70 Brazilian municipalities, as well as at state and national levels. It will be open access
he most recent version led to an estimated 911 Mtons of CO_2 associated with agriculture
associated with planted pastures. National level dLUC emission rates for corn, pasture
ne were estimated as 2.0, 4.1, 2.3 and 0.3 $tCO_2ha^{-1}yr^{-1}$, respectively. The dLUC emissio
neous across the country and land uses, ranging from positive to negative. In general, the
mazon biome, due to deforestation, and lower in eastern Brazil, where agricultural areas a
The resulting data is more consistent with dLUC rationale, IPCC guidelines and PAS205
use is known and is recommended to be used, whenever data at farm level are not availabl
ws the strong effect of different dLUC modeling choices on results and reinforces recon
her mitigation options.

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carbon footprinting (CF) and life cycle assessments (LCA) of agricultur
products (Castanheira and Freire, 2013). With escalating pressures an
commitments for the decarbonization of countries (Höhne et al., 2021
and supply chains (Black et al., 2021), having accurate LUC estimates
critical.
LUC includes direct land-use change (dLUC) and indirect land-u
change (iLUC) (ILCD, 2010). According to ISO 14067 (ISO, 2018
dLUC occurs when there is a change of land use within a relevan
boundary and iLUC when there is a change of land use outside th
relevant boundary, in consequence of dLUC. Accounting for carbo
emissions from dLUC (less from iLUC) is a currently required process f

), renan.milagres@embrapa.br (R.M.L. Novaes).

epted 31 May 2022

The International Journal of Life Cycle Assessment
https://doi.org/10.1007/s11367-020-01763-3

LCA FOR AGRICULTURE.

Integrating regionalized Brazilian land use change datasets into the ecoinvent database: new data, premises and uncertainties have large effects in the results

Ana Cristina Guimarães Donke[1] · Renan Milagres Lage Novaes[1] · Ricardo Antonio Almeida Pazianotto[1] · Emilia Moreno-Ruiz[2] · Jürgen Reinhard[3] · Juliana Ferreira Picoli[1] · Marília Ieda da Silveira Folegatti-Matsuura[1]

Received: 31 July 2019 / Accepted: 27 April 2020

Abstract
Purpose Land use change (LUC) is a critical process in the life cycle greenhouse gas emissions of agricultural products and Brazil is a major exporter of these. This work had the objective of integrating refined and regionalized datasets of LUC in Brazil into the ecoinvent database, to better represent its dynamics and heterogeneity. We present the adaptations needs for having it suitable for crops, pasture and forestry in state-level and impacts of modelling assumptions and uncertainties.
Methods Adaptation and integration were based in ecoinvent version 3 guidelines and the database requirements to LUC modelling. BRLUC, a method for Brazilian LUC accounting, was the main data source. The workflow for the integration process consisted in identifying necessary adaptations in both sources to allow a better representation of Brazilian LUC. Four new reference products and 27 geographies were added in the database.
Results and discussion A total of 566 new datasets were integrated into ecoinvent version 3.6, allowing the incorporation of LUC in Brazilian products in state, regional and national level. GHG emissions reduced, being 42.2% and 99.9% lower to soybean and sugarcane than in ecoinvent v3.5. Four improvements were the main causes: (i) state-level LUC modelling with national official data; (ii) regionalizing carbon stocks; (iii) including pasture and forestry land use categories; (iv) and considering sugarcane as a perennial crop. The way to calculate national-level results based on subnational data was an important source of difference in emissions too. Uncertainties specifically associated with land use substitution patterns were not incorporated, and they can potentially have impacts as large as the uncertainties of all the remaining processes combined.
Conclusions Results showed that small changes in data sources and premises have large impacts on emissions associated with LUC in agricultural products. It also showed the large impacts of uncertainties of LUC patterns. Improving current models in better representing regional LUC patterns, regional carbon stocks and uncertainty accounting could reduce these impacts. Nonetheless, efforts in reducing the complexity of LUC accounting methods could enhance transparency and effectiveness.

Keywords LUC · Soybean · Sugarcane · Maize · Timber · Beef · Mango · Mato Grosso

Responsible editor: Miguel Brandão

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s11367-020-01763-3) contains supplementary material, which is available to authorized users.

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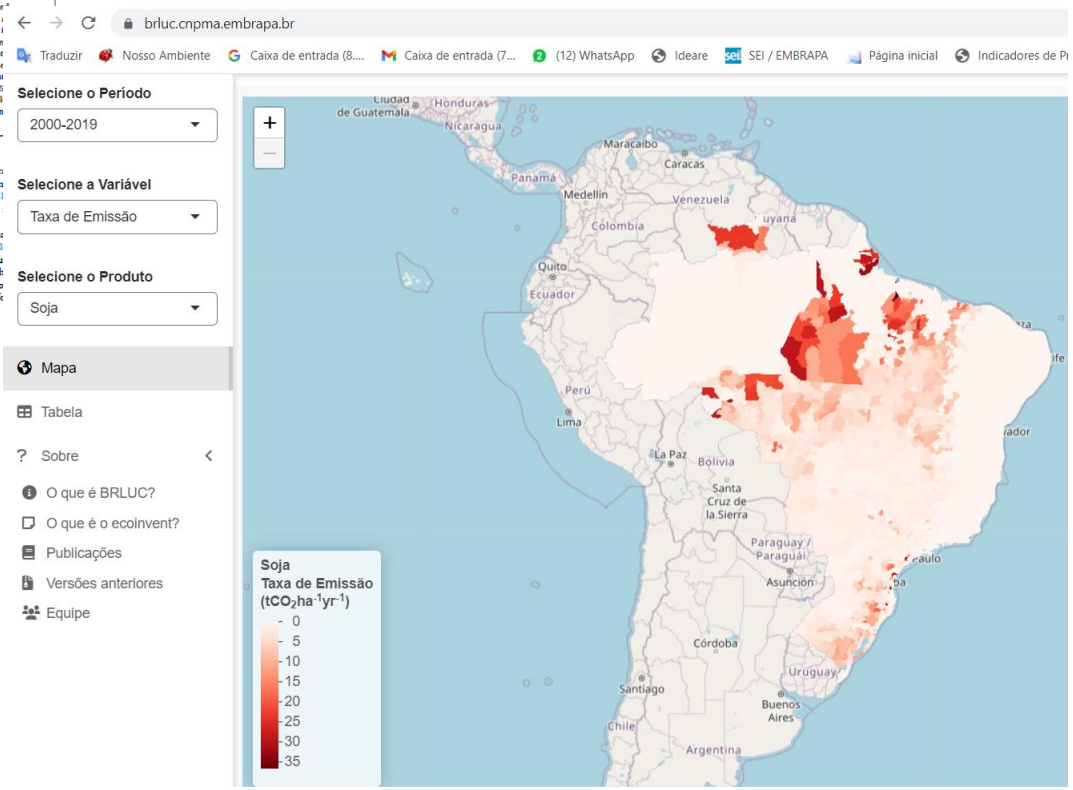
1 Introduction

Land use change (LUC) datasets and the derived greenhouse gases (GHGs) are a fundamental part of LCA, especially of agricultural products. In 2010, approximately 11% of global anthropogenic GHG emissions could be allocated to LUC (IPCC 2014). Agriculture is a relevant economic activity in Brazil and GHG emissions derived from it occupy an important role in Brazilian total emissions. In 2010, 42% of CO_2 emissions of the country were related to LUC (BRAZIL 2016). By its importance, LUC emissions became more frequently integrated into LCA studies as of 2007, which required the development of

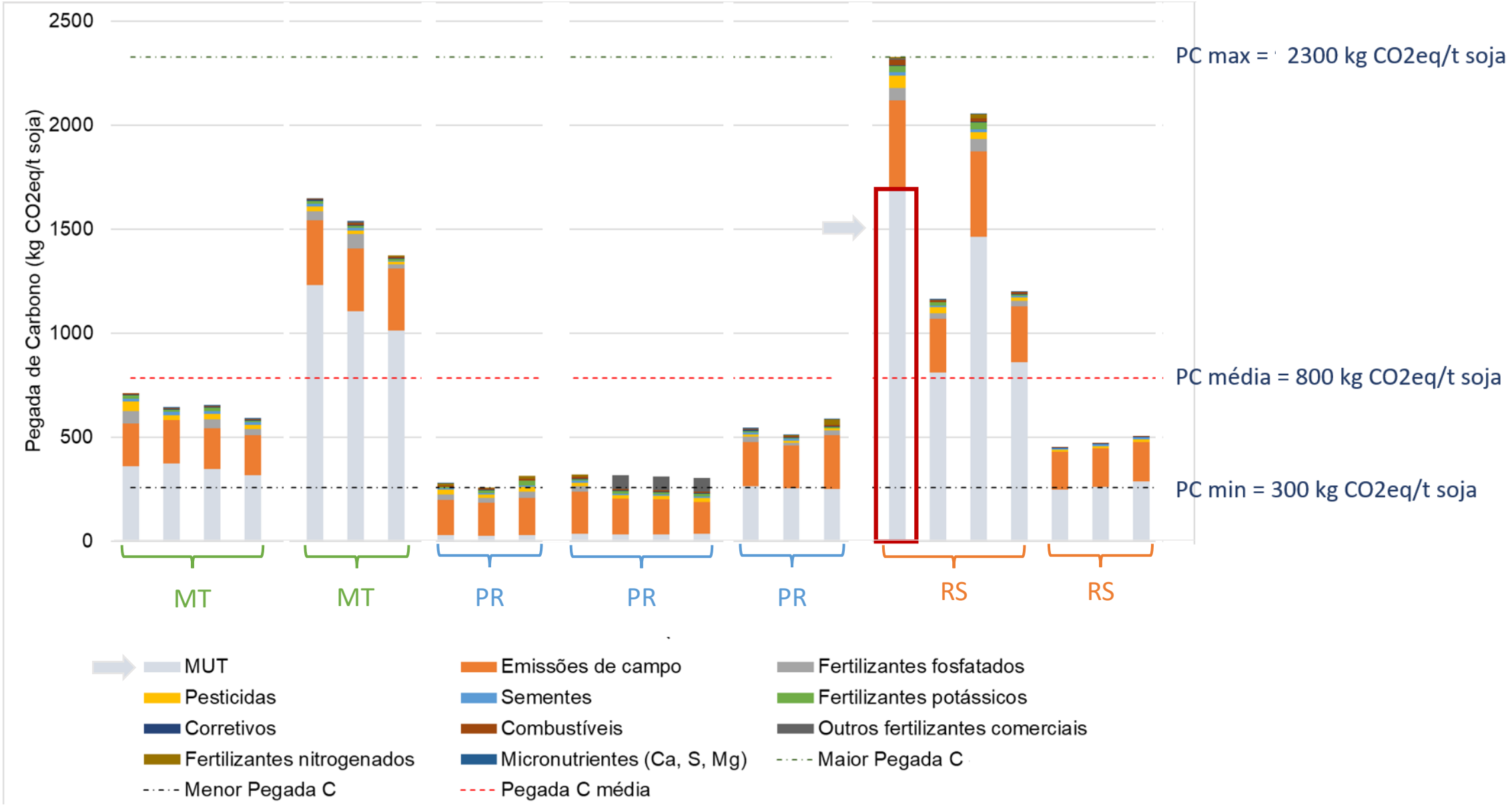
Published online: 20 May 2020

BRLUC - Embrapa

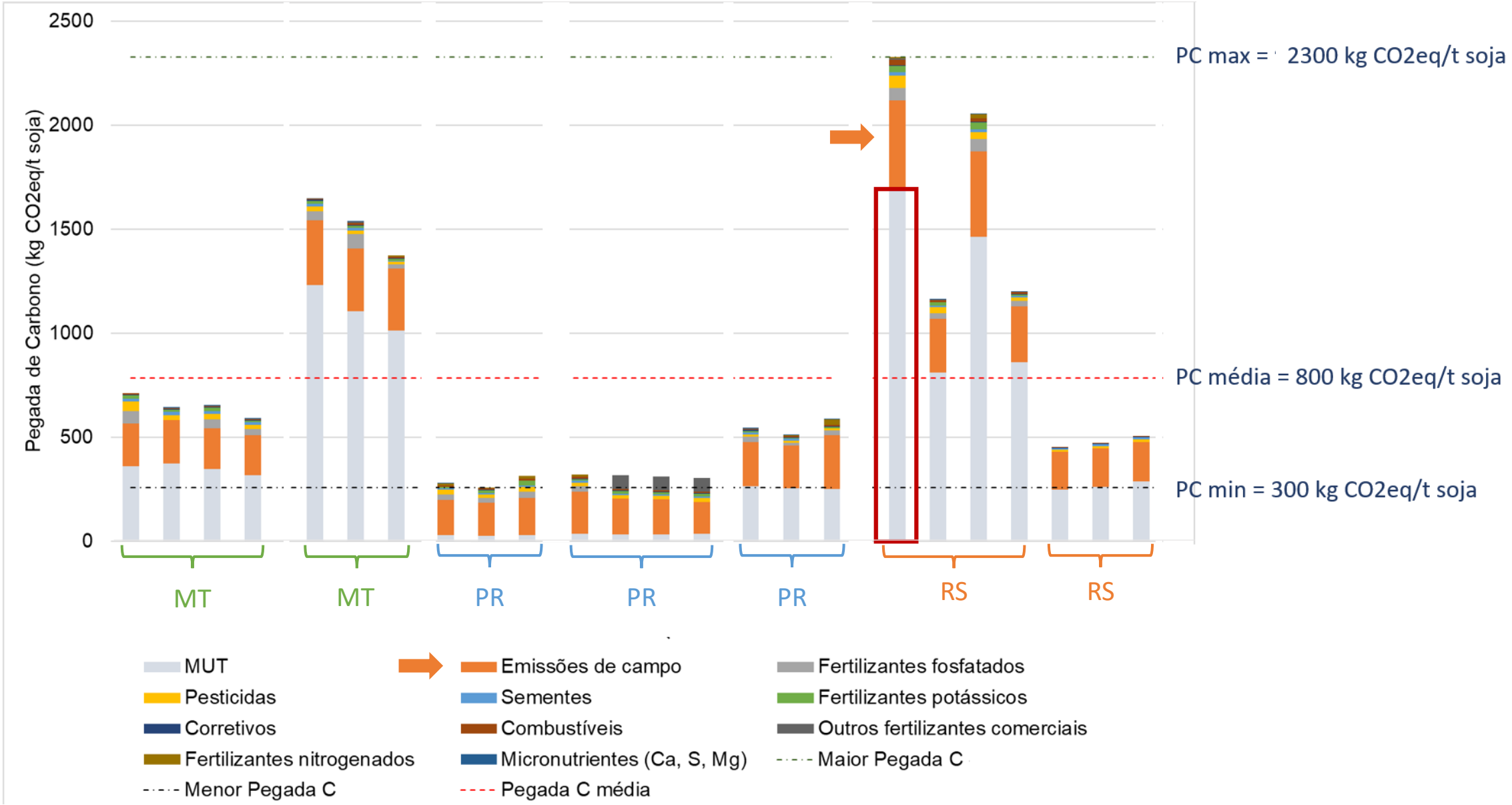
https://brluc.cnpma.embrapa.br/



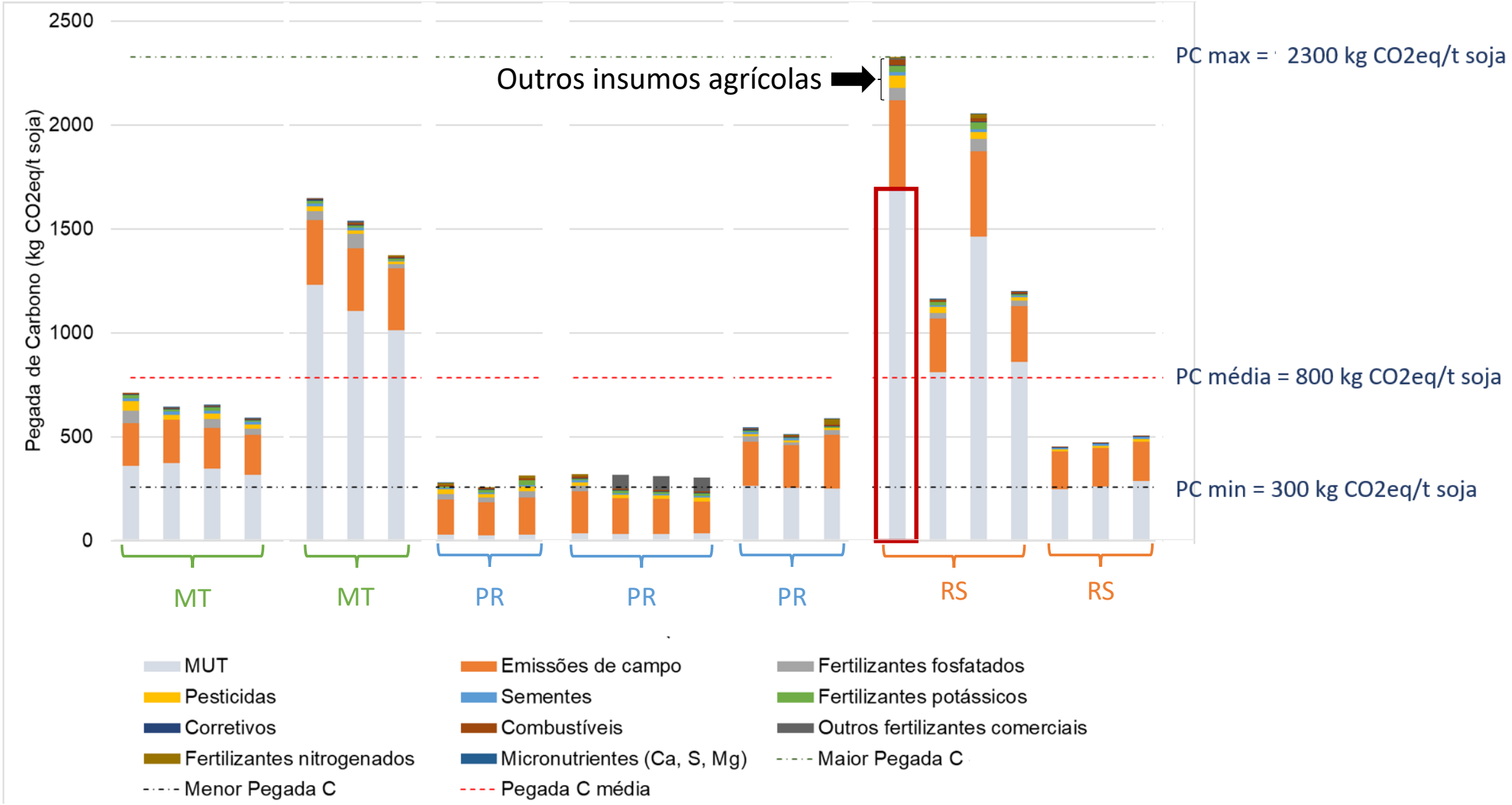
Pegada C da soja



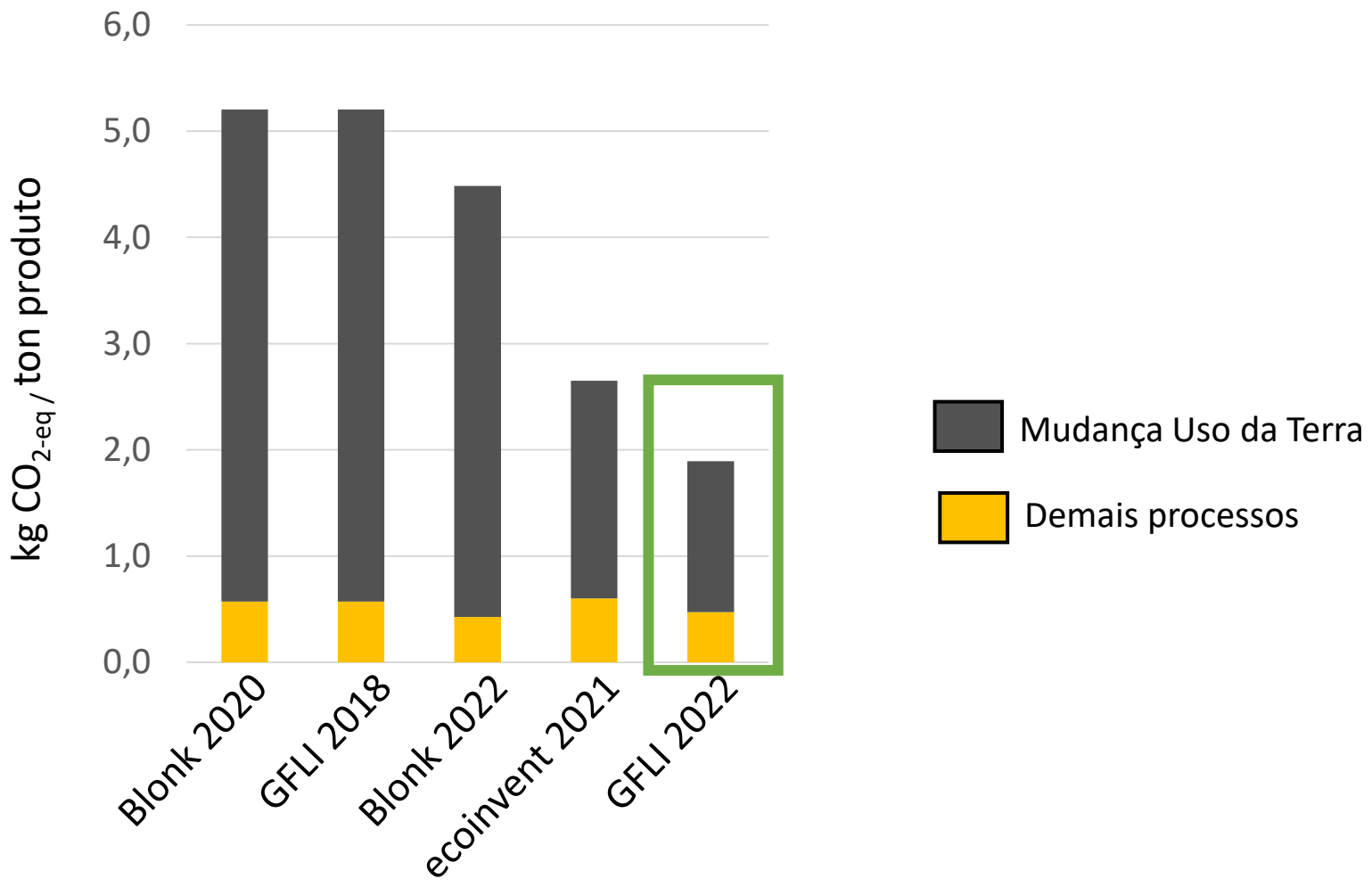
Pegada C da soja



Pegada C da soja

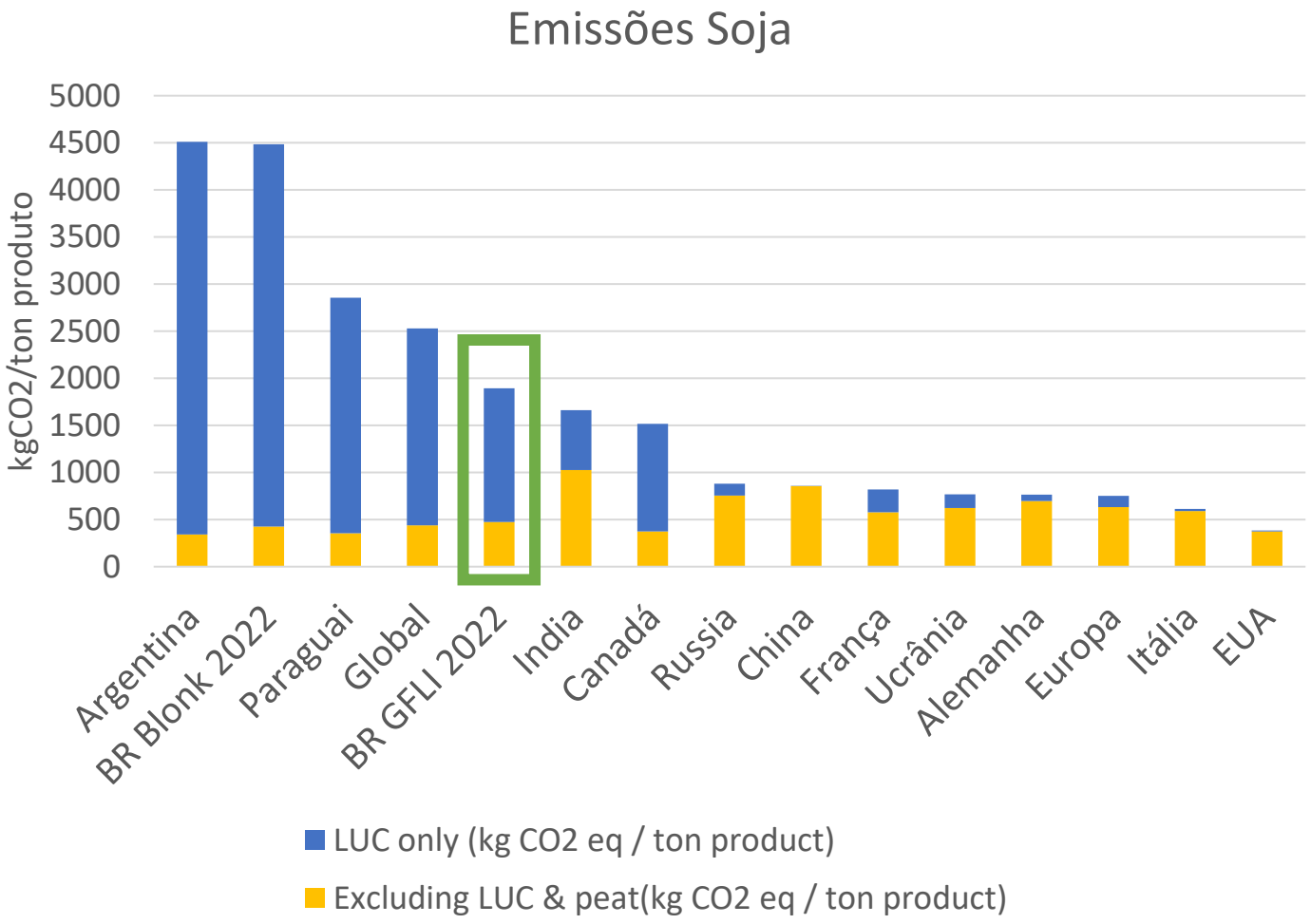


Soja

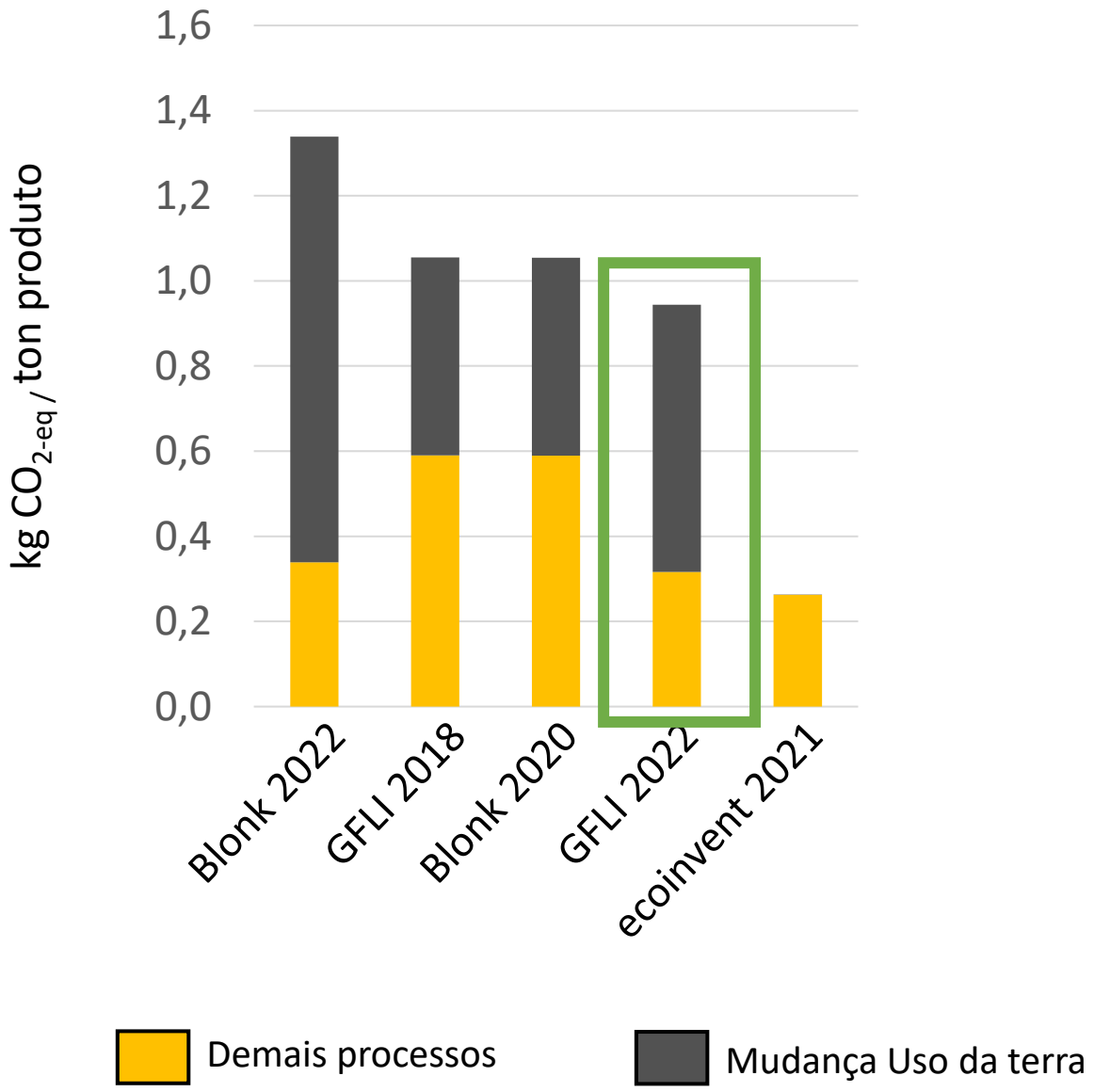


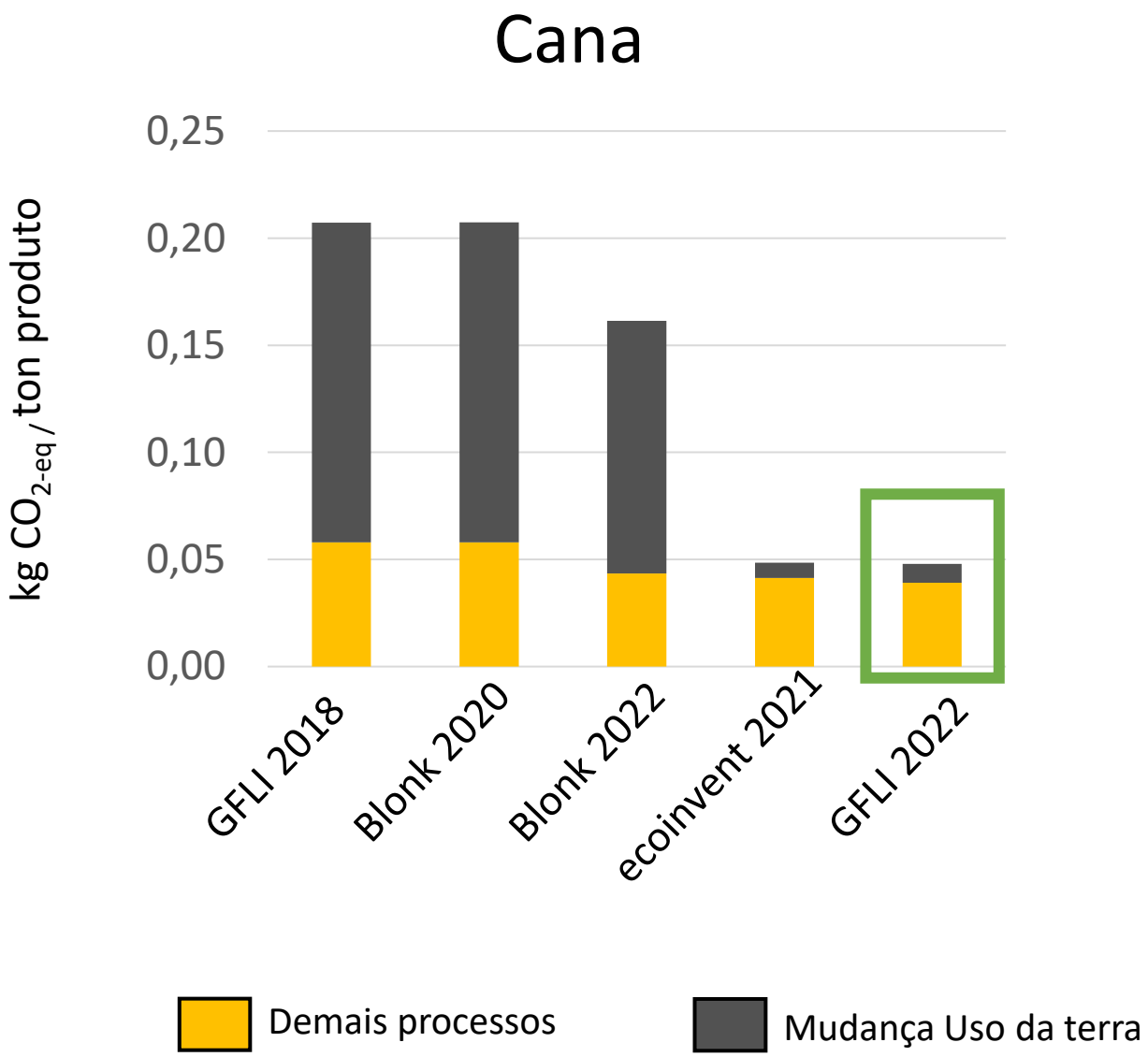
The GFLI-Brazil project produced more precise, higher quality (“higher tier”) data on three Brazilian crops (corn, soybean, sugarcane) and three processed products (soybean meal, crude soybean oil, sugarcane molasses).

Soja outros países



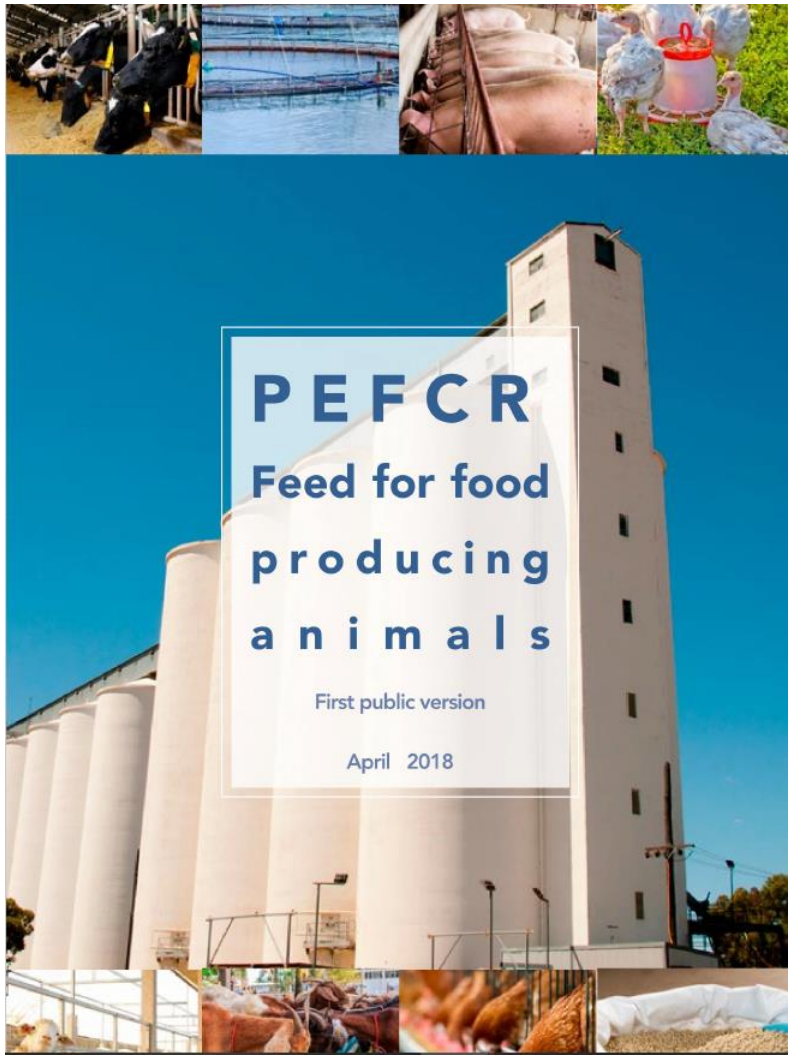
Milho


1,6
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
kg $CO_{2\text{-eq}}$ / ton produto
Blonk 2022
GFLI 2018
Blonk 2020
GFLI 2022
ecoinvent 2021
Demais processos
Mudança Uso da terra

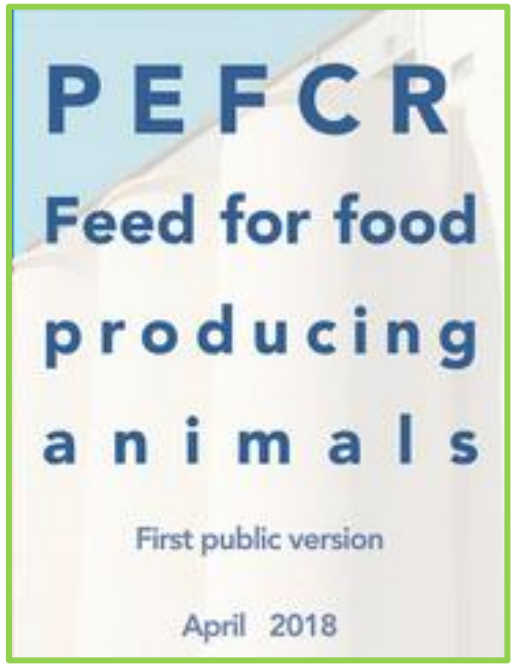

Cana
0,25
0,20
0,15
0,10
0,05
0,00
kg $CO_{2\text{-eq}}$ / ton produto
GFLI 2018
Blonk 2020
Blonk 2022
ecoinvent 2021
GFLI 2022
Demais processos
Mudança Uso da terra

Como essa informação é usada?

- Estratégias de gestão
- Estratégias de marketing
- Relações comerciais internacionais
- Políticas públicas



Certificados baseados em ACV tendem a ser mandatórios para o comércio com a Comunidade Europeia



European Commission | Translate this page

Environment

Home > Sustainable Development >

- Single Market for Green Products
- Initiative on Green Claims
- Environmental Footprint transition phase
- Environmental Footprint pilot phase
- Communicating to consumers
- Questions and Answers

Single Market for Green Products Initiative

A company wishing to market its product as environmentally friendly in several Member State markets faces a confusing range of choices of methods and initiatives. Sometimes they have to use different ones for different markets. This results in costs for companies and confusion for consumers.

The European Commission proposed the Product Environmental Footprint and Organisation Environmental Footprint methods as a common way of measuring environmental performance.

The approach was tested between 2013-2018 together with more than 280 volunteering companies and organisations. The results and reports of the pilot phase are available.

Based on the results of the testing, the European Commission is now exploring how to use the Product and Organisation Environmental Footprint methods in policies. The European Commission launched a series of consultations on this subject in 2018. Read the report here.

The 2020 Circular Economy Action Plan foresees that "The Commission will also propose that companies substantiate their environmental claims using Product and Organisation Environmental Footprint methods." It is part of a set of interrelated initiatives to establish a

News

- Cut flowers and potted plants
  - The first public consultation on the draft Cut flowers and potted plants Product Environmental Footprint Category Rules (PEFCRs) and Representative Product study (PEF-RP study) has started and is accessible on this page. It will be open until 1rst of October 2021
- Marine fish
  - The first public consultation on the draft Marine fish Product Environmental Footprint Category Rules (PEFCRs) and Representative Product study (PEF-RP study) has started and is accessible on this page. It will be open until 20th of September 2021
- *The first public consultation on the draft apparel and footwear Product Environmental Footprint Category Rules (PEFCRs) and Representative Product study*

https://ec.europa.eu/environment/eussd/smgp/index.htm


Embrapa
Obrigada!