Carbon and Coffee, Kenya

Cool Farming Options Pilot with Sangana Commodities Ltd and GIZ

GIZ (German Agency for International Cooperation) focuses on sustainable development with worldwide operations with an objective to improve people's living conditions on a sustainable basis.	Sangana Commodities is the Kenyan subsidiary of Swiss ECOM Agroindustrial Corp. It is a major coffee exporter. Their technical division, Sustainable Management Services (SMS), provides technical assistance to farmers.

Sangana Commodities Ltd and GIZ are implementing a Public-Private-Partnership (PPP) between 2008 and 2011 in order to improve the Kenyan coffee sector's capacity to adapt to climate change and consider mitigation options such as storing greenhouse gases in their production systems. The aim is to create an add-on to an existing standard that allows coffee producers to adapt their production to the changing climate and to create and use synergies between adaptation and mitigation. A voluntary climate module has been developed with the 4C Association, which complements the existing three components (social, environmental, economic) in its Code of Conduct. Along with the 4C Association, Tchibo GmbH and the World Bank are additional partners to the Sangana PPP.

Sponsor Goals for use of the Cool Farm Tool

The members of the Sangana PPP are piloting the use of the Cool Farm Tool to analyze emissions on production level and to understand how data collection for carbon footprinting can be integrated into the 4C verification process. Aspired benefits are to identify emission hot spots on the farm and to help develop emissions reductions goals and strategies, to monitor the impact of implementation of the Climate Module on emissions and to potentially create more value for the coffee. The key questions addressed in the pilot were:

- What is the impact of the implementation of the 4C Climate Module on on-farm emissions and sequestration potential?
- What is the carbon footprint of key farmer types found within the farmer cooperative?
- What are the key pathways to reduce emissions and maximize carbon sequestration?
- How can the use of the CFT be integrated with the 4C add-on climate module?
- What is needed to adapt the generic CFT to function as a 'coffee specific' tool?

Farming System

The Sangana PPP works with the Baragwi Farmers Cooperative Society, comprised of 12 wet mills and 16,364 smallholder farmers who grow their coffee in the volcanic soils of central Kenya on Mt. Kenya's southern slopes. Baragwi and Sangana are working together to improve the quality, productivity and environmental stewardship of the farms.

The farms in the system are small-scale, largely under 1 hectare, and range in management practices such as pruning, fertilizer use and shade and residue management. All of the farms surveyed had been under coffee cultivation for over 20 years and the standing shade cover varied from 2 shade trees to a maximum of 370 trees per hectare (mean 115trees/ha).

Methodology

Sustainable Management Services Ltd (SMS) was the agency tasked with data collection for the CFT. An initial data collection was done by GIZ in May 2010 for 40 farms, however we determined after this sampling that a sequestration function was necessary in the CFT to allow for proper accounting for the carbon sequestration of above ground biomass in perennial crops. SMS then collected data, including numbers, species and diameters of non-coffee trees within the coffee parcels, from 25 additional farms. They categorized these 25 farmers by agroecological zone (Upper, Mid, Low) and by management level (low, medium, high). The management levels correspond with average yields:

Low Management	=	0-2.9 kg cherry/bush
Medium Management	=	3-4.9 kg cherry/bush
High Management	=	5 and above kg cherry/bush

An additional coding for ‘promoter farmers’ was added for those farmers engaged in SMS’ improvement program. Therefore a promoter farmer adopts proposed practices quicker than a normal farmer.

Preliminary Results

The focus of the CFT pilot was to calculate the per kg net emissions for coffee cultivation and primary processing (wastewater data was not available in this pilot). The first set of results focuses on *cultivation emissions* partly to understand the key management practices available to farmers to mitigate their GHG emissions and partly to optimize the learning for adaptation of the CFT for coffee.

Figure 1 shows the on-farm net emissions from this sample of farms is an average of -0.50kg CO2e per kg coffee cherry when calculated on a straight average. The weighted average according to each farm’s production volume is -0.65kg CO2e/kg cherry. The results presented here (both the averages across farms and also for the examples of individual farmers presented below) were done using version 1.10312 of the Cool Farm Tool. Since that version there have been a number of adjustments to the tool, so a more reliable estimate and analysis of emissions would require porting of this data into version 2.0 of the tool. Emissions from fertilizer production and induced emissions from fertilizer use along with crop residue management are the primary sources overall. Carbon sequestration from above ground biomass and management practices such as incorporation of residues, compost and manure account for the significant carbon stock changes seen in the system, which largely offset the emissions.

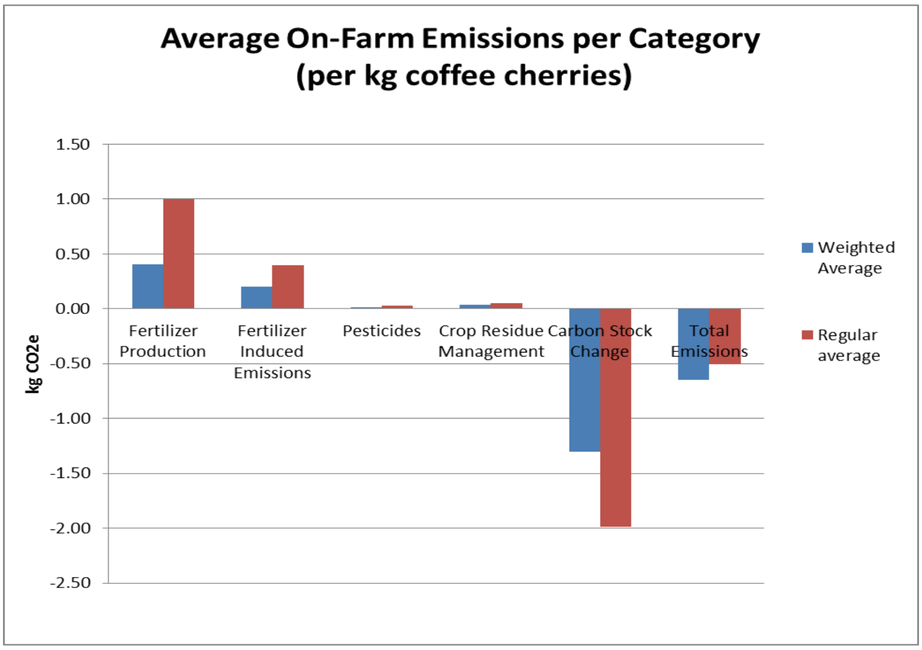

Figure 1. Comparison of emissions by category and total for average and weighted averages of the 25 sampled farms, kg CO2e/kg coffee cherry

An important note here is that understanding how the data is collected for numbers and diameters of shade trees, quantity and treatment of crop residues and fertilizers is critical to understanding how representative the results are of the entire system. For example, emissions related to crop residues will be skewed in this case; the residue amounts we received were samples of the stump and stem weights of trees, and were not limited to leaf litter and pruning data. Therefore, assumptions had to be made in order to provide more meaningful results. The above ground biomass stored in the coffee bush is accounted for in the allometric equations underlying the tree/bush numbers on the Sequestration tab, whereas the crop residues should only be the dry matter remaining from pruning or leaf litter. There is not a standardized methodology for calculating coffee bush residues in the CFT and the existing literature does not offer consistent and robust data to allow for entering default residue figures. Therefore, our reporting of emissions related to crop residue management will be affected as will any positive sequestration benefits of incorporation, etc. of this residue. Proper/ feasible accounting of tree numbers, growth rates (we assumed a zero growth rate of trees in the last year), species and diameter measurements are other areas that we are also still examining. This pilot has illuminated these areas of the CFT that will benefit from improved functionality to provide user guidance on data collection and improvement of the format to ensure accurate results.

The second type of analysis we did was to compare emissions for the farmers grouped by management level (High, Medium, Low) and by agroecological zone (Upper, Mid, Low). The preliminary data analysis has not yielded clear patterns as of yet, however as SMS analyzes the data they may be able to pull more definitive conclusions from the data given that they have first hand understanding about the practices and conditions that determine how farmers are placed in these two categories. While clustering farmers along definitive variables such as region or management practice is a good methodology to follow, it will not yield quality results unless the farmers are indeed following specific practices that correlate with the category. These farmer groupings need to be carefully considered with the agronomists at SMS who are directly familiar with the practices of the farmers surveyed to distill and verify the conclusions that can be made from these results.

Conducting a disaggregated analysis of the carbon footprints associated with different types of coffee farming will offer valuable insight into which practices deliver the optimum climate impact and where additional training or incentives are required. To provide an example of how the Cool Farm Tool can be used with individual farmers to highlight emissions sources and better identify potential management changes, Figure 2 shows the individual results for three farms. The farmer represented in blue (Bernard) represents the highest emissions from those farms sampled from the Baragwi Cooperative, with per kg coffee cherry emissions of 3.92 kg CO2e. The farmer represented in green (Cyprian) shows the farmer with the lowest overall total emissions of those farmers sampled with -7.46 kg CO2e emissions per kg of coffee cherry. Although these two farmers represent the range in data collected, most farmers like Jamlick (represented in red) fall between 0.90 and -2.72 kg Co2e emissions per kg coffee cherry.

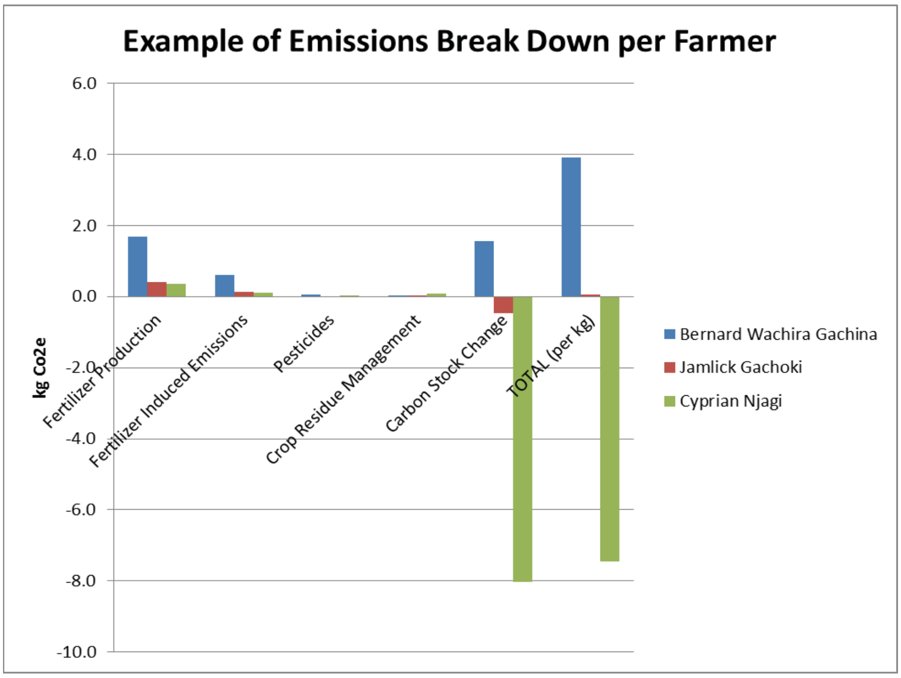

Figure 2. Example of Per Farmer CFT Results (kg CO2e per kg coffee cherry)

Processing Emissions

We were able to obtain some information from the wet mills of the Baragwi Farmers Cooperative Society, including electricity, diesel and petrol use. Unfortunately, we were not able to obtain wastewater data, which tends to be a significant portion of coffee's Product Carbon Footprint. Figure 3 shows the total emissions per wet mill based on the data available for the three categories of data available to us. It is worth mentioning that these emissions are for the total amount of coffee processed at each mill in general and are not limited to the individual farmers whose on-farm emissions were calculated above.

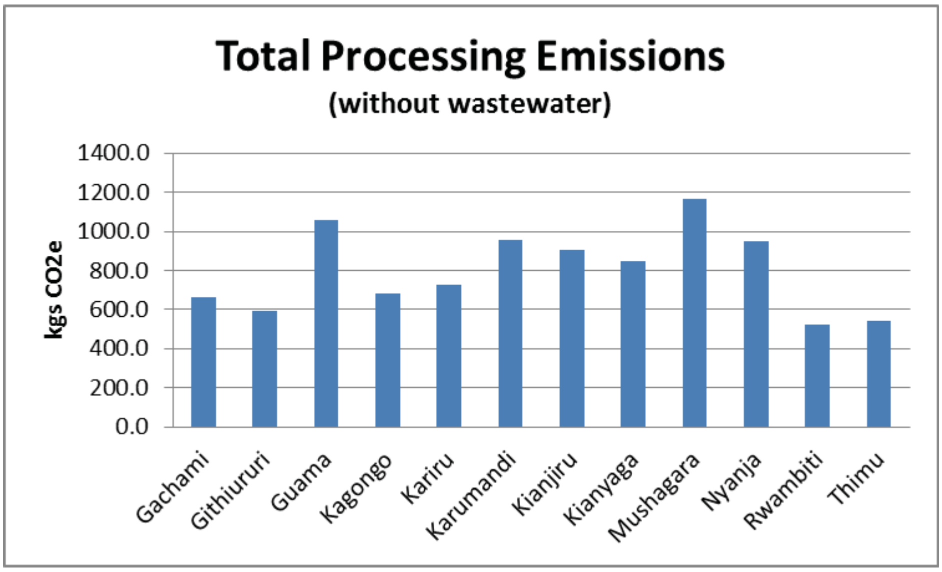

Figure 3. Total Processing Emissions per Wet Mill (not including wastewater)

Figure 4 provides a breakdown of these emissions per metric tonne of finished product and by emissions category to provide a more complete picture of each mill's emissions. This graph makes clear that although a particular mill may have higher emissions overall it may be more efficient in terms of the amount of finished product produced (at least in terms of the emissions categories listed here). It is also worth pointing out that we are unclear about the use and the reporting of petrol and diesel in these processing facilities (in fact, the data provided seems very low), so we are not sure how accurate or representative these emissions factors are.

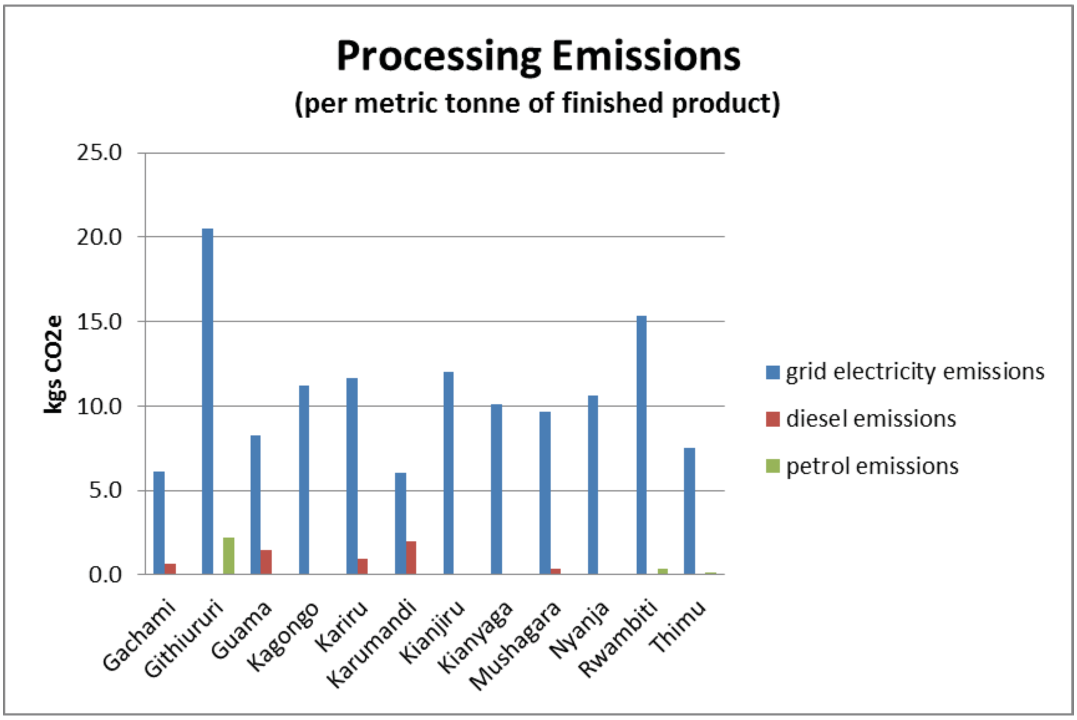

Figure 4. Breakdown of Emissions per Wet Mill (per metric tonne of finished product)

Reduction Scenarios

The key findings in this assessment are that fertilizer use, crop residue management and carbon stock changes offer the most significant opportunities for mitigation. These practices also relate to the best agricultural practices being promoted in the SMS Agricultural Training Manual.

Fertilizers and Crop Residues: The efficient use of fertilizer is central to both a productive and a climate friendly coffee farm. Efforts should be made to optimize the use of organic fertilizers and efficient use of synthetic fertilizers to boost yields without unnecessarily boosting GHG emissions. Practices such as composting and/or mulching residues (both from processing and pruning) and incorporating compost and manure when available will increase the organic matter of the soil, boost productivity and sequester carbon in the soil. Efforts to adequately aerate composting residues are also critical to minimizing the methane emissions from this process.

Above Ground Biomass: The presence of shade trees within the coffee farms is clearly a critical pathway to sequestering carbon. Shade trees vary in their percentage of canopy cover and ability to fix nitrogen, so region-specific recommendations are needed for coffee farmers to learn which trees can offer the co-benefits of fertilization, carbon sequestration and possibly eventual timber revenue with valuable species. Farmers of agroforestry crops like coffee must balance these benefits with the need for increased productivity for livelihood and quality needs.

Notes on the Cool Farm Tool (CFT)

This pilot has been helpful in identifying how functionality for perennial crops like coffee could be added into the CFT. Early on in the process, the Food Lab convened an adhoc group of experts and stakeholders interested in using the CFT for tropical agroforestry crops. This group included GIZ, CIAT, Rainforest Alliance, CATIE, Efico Trading, and Solidaridad and provided critical insight on robust data and literature. University of Aberdeen then incorporated aspects of carbon sequestration into the CFT including Land Use Change and Above Ground Biomass, increasing the functionality and relevance of the tool for these systems. The following are remaining issues within the tool that could be improved for use in coffee:

Default crop residues: identifying robust, representative data for crop residues would allow for more consistent results given the complexity of measuring this on farms.

Above Ground Biomass: the development of a methodology for categorizing a coffee farm by differentiating variables such as shade structure and strata might lead to a linked carbon stock quantity thus allowing the use of the tool without costly and time-consuming data collection to count and measure trees on farms.

Default growth rates for trees: adding embedded algorithms that can calcaulte default growth rates for tree / bush categories or species would allow users to see sequestration over time without the need to return to the farm to measure trees on an annual basis.

Guidance for local trees: regional guidance documents are needed to place local tree species into the CFT tree categories of tropical hardwoods, etc.

Methane emissions from processing: The CFT currently accounts for the methane emissions from waste water but does not sufficiently address the full emissions from decomposition from coffee pulp. Again, robust data from the literature is required to enable inclusion in the CFT.

Crop specificity: GIZ supports the development of a 'coffee-specific' CFT and this pilot project has produced a mock up version of the Coffee Cool Farm Tool. However, the current funding and management structure behind the CFT at the University of Aberdeen and the Sustainable Food Lab do not allow for the continued support of crop-specific versions of the generic tool. Draft versions of an online questionnaire which can be adapted for coffee and any other crop has been developed and the future form of the CFT will involved an online interface to allow for this flexibility. We are actively seeking support for this next stage of the tool among industry and public sector stakeholders.

For more information on this project and the Cool Farm Tool, please visit http://sustainablefood.org/projects/climate .