Calculating and Reducing the Carbon Footprint of Coffee
with the 4C Carbon Footprint Add-On

Claudia Bulgheroni
4C Online Seminar "Sustainable Coffee Day" - The Carbon Footprint of Coffee, 25th May 2022
Globally leading certification system for coffee.

Certification system for high-quality carbon credits.

Risk assessment and verification of sustainable and deforestation-free supply chains based on remote sensing and AI-based algorithms for image interpretation.

meo is an independent company but part of a group of organizations providing expertise on sustainability.

Independent management consultancy with a focus on sustainability and climate protection.

The world's leading certification system for sustainability and greenhouse gas emissions.
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The relevance of GHG emissions in coffee sector
Humans have damaged a quarter of land on Earth through land degradation and agriculture, which are responsible for almost a quarter of the world’s GHG emissions.

The global emissions **must halve** by 2030 and be **net zero** by 2050 if global temperature rise has to be kept to 1.5°C. Agriculture will play an important role in managing the land and reducing GHG gas emissions.

The Intergovernmental Panel on Climate Change, 2019
Coffee, as agricultural product, should contribute to the mitigation of climate change and to the sustainable development

- With demand for coffee **expected to triple by 2050**, the increasing global demand for environmentally friendly products has pushed a rapid acceleration of sustainability initiatives among coffee producers and retailers.

- If coffee has to become more sustainable we need to understand:
  - **how and where GHGs are emitted** through the production cycle
  - **how emissions can be mitigated**
  - **how the environmental impact of coffee production can be reduced**

Source: Geography and Environment, Volume: 7, Issue: 2, First published: 30 December 2020, DOI: (10.1002/geo2.96)
GHG emissions from green coffee beans production dominate overall emissions

Potential biggest impact factors in green coffee beans production:
- (Synthetic) fertilizer usage
- Transportation (farm to mill)
- Wastewater treatment (methane)
- Packaging
- Land use change

Green coffee beans production covered by

Source: German Coffee Association, Climate Partner (2020). *raw materials include production material, packaging material and process inputs
Zero emissions targets are being adopted by many companies.
The GHG emissions calculation methodology
Comprehensive climate protection in the coffee sector means detection, reduction and offsetting of carbon emissions.
Most relevant standards and initiatives on GHG emissions calculation

The 4C Add-On is aligned with:

- **ISO 14067:2018** → provides guidance for the quantification of GHG for the development of the carbon footprint of a product

- **GHG Protocol Product Standard** → Product Life Cycle Accounting and Reporting Standard is the guideline document stating the requirements for a LCA of a product

- **PAS 2050:2011** → Publicly Available Specification for the calculation of the GHG emissions produced during a product’s life cycle (BSi)


- **The guide from the Science Based Target Initiative (SBTi) and the Paris Agreement target to limit global warming to 1.5°C**
Measurement of carbon footprint based on recognized methodologies in line with science-based target initiative

- Greenhouse gas (GHG) emissions calculation for coffee cultivation and the whole supply chain
- Introduction of mitigation measures and monitoring of GHG reduction
03 4C Carbon Footprint Add-on
The quantification of GHG emissions from the coffee supply chain steps shall contain the following elements:

\[ E = e_c + e_l + e_p + e_{td} - e_{soc} \]

Where:
- **E**: total emissions from the coffee supply chain in the final unit \( \text{kg CO}_2\text{eq/t of green coffee beans} \)
- **e_c**: emissions from the **cultivation** of coffee
- **e_l**: annualized emissions from carbon stock changes caused by **land-use change**
- **e_p**: emissions from **processing** (dry milling, wet milling, roasting, etc)
- **e_{td}**: emissions from **transport and distribution**
- **e_{soc}**: emission **savings** from **soil carbon accumulation** via improved agricultural management
Basic data needed for a GHG emission calculation for coffee production

<table>
<thead>
<tr>
<th>General Data</th>
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<tbody>
<tr>
<td>▪ Name of the company, address, coordinates, contact person</td>
</tr>
<tr>
<td>▪ Cultivation area in ha</td>
</tr>
<tr>
<td>▪ Number of plantations/ smallholders</td>
</tr>
<tr>
<td>▪ Rotation period</td>
</tr>
<tr>
<td>▪ Time period of data input (an entire year)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
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<tbody>
<tr>
<td>▪ Yield of main product in wet and dry tons</td>
</tr>
<tr>
<td>▪ Moisture content</td>
</tr>
<tr>
<td>▪ Yield per ha</td>
</tr>
<tr>
<td>▪ Waste &amp; Residues</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Inputs</th>
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</thead>
<tbody>
<tr>
<td>▪ Agricultural inputs (e.g. seedlings for replanting)</td>
</tr>
<tr>
<td>▪ Processing inputs</td>
</tr>
<tr>
<td>▪ Fresh/ process water and wastewater production incl. methane</td>
</tr>
<tr>
<td>▪ Packaging material</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Up-/ downstream Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Type of transport</td>
</tr>
<tr>
<td>▪ Maximum load of the transport mean</td>
</tr>
<tr>
<td>▪ Distances loaded and empty</td>
</tr>
<tr>
<td>▪ Fuel consumption for transport</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fertilizers, Herbicides, Pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Nitrogen fertilizers</td>
</tr>
<tr>
<td>▪ Mineral phosphate fertilizer and other fertilizers</td>
</tr>
<tr>
<td>▪ Herbicides &amp; pesticides</td>
</tr>
<tr>
<td>▪ N2O field emissions</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Energy Consumption</th>
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</thead>
<tbody>
<tr>
<td>▪ Fuel and steam consumption in litres/MJ</td>
</tr>
<tr>
<td>▪ Electricity consumption in kWh</td>
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</table>
The 4C Carbon Footprint Add-On is the solution for 4C system users to address the increasing demand for GHG emission in coffee supply chain.

The purposes:

1. calculate carbon footprint
2. identify emission reduction options
3. use carbon offsetting for remaining emissions

- describe GHG emissions and their reduction along the coffee supply chain
- provide the methodology for GHG calculations
- explain the prerequisites and processes to get certified
- describe rules and guidelines for calculating and verifying GHG emissions
- outline carbon offsetting options to compensate unavoidable emissions along the supply chain
- clarify the use of “4C Climate Friendly Coffee” and “4C Climate Neutral Coffee” logos and claims
Levels of Implementation of the 4C Carbon Footprint Add-On

Level 1: GHG emissions calculation at the 4C Unit level

4C Unit

Level 2: GHG emissions calculation at the 4C Unit level and Intermediary Buyers including logistics until gate of last entity in boundary
Option: Inclusion of final buyers

Intermediary Buyer

Local exporter or local government board

Intermediary Buyer

International trader

Final Buyer

Roast and ground, soluble, capsule, decaf industry

Level 3: level 1 or 2 including the reduction of the GHG emissions
Level 4: level 3 including carbon compensation
Reducing GHG emissions with the 4C Carbon Footprint Add-On

Level 1 & 2
→ baseline GHG emissions calculation

Level 3
→ Set up of improvement plan and implement activities to reduce emissions and achieve the **target reduction of 4.2% of emissions per year**

Level 4
→ Potentially offset remaining emissions
Impact and usage of a GHG calculator to enhance responsible agriculture in coffee supply chains

- Individual use of the calculator by the company (updating data values and input factors)
- Upscaling of the calculator results
- Monitoring of general coffee production, fields and mills
- Identification of impact factors to reduce GHG emissions

→ Communication on climate friendly or climate neutral coffee to customers and consumers
“Regenerative agriculture is an inclusive agroecosystems approach for conserving land, soil, biodiversity, and improving ecosystem services within farming systems. Regenerative agriculture techniques can improve crop yields through increased soil nutrients and organic content, reducing the need for fertilizers, soil erosion, improving water retention and biodiversity while reducing costs for farmers.”

(IUCN, 2021)
Many thanks for your attention!
A leading global trader of tropical agricultural commodities, Touton creates lasting relationships to build sustainable agro-industrial value chains.

Our deepest commitment is to the long term. We create strong bonds with producers in order to embark on long lasting adventures with clients.

More than mutual trust, we promise a relationship built on sustainable trust.

To deliver the right quality, at the best price, at the right time.

From climatic and agricultural hazards, markets’ volatility, epidemic threats, political instabilities to diversity of local realities, we master risks and responsibly source tropical agricultural commodities:

- **Cocoa**
- **Coffee**
- **Vanilla**
- **Spices**
- **Cocoa Products**
- **Specialty Coffee**
DRIVEN BY TRANSITION

TO ADAPT AND OFFER THE BEST SERVICE

From traders to supply chain managers

More than goods, we offer a service you can trust. We master the supply chain every step of the way. We strengthen the bond between producers and customers, based on shared value creation.

Innovation and digitalisation

Data management, impact assessment and partnerships with startups, we invest for better efficiency and impact at all levels of the value chain.

Sustainable trust

We promise our customers a relationship built on sustainable trust:
• through our commitment to build resilient and more virtuous supply chains that respect both human rights and the environment
• through the genuine rapports we build based on integrity, reaffirmed over time

OUR DYNAMIC APPROACH TO SUSTAINABILITY

Touton’s approach to sustainability is one of shared value creation.

To deliver on our promise of sustainable trust, we make sustainability dynamic to fit with:
• the reality of the supply chain on the ground
• changing market conditions, regulations and clients’ requirements

Acting as a catalyst between local farmers and global agro-industrial actors, we co-design and manage sustainable and service-oriented, tropical commodities value chains, including cocoa, coffee, vanilla and ingredients.
CONNECTING THOUSANDS OF COFFEE PRODUCERS WITH WORLDWIDE ROASTERS

Ambitious, responsible, and tailor-made services

Building on 15 years of experience, we offer all ranges of green coffee, Robusta, and Arabica, master qualities and the complexities of those supply chains.

Through our vast and reliable network of partners and offices in Africa, Asia, Europe, USA and Latin America, we offer a unique and comprehensive expertise to meet our clients’ needs, with the highest degree of flexibility.

- Innovative market intelligence
- Financial
- Logistics
- Sustainability services

Coffee sales 2020-21 by Touton

- Robusta: 73,290 MT (65%)
- Arabica: 39,450 MT (35%)
- Certified: 14%
Boosting yields for climate friendly Robusta coffee in Tanzania
Objective:
To reduce the emissions of GHG generated by the production of Robusta coffee by 7,000 smallholder farmers and processors in Tanzania within the JDE Peet’s supply chain

Duration & location:
• August 2021 – July 2024
• Kagera region, northwest of Tanzania

Project partners:
• Management: 4C Services GmbH
• Financing: Deutsche Investitions-und Entwicklungsgesellschaft mbH (DEG) from public funds of the German Federal Ministry for Economic Cooperation and Development (BMZ), together with funds of JDE Peet’s.
• Implementing partners: Touton S.A., Karagwe District Cooperative Union, 4C Services, Meo Carbon Solutions and GRAS Global Risk Assessment Services.
DEVELOPPP PROJECT

RATIONALE

Climate change plays a key role for the sustainable transformation of our agricultural systems.

Coffee production generates GHG emissions. Conversely coffee yields are increasingly vulnerable to the effects of climate change.

Total GHG emissions from Tanzania in 2014 were 286.49 million metric tons of carbon dioxide equivalent (MtCO2e), totaling 0.59% of global GHG emissions. Of these emissions, land-use change and forestry sector account for 72.7% followed by agriculture contributing 17.3% (Climate links, 2014).

Research shows Kagera region is a GHG emissions hotspot in the Tanzanian coffee supply chain.

STEPS

1. Measure and assess the carbon footprint of coffee production
2. Identify core impact factors and potential for improvement
3. Implement mitigation strategies (in- and off-setting)
4. Support market uptake of climate friendly coffee
5. Create positive socio-environmental benefits for the farmers and local coffee communities in Tanzania and beyond

IMPACT

• GHG emissions reduction by 15 to 20%
• 7,000 farmers and supply chain actors to receive technical and financial support to reduce GHG emissions and carbon in-setting measures through training activities and demonstration plots
• 4C Climate Friendly certification of farmers with an objective of 6,000 tons market uptake of Climate Friendly coffee in Europe
• Raise awareness and boost knowledge transfer of outputs in Tanzania and neighboring countries to replicate good practices
3 SCOPES

Final emission value 158.97 kg CO2 eq/ton of green coffee including all processing steps.

The main contributors to GHG emissions are final downstream transportation and packaging.

Theses values includes upstream activities from farm level and AMCOS and final processing at dry mill.

→ Emission values are forwarded down the coffee supply chain to calculate a final emission value for the final product as green coffee.
POTENTIAL IMPROVEMENT MEASURES

Stage 1

FARM LEVEL
- Implementation of minimum levels of organic fertilizers
- Avoidance of pesticide use on all farms
- Start and/or increase the implementation of carbon sequestration activities in soil
- Implement and/or improve carbon sequestration in above and belowground biomass (e.g., shade trees)
- Collection points and routes and different transport modes for a more efficient transportation of coffee cherries to the AMCOS

AMCOS LEVEL
- Change of transportation management to improve the efficiency of the delivery of green coffee to the dry mill

DRY MILE LEVEL
- Use of more sustainable packaging materials or less carbon intensive packaging
- Collaboration with local clients for a more efficient distribution of the final product

Stage 2

FARM LEVEL
- Soil Analysis: Including basic parameters: soil texture, pH, and macronutrients (N, P, K, and Mg)
- Analyze the effect of pruning residues left on SOM quantity, carbon content, and soil chemical properties (e.g., PH)
- Identify the tree species and their water demand/requirement
- Effect of tree residues and shade tree coverage:

FOCUS SOIL SAMPLING
- Capacity building to KDCU staff, AMCOS, lead farmers on the essence of soil sampling, its relation to soil fertility (1-day in-house training by consultant + practical in the field)
- 27 participants (10 female, 17 male)
- Sample collection of 126 farms (with geocoordinates)
- Various parameters are being analyzed, like N, P, K, micronutrients, soil pH, SOC, bulk density, etc.
- A final soil sample will also be taken at the end of the project implementation to see the changes in SOC to be included into the overall GHG calculation
NEXT STEPS

Monitoring GHG emissions reductions and carbon accumulation

Defining GHG emission criteria and calculation requirements for 4C Climate Friendly Coffee add-on and In p certification of 7,000 smallholder farmers

Supporting implementation og GHG reduction/insetting measures

Exploring and proposing off-setting options