TECHNICAL PAPER

CLIMATE CHANGE AND THE COFFEE INDUSTRY

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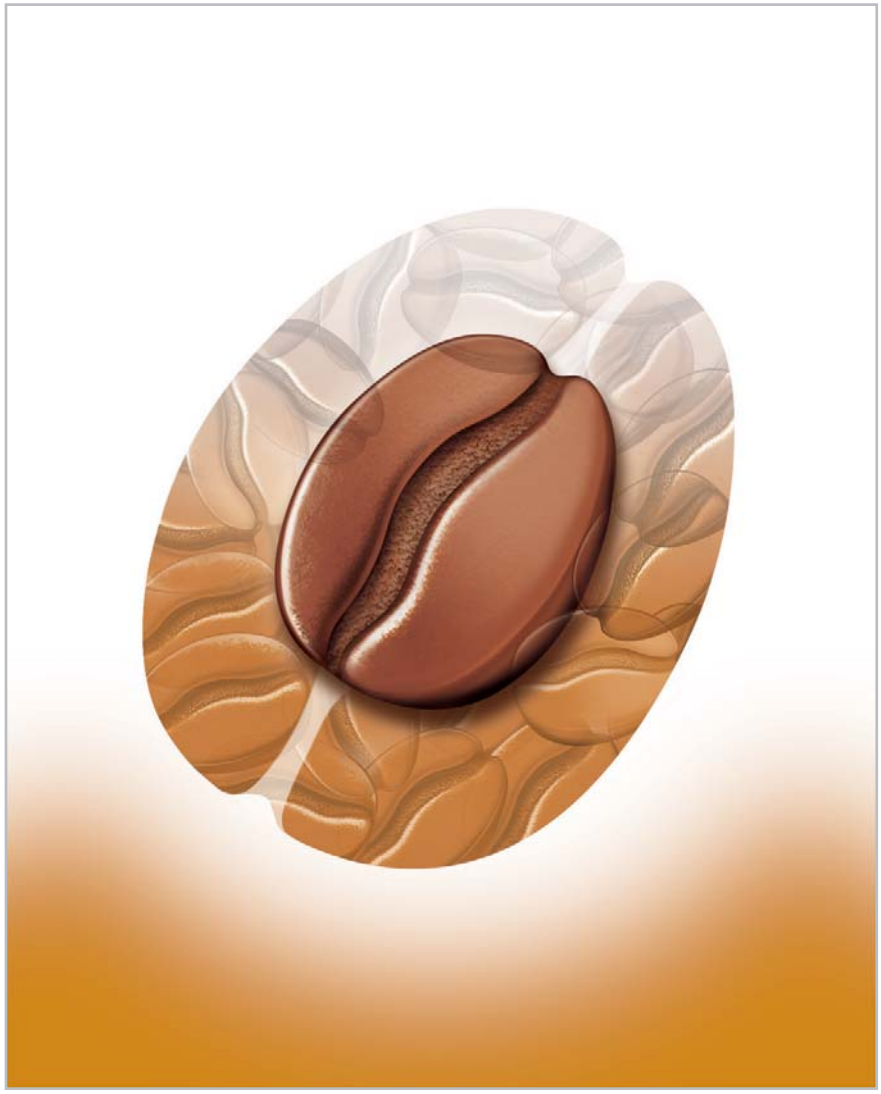

International Trade Centre

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CLIMATE CHANGE AND THE COFFEE INDUSTRY

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Climate Change and the Coffee Industry

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Climate Change and the Coffee Industry
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Paper focusing on the effect of climate change on global coffee production, with particular reference to small coffee producers in developing and least developed countries - highlights the possible effects of climate change on quality, yield, pests and diseases, and irrigation; considers potential areas of intervention, and looks at short-term solutions and long-term strategies to make coffee producers better prepared; discusses the issue of carbon credits, and provides examples of individual initiatives to reduce product carbon footprint; lists ongoing initiatives and information sources that may assist coffee growers.

Descriptors: **Coffee, Production, Climate Change, Environment.**

English

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Contents

This document is based on Chapter 13 of www.thecoffeeguide.org by February 2010.
There is a brief description of the website at the end of the document.

Climate Change and the Coffee Industry

Executive summary

Climate change will affect coffee producers, particularly smallholders who are least equipped to cope with it. Areas of intervention include (i) changing agricultural practices, (ii) creating social organization, and (iii) participating in new market strategies.

Strategic support areas include (i) improving access to information, (ii) establishing financial mechanisms and (iii) investing in social capital.

With respect to carbon market opportunities, gaining access to carbon credits has to be preceded by establishing greenhouse gas emission baselines and monitoring carbon sequestration rates. Methodologies for Monitoring, Reporting and Verification of emissions from land use projects are being developed.

The voluntary carbon market system appears to be the preferred option for credits from coffee production as land-use or agricultural mitigation projects are very limited in their eligibility for the mandatory markets like the Clean Development Mechanism (CDM). Furthermore, the application process is too costly and complex for small and medium enterprises.

Climate change and coffee

Whilst climate change is just one of numerous factors that may affect global coffee production, the International Coffee Organization considers it will likely be one of the most important ones with smallholders (who produce the majority of the world's coffee) the most vulnerable group. Moreover, it is important to note that current initiatives to reduce the extent of global warming are mostly aimed at limiting further warming, not to rapidly reverse it!

Complexity and uncertainty make it hard to be precise but it is generally accepted that climate change will affect both arabica and robusta producers. Rising temperatures are expected to render certain producing areas less suitable or even completely unsuitable for coffee growing, meaning production may have to shift and alternative crops will have to be identified. Incidences of pests and diseases will increase whereas coffee quality is likely to suffer, both factors that may limit the viability of current high quality producers. More coffee may need to be grown under irrigation, thereby increasing pressure on scarce water resources. All the foregoing will increase the cost of production whereas in the future fewer parts of the world may be suitable for coffee production. If so then the already evident growth in concentration could become even more pronounced, bringing with it an increased risk of high volatility. For example if an extreme event should severely curtail the output of one of the major producers.

Coffee production contributes to the emission of Greenhouse Gases (GHG) (as do other links in the chain). The industry therefore must not only focus on *adaptation* (help producers cope with climate change) but also on *mitigation* (reduce its own contribution to GHG emissions). It is important to differentiate between these two aspects, even though they are closely intertwined. Finally, the industry also needs to gear up to exploit the benefits that will spring from generating marketable carbon offset credits.

Short-term adaptation strategies include better farming practices and more efficient on-farm processing. Most progressive farmers apply these as a matter of course but smallholders do not always have the necessary resources and/or knowledge to do so. *Longer-term strategies* include capacity building, mapping of climate data, improving soil fertility, examining different production models, developing/planting drought and disease resistant varieties. And for some, in the extreme, diversify out of coffee and/or shift production to more suitable areas.

Short-term mitigation strategies include calculating and reducing the on-farm carbon footprint, and determining the feasibility of creating carbon sinks. *Longer-term strategy* would be to link producers, especially smallholders, with the carbon markets to exploit carbon footprint opportunities.[1]

Priorities

Smallholders produce the bulk of the world's coffee and the industry cannot afford steeply falling output in this sector. Yet, the ability of smallholders to cope with climate change is limited. Not all views on how to go forward concur but three priority areas are indicated:

Adaptation

1. Short-term technical solutions for adapting coffee production and processing to current climate variability, aimed at producers.

2. Long-term strategies to improve framework conditions for adaptation to future climate risks, and to build the necessary capacities including financing mechanisms.

Mitigation

3. Measures to reduce GHG and so contribute to climate protection and carbon credit generation, aimed at all participants in the value chain.

This is confirmed by a survey in the Mesoamerican region that ranked five potential areas of intervention as follows:

- **More important:** (i) changes in agricultural practices and (ii) social organization.
- **Important:** (iii) participation in new marketing strategies.
- **Less important:** (iv) new economic activities and (v) new cash crops.

Strategic recommendations include, in addition to recognizing the value of human capital, i.e. the collective farming knowledge that already exists in the smallholder sector:

- **Improving access to information,** including market information, farming technology etc., and developing the ability to interpret such information.
- **Establishing financial mechanisms,** including climate insurance, access to micro-credit to facilitate adaptation, i.e. organic, substitute crops, new varieties, shading etc.
- **Investing in social capital,** i.e. building structures that enable smallholders to access the resources necessary to adapt to climate change, access new markets and exploit the social and environmental value of their farming activities.

Although considerable preparatory progress has been made in the development of both methodologies and tools it is obvious that the industry as a whole is still in the preliminary stages of trying to transform strategy into widespread action.

[1] *Carbon sinks* are natural or man-made systems that absorb carbon dioxide from the atmosphere and store them. Trees, plants and the oceans all absorb CO_2 and, therefore, are carbon sinks. *Carbon footprint* opportunities arise from the wish by industry in developed countries to reduce or offset their carbon footprint, i.e. the total amount of GHG emissions caused directly or indirectly by an organization or a product.

Carbon credits

Agricultural carbon credits, i.e. credits generated through agricultural practices like coffee production, are not eligible under the mandatory carbon market, including the Clean Development Mechanism (CDM). Therefore, marketable carbon credits do not yet feature in coffee production and to date only one CDM project (the Coopeagri Forestry Project in Costa Rica) lists coffee growers amongst its indirect beneficiaries.[2]

There is more scope for land use based projects under the smaller voluntary carbon offset market – this is discussed in section13.04. Given the complexities surrounding CDM the general consensus amongst researchers appears to be that the voluntary carbon markets system presents the better option for coffee growers. But again, by end 2009 there were no obvious signs yet of any full-scale application in the coffee sector.

Meanwhile the retail end of the industry is increasingly looking across the supply chain to reduce the carbon footprint of products, including coffee. Measuring coffee's Product Carbon Footprint or PCF is costly and complex. Furthermore, generally there is a lack of consistency in calculating and reporting PCFs. Nevertheless, for coffee an encouraging start has been made through a study sponsored by the major German roaster Tchibo, covering coffee produced in Tanzania and consumed in Germany – see topic box 13.04.03.

Developing carbon projects is both complicated and time consuming whereas credible carbon monitoring methodologies for coffee farms have only recently come to the fore. But, a number of tools are now available and different initiatives are conducting or planning pilot projects that should facilitate extending carbon projects to the majority of coffee producing countries.

Provided the necessary capacity building and legislative support in those countries is forthcoming it may be assumed that progress will accelerate from 2010 onwards.

[2] Visit http://cdm.unfccc.int/Projects/index.html for information on all categories of CDM projects.

1. Climate change and the coffee industry

Acknowledgement

The text in Sections 1.1 to 1.7 is largely based on the report ***Climate change and coffee*** published by the International Coffee Organization – ICO (www.ico.org) in September 2009.

The full report, including a list of selected organizations that are funding mitigation and adaptation to climate change initiatives, is available on the ICO website. Search 'climate change' or go to: http://www.ico.org/show_document.asp?id=3308

The ICO's permission to make use of this report is gratefully acknowledged.

1.1 Overview and background[3]

New scientific evidence suggests that climate change is accelerating at a much faster pace than previously thought and that important tipping points, leading to irreversible changes in major Earth systems and ecosystems, may already have been reached or even overtaken.[4]

Human beings depend for their livelihood on agriculture more than on any other economic activity. This is particularly true for small farmers in developing countries whose economic well-being and food security hinges primarily on farming. Because of this and its high dependence on climate, agriculture has received a great deal of attention promoting studies and debates over how developing countries might adapt to the impact of climate change. The subject is exceedingly complex, not only from the agricultural perspective but also because of its implications for the global agricultural and trade policies that impact agricultural production and food security.

While climate change is just one of numerous factors that may affect global coffee production, it is nonetheless likely to be one of the most important ones. It is true that a great degree of uncertainty still exists with regard to how individual producing regions will be affected, and how climate change will affect overall coffee production. However, experts expect some changes to occur, and these could be significant in some regions. To complicate matters further, the potential impact will not only vary between countries but also within producing areas in individual countries, for example due to different altitudes.

Global initiatives to reduce the emission of *Greenhouse Gases (GHG)* are expected to play an important role in the mitigation of climate change but this apart, better farming methods and improved technology throughout the value chain are of the utmost importance. It is here where the coffee sector is focusing increased attention as will be shown to the extent possible in the topic boxes that follow.

[3] *'Coffee - An exporter's guide'* is part of ITC's mission to contribute to sustainable development through technical assistance in export promotion and international business development. As such the Coffee Guide's main emphasis is on international green coffee trade matters, rather than on issues related to production. However, in recent years concern about the potential impact of climate change, coupled with the quest to achieve sustainability throughout the coffee value chain, is increasingly interlinking many producer and trade issues. The object of this section of the Guide is therefore to highlight climate change and sustainability issues of particular relevance to the coffee industry, bearing in mind that it is not possible to offer a comprehensive insight into this enormous subject. Therefore, wherever possible sources of more extensive information are indicated.

[4] From the foreword by Mr Ban Ki-moon, UN Secretary General, to the 2009 Climate Change Science Compendium, published by the United Nations Environment Programme.

1.2 Climate change and coffee production

Whereas c*limatic variability* has always been the main factor responsible for the fluctuation of coffee yields in the world, *climate change*, as a result of *global warming*, is expected to result in actual shifts on where and how coffee may be produced in future. This will affect millions of producers as well as all other participants in the value chain, right up to the end-consumer and presents a major challenge to the coffee industry. How to mitigate the impact?

The current change in global climate is largely due to the burning of fossil energy (coal, oil, natural gas) and to the mineralization of organic matter as a result of land use. These processes have been caused by mankind's exploitation of fossil resources, clearing of natural vegetation (forests for example) and use of these soils for agriculture. These activities have primarily led to a measurable increase in the carbon dioxide (CO2) content of the atmosphere, an increase that results in global warming. This is so because CO2 hinders the reflection of sunlight back into space, thereby trapping more of it in the Earth's atmosphere. Other contributing GHG are Methane (CH4), Nitrous Oxide (N2O), Hydro Fluorocarbons (HFCs), Per Fluorocarbons (PFCs) and Sulphur Hexafluoride (SF6).

It is important to note that different forms of agriculture, including coffee production, also contribute to GHG emissions, and hence to climate change. But so do all other links in the chain: processing, trading, transport, roasting, packaging, retailing, brewing, serving etc.. Thus there is a need for all participants to collaborate on limiting coffee's contribution to the GHG problem. However, *coffee growers* are by far the most numerous group that is directly affected and the most vulnerable to the impact of global warming.

The first formal global reaction to the need to isolate GHG from the atmosphere and to limit their emission was materialized in a document called *The Kyoto Protocol.* For more on this visit http://unfccc.int/2860.php.

1.3 New terminology…

The debate over climate change has generated a host of new terminology that is not always clear to the average reader.

The United Nations Framework Convention on Climate Change – UNFCC has therefore published a detailed **Glossary of climate change acronyms** that can be accessed at http://unfccc.int/essential_background/glossary/items/3666.php.

The United Nation's Food and Agricultural Organization offers a similar but possibly somewhat more agriculture related glossary at http://www.fao.org/climatechange/en/

1.4 Measuring and forecasting climate change – a brief overview

Global climate change models make projections about future climates based on current understanding of what drives climate change. These are then related to the potential impacts on crops, particularly cereal crops given the importance of global food security.

Controlled field experiments grow crops in controlled environments where variables can be varied, for example the concentration of different gases in the atmosphere; the availability of water; and temperature levels. This is crucial in understanding how climate change affects individual crops. However, incorporating the results into large-scale climate change models remains wrought with uncertainty.

Integrated climate-crop models attempt to address some of these problems, including the fact that individual crops react differently to outside drivers. But other factors, like changes in land use for example, may independently affect local climates, making it difficult for such models to be all-encompassing.

Statistical analysis of past climates is used to determine the impact on past crop production and to estimate how such crops may respond in future. But this assumes that adequate historical data is available which is not always the case, nor is it certain that past reactions will be repeated.

Climate change scenarios have been developed by the Intergovernmental Panel on Climate Change (IPCC - www.ipcc.ch), based on four different storylines of different future worlds. These differ in terms of projections in population growth, world GDP changes, differences in per capita income between developed and developing countries, and the energy level of the economy (related to emission levels).

The common thread running through all these is complexity mixed with uncertainty.

Thus, models have to simplify certain parameters, some of which may have large implications on their outcome. Generally, uncertainties become larger the further into the future projections are made. Furthermore, there is a substantial scale-gap between large-scale global climate models (which generally have a resolution of over 100km) and the small-scale of most farming systems (generally less than 10 km). Current climate modelling studies also have significant regional biases, due to a lack of data in many developing countries, for example on precipitation patterns. Also, different crops are believed to react differently to CO2 concentrations in the atmosphere. And finally there are events such as floods and droughts that are expected to become more frequent and more severe as a result of climate change. But predicting their impact is currently very difficult…

Most modelling studies related to agricultural crops include projections of

- Changes in yields due to changes in seasonal climates;
- Changes in production potential in relation to factors such as yield, land availability and longer/shorter growing seasons;
- Crop response to changes in atmospheric conditions;
- Changes in prices and trade patterns due to climatic change;
- Changes in food security, i.e. the number of people at risk of hunger; and
- Water run-off and related water stress;

But, there are other relevant aspects and potential impacts that are hard to include in current models…

Relationships between climate change and soil degradation

According to IPCC land management practices will be the most influential factor on the organic matter content of the soil during the next decades. Climate change is likely to increase the frequency and distribution of stronger winds and increased rainfall, both major determinants of erosion, likely leading to reduced soil capacity to hold water. This is of particular importance to crop production in semi-arid and arid areas, particularly if coupled with rising temperatures.

Water availability: In a warmer world, the hydrological cycle is expected to become more intense, likely to result in 'very wet' and 'very dry' areas compared to past measurements. Globally, the number of people exposed to extreme droughts at any one time is also expected to increase as a result of climate change.

Extreme events: These can influence agriculture quite heavily but projecting their *impact* is hard. Probably the best known such event is the El Niño Phenomenon that happens irregularly but dramatically affects the weather in many parts of the world. The term El Niño refers to the large-scale warming of surface waters of the Pacific Ocean every 3-6 years, which usually lasts for 9-12 months, but may continue for up to 18 months and dramatically affect the weather worldwide. Predicting the occurrence of El Niño events (but not their impact on agriculture) has only been possible since the 1980's when computing power became large enough to do so.

The impact of El Niño on coffee production has been closely studied in Colombia. During its occurrence in the Andean region of Colombia, rainfall decreases while sun intensity and temperatures increase. This causes production to fall in some regions, particularly in low-lying areas where rainfall is less than 1,500 mm/year and there is low retention of moisture and high exposure of the crop to sunlight. Lack of water during the critical stages of fruit development also brings about a high risk of black beans, small beans and other defects, as well as increased incidence of pests such as coffee berry borer.

1.5 The coffee sector and climate change

Temperature and rainfall conditions are the main drivers when it comes to yield, i.e. production. In this respect the two main species, arabica and robusta that together account for about 99% of world production, have different requirements.

Arabica coffee evolved in the cool, shady environment of the Ethiopian highland forests where there is a single dry season coinciding with the 'winter' months. The optimum temperature range is somewhere between 15 °C and 24 °C. Much higher temperatures tend to impact negatively on both yield and quality. Rainfall requirements are between 1500 and 2000 mm per annum although the use of irrigation today allows arabica to be grown also in areas with otherwise insufficient rainfall.

Robusta coffee evolved across lowland Equatorial Africa, particularly in the forests of the Congo River Basin and around the Lake Victoria Crescent in Uganda. It grows best in areas with abundant rainfall of around 2,000 mm per annum, at altitudes ranging from sea level to about 800 metres. Rainfall must be well distributed throughout most of the year because the robusta tree has a relatively shallow root system. The optimum temperature ranges from 22 °C to 26 °C and the species is less tolerant of very high as well as very low temperatures than is arabica.

Possible effects of climate change on coffee production

Quality. As temperature rises, coffee ripens more quickly leading to a fall in inherent quality. This statement is supported by the fact that low grown arabica from tropical areas with higher temperatures mostly shows less 'quality' in the cup compared to the same coffee grown at higher altitudes. The beans are softer and may well be larger but, lack that 'quality'. In this regard Dr Peter Baker of CAB International (www.cabi.org) estimates that if by the end of this century temperatures rise by 3 °C (some experts believe an increase of up to 5 °C is possible), then the lower altitude limit for growing good quality arabica may rise by some 15 ft per annum, meaning that over time areas that are currently too cold for coffee could become suitable. But it is uncertain whether land at higher altitudes would in fact become available (or be rendered suitable) for coffee production.[5]

Yield. If climatic events such as overly high temperatures occur during sensitive periods of the life of the crop, for example during flowering or fruit setting, then yields will be adversely affected, particularly if accompanied by reduced rainfall.

Pests and diseases: Higher temperatures will not only favour the proliferation of certain pests and diseases, but will also result in these spreading to regions where they were not normally present. Research suggest that the incidence of pests and diseases such as coffee berry borer, leaf miner, nematodes, coffee rust and others will increase as future temperatures rise. The consequent need for more control will make coffee production both more complicated and more expensive.

Irrigation: Areas currently not requiring this may do so in the future due to increased evaporation that reduces the soil's moisture content. Other areas may experience increases in both rainfall and the variability thereof.

Potential impact on global coffee production

As already mentioned, complexity and uncertainty make it hard to be precise. Nevertheless, there is a real possibility that fewer parts of the world will be suitable for growing coffee. If so then the already evident growth in the concentration of production could become even more pronounced. This in turn could make global production more prone to high fluctuations, as any severe disruption in output from one of the major producers would drastically curtail global output. Secondly, the cost of production will increase more than would have been the case without global warming and thirdly, competition from other crops for available arable land may increase.

In the context of this brief review perhaps the most important point to note is that current initiatives to reduce the extent of global warming are mostly aimed at limiting further warming, not to reverse it rapidly. This means everyone in the coffee value chain needs to adapt by taking actions to minimize and cope with the seemingly inevitable effects.

[5] For the original presentation by Dr. Peter Baker and Dr, Jeremy Haggar entitled 'Global Warming: the impact on global coffee' go to http://www.catie.ac.cr/BancoMedios/Documentos%20PDF/cafe_gw_baker_09.pdf.

1.6 Global warming as reported from some individual producing countries

Brazil. Rising temperatures suggest coffee production will become viable in areas formerly considered too prone to frosts. Meteorological agencies report temperatures consistently above the historical average since the 1990's. However, too high temperatures will reduce the overall acreage with climatic potential for coffee production.[6]

Colombia. Production costs are likely to increase due to new climatic conditions favouring the proliferation of insects, plagues and pathogens, and also by disturbing the natural balance between some pests and their natural predators. Diseases will spread to new areas. Water requirements may rise due to higher temperatures causing more evaporation, meaning many farmers may have to introduce irrigation. In some areas farmers would wish to transfer coffee production to higher altitudes to seek more suitable environmental conditions.

Costa Rica. Farmers are also facing threats from climate change but rising temperatures may also expand the high-altitude regions where quality coffee is grown, possibly to as high as 2,000 meters.

India. Reduced rainfall in some areas is dramatically changing the ecosystem and growing conditions, whereas higher temperatures are favouring the spread of pests as white stem borer and berry borer. Worst affected farmers are establishing deep, high-volume wells thereby lowering the water table in their region.

Kenya. The total area for coffee and tea production is expected to remain unchanged but to migrate upwards. The land now used for tea around Mount Kenya would become useless and tea production would move up the mountain, displacing the forest cover and so accelerating both local and global warming. Higher temperatures will negatively impact the incidence and spread of pests and diseases and, may adversely affect the 'Kenya cup' that the country is famous for.

Mexico. Coffee production is at risk from climate change and the proliferation of pests. Even coffee trees grown as high as 1,200 meters and previously not considered at risk, are now being affected by berry borer. Coffee at all altitudes is now at risk.

Peru. Rising temperatures and erratic weather patterns are changing historic trends in coffee growing areas. Crops appear to start earlier and farmers are reporting that high-altitude coffee trees are maturing at times more typical of their low-land counterparts. Main changes reported so far are temperature increases matched by sudden cold fronts, reduced rainfall in some areas vis-à-vis unchanged total levels but seriously disturbed distribution patterns in others, including floods and landslides, and stronger winds damaging infrastructure and coffee plantations.

Uganda. Here an Oxfam report suggests that 'if average global temperatures rise by 2 °C or more, then most of Uganda is likely to become unsuitable for coffee'. More frequent floods and landslides are already a concern whereas rainfall distribution has become more erratic. On the other hand farmers are planting more shade trees, applying more mulching and contouring the soil to capture rainwater.

[6] The website of the University of Campinas (www.unicamp.br) offers a range of related publications, for example see http://www.cpa.unicamp.br/prod_cc/artigos-em-periodicos/download.pdf/download.pdf. Another overview on Brazilian agriculture and climate change can be found at www.climaagricultura.org.br. Look for the paper entitled 'Aquecimento global pode mudar mapa de produção agrícola brasileira' by Eduardo Assad and Hilton Silveira Pinto. Alternatively contact Mr Assad at assad@cnptia.embrapa.br.

1.7 Potential strategies to make coffee producers better prepared

Detailed monitoring of changes in climate and production. This would allow the mapping of areas prone to the spread of specific pests according to the likely impact of climate change. This would assist in determining which crops are best produced where and could help ensure that government guidance and assistance are correctly targeted.

Mapping of likely climate change within each coffee region. The United Nations Framework Convention on Climate Change (UNFCC) assists least developed countries to identify their immediate priorities for adaptation options. Over 40 countries have received assistance to prepare their National Adaptation Programmes of Action and many have already submitted their action plans. See a list of proposed project details and plans at http://unfccc.int/national_reports/napa/items/2719.php.

Migration of production - latitudinal and altitudinal. *Latitudinal migration* could be northwards or southwards in search of more appropriate climatic conditions, for example a southward shift in Brazil to less frost prone areas. However, widespread latitudinal changes will be difficult given the susceptibility of both arabica and robusta to changes in the intensity and availability of sunlight that impact on the photosynthesis process. Effects range from a noticeable decrease of the growth phase to an inhibition of flower development. *Altitudinal migration* would move production to areas of higher altitude where the climate will become more suitable. After all, coffee does grow in areas outside the 'normal' tropical distribution range of coffee cultivation (Nepal and China's Yunnan province). Nevertheless, both movements in geographical location and in altitude may be restricted, for example by the potential impact on quality.

Estimating the potential impact of climate change on coffee quality. Higher temperatures mean coffee will ripen more quickly, leading to a fall in quality. This means areas currently favourable for coffee production may no longer be so in 20 years, and others currently too cold may become suitable. But this dislocation of existing areas to new ones is highly problematic, given the increasing competition for fertile land across all regions.

Devising strategies to diversify out of coffee where necessary. To date diversification has proven particularly challenging, mainly because of the lack of adequate substitute crops. However, with increasing pressure on food crops land currently used for coffee may become subject to competition from (more) profitable crops.

Evaluating available adaptation techniques, such as shade management systems. Although originally a shade tree, coffee also prospers without shade in zones with adequate climate and soils. However, shade management is highly advisable when coffee is grown in less desirable areas, or in areas that will become affected by climate change. The main effects are decreasing air temperatures (as much as 3°C-4°C), decreasing wind speeds and increasing air humidity. Shading also helps avoid large reductions in night temperatures at high elevations, or in high latitudes such as Parana State in Brazil.

High-density planting, vegetated soils and irrigation All these aim at maintaining and/or increasing organic matter and soil water retention capacity, thereby enhancing the viability of cultivation under adverse climatic conditions.

Genetic breeding. The main objectives under this concept are the development of higher yields, better quality and strength, and longevity. However, it is equally important that genetic improvement based on selective breeding contributes to the long-term sustainability of coffee cultivation in lands potentially affected by climate change. Research on varieties that are less water demanding is equally important. Some research has focused on developing varieties that could cope with higher temperatures and remain highly productive at the same time.

1.8 Additional selected websites offering background information, overviews and facts on climate change and sustainability

http://unfccc.int/2860.php - United Nations Framework Convention on Climate Change – UNFCC. Home of the Kyoto Protocol – supports all institutions involved in the climate change process. Offers overviews of the Kyoto Protocol, the Clean Development Mechanism, Data on Greenhouse Gases, National Reports, Science and CDM Projects.

http://www.ccdcommission.org - The International Commission on Climate Change and Development offers a comprehensive overview of climate change and disaster risk reduction and offers recommendations to strengthen the resilience of vulnerable countries and communities in a comprehensive report entitled 'Closing the gap'

http://unfccc.int/essential_background/glossary/items/3666.php offers an extensive glossary of climate change related acronyms and terminology.

http://www.gefweb.org - Global Environment Facility – GEF. Inter-governmental organization offering project funding for a large range of climate change and environment related issues to developing countries and countries with economies in transition.

http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTWDRS/EXTWDR2010/0,,contentMDK:21969137~menuPK:5287816~pagePK:64167689~piPK:64167673~theSitePK:5287741,00.html. This World Bank site offers the entire text of the Bank's World Development Report 2010 – Development and Climate change.

http://www.unep.org/climatechange - United Nations Environment Programme – UNEP.
Offers a wide range of insights and information on climate change related news and activities, including financing of climate change mitigation and adaptation.

http://www.undp.org/climatechange/adapt - United Nations Development Programme – UNDP. Provides resources in respect of the programming of climate change adaptation projects and their integration into mainstream development. Also offers an Adaptation Learning Mechanism – ALM. A global knowledge sharing platform, mapping good practices and information on climate adaptation.

http://www.fao.org/climatechange/en/ - Food and Agricultural Organization of the United Nations – FAO. Information and resources related to climate change with particular emphasis on food security and agriculture. Extensive glossary of climate change terminology.

http://www.odi.org.uk/themes/climate-change-environment/default.asp - Overseas Development Institute - ODI. Independent think tank on development issues, active in research on climate change issues in developing countries.

http://www.solutions-site.org The Horizon Solutions Site is a collaborative programme with UNDP, UNEP, UNFPA, Unicef, the IDRC, Yale and Horizon's colleagues at Harvard that presents answers to problems in environment, health, population and development, in case-studies (peer-reviewed), articles and exhibits.

http://www.sustainablecommodities.org - The Sustainable Commodity Initiative (a joint venture by IISD and UNCTAD) aims to promote sustainable practices in commodity production and trade. Site links into FAST (Finance Alliance for Sustainable Trade), SCAN (Sustainable Commodity Assistance Network), SSI (Reporting: State of Sustainability Initiatives) and COSA (Committee on Sustainability Analysis).

http://www.un.org/wcm/content/site/climatechange/gateway This United Nations site offers a gateway to the work of over 30 UN organizations in the field of climate change, including a link to the World Meteorological Organization's Global Climate Observing System (http://www.wmo.ch/pages/prog/gcos/index.php?name=about)

http://www.climatehotmap.org/index.html is an initiative by a number of concerned NGO's, including the World Wildlife Fund, and offers an inter-active 'Early Warning Signs' map, detailing a number of potential global warming effects by region.

http://sdwebx.worldbank.org/climateportal/home.cfm?page=globlemap - The World Bank's Climate Change Data Portal. Provides information on climate change and a number of tools.

http://www.adaptationlearning.net - The United Nation's Development Programme's Adaptation Learning Mechanism is a knowledge-sharing platform on climate change.

http://www.isealalliance.org - The International Social and Environmental Accreditation and Labelling Alliance - ISEAL is the global association for social and environmental standards systems. Site includes the complete output and documents of the Social Accountability in Sustainable Agriculture project - SASA and is of interest to coffee growers generally.

http://www.cgiar.org - The Consultative Group on International Agricultural Research - CGIAR is a strategic partnership whose 64 members support fifteen international research centres for which links and contact details are provided.

http://www.iwmi.cgiar.org - The International Water Management Institute - IWMI is one of the 15 CGIAR-linked research centres. Its mission is to improve the management of land and water resources for food, livelihoods and nature.
Look for its Water Policy Brief at
http://www.iwmi.cgiar.org/Publications/Water_Policy_Briefs/PDF/WPB31.pdf

http://www.ifpri.org - The International Food Policy Research Institute - IFPRI is another of the CGIAR-linked research centres and concentrates on food security issues. Their report entitled '*Climate change: Impact on agriculture and costs of adaptation'* presents research results that quantify climate-change impacts, assesses the consequences for food security, and estimates the investments that would offset the negative consequences for human well-being. Although not directly coffee-related, this analysis brings together, for the first time, detailed modelling of crop growth under climate change with insights from an extremely detailed global agriculture model, using two climate scenarios to simulate future climate.

http://www.wbcsd.org - The World Business Council for Sustainable Development – WBCSD is a global business initiative. Although not directly relevant to coffee the site nevertheless offers interesting information, for example on water and forest products.

2. Translating strategy into actual responses

2.1 What are the priorities?

Smallholders are amongst the most vulnerable groups when it comes to the potential impact of climate change. Smallholders also produce the majority of the world's coffee but for many their ability to adapt to climate change is limited by insufficient or no access to the resources, including technical assistance, that this requires. This is not to suggest that all such resources have been identified, far from it, but what is clear is that the coffee industry cannot afford severely reducing smallholder production, neither in terms of quantity nor in terms of quality and quality diversity. This therefore confirms the need for concerted industry-wide initiatives. But how?[7]

Not all views on how to go forward concur but it would seem reasonable to argue that there are three main areas for action to be undertaken.[8]

- Short-term technical solutions for adapting coffee production and processing to current climate variability, aimed at producers;

- Measures to reduce GHG and so contribute to climate protection and carbon credit generation, aimed at all participants in the value chain;

- Long-term strategies to improve framework conditions for adaptation to future climate risks, and to build the necessary capacities – aimed at all in the value chain but, mostly, producers;

Short term technical solutions will vary from country to country and between areas in a single coffee producing country. Farmers are already experiencing climate change, they know their circumstances better than anyone and many have innovative ideas on how to combat at least some of the effects. In other words, of course external assistance is needed but to be successful it should combine with local stakeholders to jointly develop adaptation and mitigation processes.

Measures to reduce GHG are equally important but it is proving difficult for farmers to gain carbon offset credits, mostly because projects to reduce GHG emissions must demonstrate their ***additionality***. That is to say, they must show an additional/added value effect in the GHG scenario. Under this concept coffee farms have to prove that they create GHG savings that are additional to anything that might happen anyway. Ironically, it is technically probably easier for other partners in the value chain to generate carbon offsets than it is for the grower. This is demonstrated by the fact that to date agri-based offsets are not widespread.

[7] This brief discussion is limited to the coffee sector and as such no reference will be made to the debate between industrialised and developing countries on Climate Change.

[8] Quote adapted from 'Adaptation for Smallholders to Climate Change' by Mario Donga and Kathleen Jährmann – http://www.adapcc.org/en/downloads.htm - a joint project of Cafédirect and German Technical Cooperation – GTZ.

Long-term strategies at the production level are essential and require major industry support and supporting legislation. Many of these are identified and discussed in the ICO's paper on 'Coffee and climate change' and it is beyond the scope of the Coffee Guide to discuss these in more detail. Suffice it here to add that the March 2009 Coffee Issues Management Forum (organised by the National Coffee Association of the USA – www.ncausa.org) identified *producer sustainability* as the prime priority issue with *adaptation to climate change* listed as the most important sub-issue under this heading…

In the meantime however coffee producers require mostly short-term solutions to try and help them cope as things move along in the world of climate…

To a limited extent, progress towards mitigating the effects of climate change is of course assisted by adhering to Good Agricultural Practices or GAP, further aligned to coffee production through observance of one or more of the different certification or verification standards that are active. But, it is of obvious that climate change itself cannot be adequately addressed at the individual farm level.

The reduction and trapping of GHG by coffee growers will very likely, if not automatically, also help towards mitigating at least some of the effects of climate change they are already experiencing.

And whilst it is not possible to 'sell coffee or shade trees', it is possible to work towards producing carbon credits that can be traded, either through the mandatory CDM process, or through voluntary arrangements. For individual smallholders though CDM type coffee carbon credits may be very difficult to achieve. For them the better route is probably through 'umbrella projects' that encompass larger areas and take a holistic approach to the issue. This is further discussed in section 3 of this paper.

2.2 In reality, what specific actions could or should be taken?

It is important to differentiate between mitigation and adaptation, i.e. actions that would help to reduce climate change, and actions that could help coffee growers to adapt to the impact of climate change. That is to say Coffee production itself contributes to GHG emissions. How can those emissions be reduced? And, how could carbon sinks be increased?[9]

In practical terms, what if anything can coffee growers do to adapt to the effects of climate change?

It is equally important to appreciate that, collectively, smallholders possess a vast amount of practical farming knowledge and history, meaning they understand what has changed or is changing in their area. The value of this 'human capital' should not be ignored.

[9] **Carbon sequestration.** The process of increasing the carbon content of a carbon reservoir other than the atmosphere. Biological approaches to sequestration include direct removal of carbon dioxide from the atmosphere through land-use change, afforestation, reforestation, and practices that enhance soil carbon in agriculture. Physical approaches include separation and disposal of carbon dioxide from flue gases or from processing fossil fuels to produce hydrogen- and carbon dioxide-rich fractions and long-term storage in underground in depleted oil and gas reservoirs, coal seams, and saline aquifers. **Carbon sink.** Any process, activity or mechanism that removes a greenhouse gas, an aerosol, or a precursor of a greenhouse gas or aerosol from the atmosphere. Alternatively, carbon sinks are reservoirs that can absorb or 'sequester' carbon dioxide from the atmosphere and include forests, soils, peat, permafrost, ocean water and carbonate deposits in the deep ocean. The most commonly referenced form of carbon sink is that of forests. Plants and trees absorb carbon dioxide from the atmosphere via photosynthesis, retain the carbon component as the building block of plant fiber and release oxygen back into the atmosphere. Therefore, long lived, high biomass plants, such as trees and forests represent effective carbon sinks as long as they are maintained.

A survey and policy brief published by the Centro Agronómico Tropical de Investigación y Enseñanza – CATIE in Costa Rica (www.catie.ac.cr) identifies three main responses by Mesoamerican coffee growers to past crises and ongoing change in the coffee sector:[10]

- **Changes in agricultural practices,** directed at reducing costs, improving soil fertility, or meeting sustainability criteria for new markets.
- **Social organization,** necessary for small producers to access new markets, technologies or support programmes, and to help farmers recover or respond to global changes.
- **Participation in new marketing strategies,** to help them identify and develop the social and environmental value of their products.

Other responses have included diversification to non-agricultural activities, adopting more profitable crops, decreasing the area dedicated to coffee, lessening labour and input use, and even migration to urban centres or more developed countries.

Surveys that were conducted ranked five potential areas of intervention as follows:

- **More important:** i) changes in agricultural practices, and
  ii) social organization.
- **Important:** iii) participation in new marketing strategies.
- **Less important:** iv) new economic activities, and v) new cash crops.

In addition to recognizing the value of human capital, i.e. the collective farming knowledge that already exists in the smallholder sector, strategic recommendations include:

- **Improving access to information,** including market information, farming technology etc., and developing the ability to interpret such information.
- **Establishing financial mechanisms,** including climate insurance, access to micro-credit to facilitate adaptation, i.e. organic, substitute crops, new varieties, shading etc.
- **Investing in social capital,** i.e. build structures that enable smallholders to access the resources necessary to adapt to climate change, access new markets and exploit the social and environmental value of their farming activities.

A number of projects elsewhere in the world have conducted or are conducting similar surveys. The indications are that the results may not be all that different. Examples are given elsewhere in this paper.

2.3 Adapting to climate change in practice

Good farming practices automatically help conserve soil and water and in so doing also make it easier to adapt to global warming whilst at the same time lessening its impact. But the necessary resources are not always available, especially not in the smallholder sector.

[10] September 2009 'Building resilience to global change for coffee farmers in Mesoamerica' by Hallie Eakin, Edwin Castellanos and Jeremy Haggar. NB: Mesoamerica = Central American region and Mexico. For an overview visit http://www.catie.ac.cr/BancoMedios/Documentos%20PDF/cafe_politicas_09_ing.pdf.

Hands-on options include (list not exhaustive of course)[11]

In the field

- Mulching to reduce evaporation, avoid erosion and improve soil fertility.
- Terracing/contouring, drainage and trapping/storing run-off rain water.
- Planting hedges, planting contours to mitigate wind and water damage
- More effective irrigation and water resources management
- Shading to mitigate increased solar brilliance, reduce temperature variations and help retain moisture.

Processing

- Reduce water usage = eco-friendly pulpers
- Improve wastewater management and disposal
- Make effective use of all compostable materials
- Use solar energy, i.e. sun drying where feasible
- Use renewable energy sources for mechanical drying
- Make better use of dry milling by-products (fuel, charcoal briquettes, board)

Longer-term options include

- Strengthening institutions
- Improving access to climate data
- Mapping potential climate change impact on coffee areas[12]
- Improving soil fertility
- Examining different production models, for example high density planting
- Developing/planting disease and drought resistant varieties
- Shifting production to more suitable areas where feasible
- Developing finance mechanisms to facilitate all or some of these

Carbon sequestration and sinks[13]

- Calculating and reducing the on-farm carbon footprint
- Determine the feasibility of creating marketable carbon sinks
- Linking smallholders to carbon markets to exploit carbon footprint opportunities[14]

2.4 Who is doing what?[15]

As of end 2009 it is obvious that the industry is still in the preliminary stages of trying to transform strategy into action. Much information has to be collected whereas potential methodologies and solutions not only need to be identified but must also be tested.

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[11] Many if not all of these are of course also promoted by the different certification and verification standards as Organic, Rainforest Alliance, Utz Certified, 4C Association and corporate standards as Starbucks' CAFÉ Practices and Nespresso's AAA Program.

[12] Examples of climate mapping can be found at http://www.ciat.cgiar.org (contact Dr Peter Laderach, Centro Internacional de Agricultura Tropical or International Center for Tropical Agriculture at p.laderach@ciar.org.) and at http://www.iac.sp.gov.br. (contact Marcelo B. Paes de Camargo, Instituto Agronômico – Campinas – IAC in Brazil at mcamargo@iac.sp.gov.br).

[13] This is further discussed in section 3.

[14] Carbon footprint opportunities arise from the wish by industry in developed countries to reduce or offset their carbon footprint, i.e. the total amount of GHG emissions caused directly or indirectly by an organization or a product.

[15] Some projects are mentioned more than once in this paper because they 'overlap' in that they look at adaptation/mitigation options as well as carbon offset credit options.

Nevertheless, a considerable amount of activity is ongoing or planned as listed below (in chronological order where possible):[16]

2.4.1 CATIE: the Centro Agronómico Tropical de Investigación y Enseñanza in Costa Rica worked on **Carbon Capture and Development of environmental Markets for Indigenous Cocoa Farms and Other Agroforestry Systems.** Duration 2004-2006. A technical manual was developed on how to estimate carbon.
Contact: Eduardo Somarriba, esomarri@catie.ac.cr.

2.4.2 CATIE, CIRAD and the University of Bangor in the CAFNET project **Sustaining Environmental Services in Coffee Agroforestry in Central America, East Africa and India** are conducting research into the tradeoffs between the provision of environmental services and profitability of coffee production, and the dynamics of C in shaded coffee systems, to determine how management practices may affect the carbon balance of the production system. Visit http://web.catie.ac.cr/congreso/congreso_ENG.htm or Contact: Jeremy Haggar at jhaggar@catie.ac.cr.[17]

2.4.3 The University of Campinas in Brazil has published a number of studies on both climate change and the mapping of climate change that provide important information, both as regards methodology and as regards impact, for different crops including coffee. Visit http://www.cpa.unicamp.br and look under Cepagri for the August 2008 report entitled **'Global Warming and the New Geography of Agricultural Production in Brazil'** by Hilton S. Pinto and Eduardo D. Assad.

2.4.4 GTZ and Cafédirect - Adaptation for smallholders to Climate Change is a public-private partnership project between Cafédirect plc (www.cafedirect.co.uk) and the German Technical Cooperation (GTZ - http://www.gtz.de/en) that aims to strengthen coffee and tea smallholders' capacities to adapt to climate change and to enhance their access to respective financing mechanisms. Implementation commenced with pilot producer groups in Peru, Nicaragua, Mexico and Kenya. The overall objective is to disseminate the results and lessons learned from the 4 site-specific adaptation strategies that each pilot implemented throughout 2009 or is still implementing, and to scale up to a much wider footprint with more international partners.

The adaptation strategy of the Peruvian pilot group focuses around an afforestation carbon project that, although located in a higher water catchment area, is providing adaptation effects in the lower coffee producing regions. Duration 2007-2010. Visit http://www.adapcc.org for more.

For details including a complete set of project documents, project fact sheets and a number of very relevant background presentations visit
http://www.adapcc.org/en/downloads.htm
Visit http://www.gtz.de/en/themen/3958.htm for more on GTZ and climate change generally.

[16] Other initiatives, aiming particularly at generating carbon offset credits are listed in section 3.

[17] The CATIE home site (www.catie.ac.cr) offers a considerable amount of relevant information, also in English. The site below lists a total of thirteen climate change related projects, together with individual contact details. http://web.catie.ac.cr/congreso/congreso1_ENG.htm. Alternatively visit the Spanish language coffee home site at http://www.catie.ac.cr/BANCOCONOCIMIENTO/C/CAFE_INTRODUCCION/CAFE_INTRODUCCION.asp?TxtSiglaTema=&Viene=1&NomSeccion=&NomMagazin=&CodIdioma=ESP&CodSeccion=781&CodMagazin=25 and visit this site for climate change subjects, also in Spanish:
http://www.catie.ac.cr/BancoConocimiento/C/cafe_adaptacion_caficultura/cafe_adaptacion_caficultura.asp?CodIdioma=ESP&NombreSubMenu=Adaptación%20de%20la%20caficultura%20al%20cambio%20climático&Sigla=TEMA_Cacao&NomMagazin=Cacao&CodMagazin=25&CodSeccion=781&IntMenu=3&MagSigla=

2.4.5 Climate Change Adaptation and Mitigation in the Kenyan Coffee Sector is a public private partnership between the German Technical Cooperation (GTZ – http://www/gtz.de/en) and Sangana Commodities Ltd (a subsidiary of Ecom Industrial Trading Corporation Ltd – www.ecomtrading.com) that looks at improving the Kenyan coffee sector's capacity to adapt to climate change and consider mitigation options such storing GHG in their production systems. The aim is to develop a standard module that allows coffee producers to adapt production as well as create and use synergies between adaptation and mitigation methods. Further partners are the World Bank's BioCarbon Fund and the 4C Association. Duration 2008-2011.

2.4.6 CIAT – the International Center for Tropical Agriculture is engaged in an ongoing Clean Development Mechanism land reclamation project in Colombia - the Caribbean Savannah Carbon Sink Project. The objective is to pilot the use of carbon sinks (through sylvo-pastoral and reforestation systems) as a tool to arrest the process of land degradation and to develop a project cycle map showing the road to marketable CER's. Whilst not directly linked to coffee, once the feasibility of the approach is proven the project is also expected to serve as a catalyst for future such initiatives elsewhere. The detailed project appraisal report is available at http://go.worldbank.org/9CQ0H62MA0 or visit http://www.ciat.cgiar.org

2.4.7 CIAT: the International Center for Tropical Agriculture also runs the 'CUP - Coffee Under Pressure' project that intends to quantify and evaluate the impact of climate change on coffee production in Central America: Nicaragua, Guatemala and El Salvador. And, to identify site-specific community based adaptation options and strategies that are applicable to and feasible for rural communities. This project started in June 2009. See http://www.ciat.cgiar.org and the comprehensive presentation: http://www.adapcc.org/download/PLaderach_CCimpactsAgriculture.pdf

2.4.8 UNCCD - Using Biochar (charcoal) to replenish soil and carbon pools, restore soil fertility and sequester CO2 is a submission by the UN's Convention to Combat Desertification-UNCCD. Go to www.unccd.int/ and search for Biochar to obtain the full text. For technical information and background go to http://www.carbon-gold.com. who are the developers. A pilot project is under way in cocoa plantations in Belize.

2.4.9 Coffee and Climate Change Program - Building a Sector-wide Initiative: is a Private Public Partnership started by International Coffee Partners (ICP - www.coffee-partners.org), Luigi Lavazza SpA, Gustav Paulig Ltd., Tchibo GmbH and German Technical Assistance (GTZ) that plans to evaluate and interpret the impact of climate change on producers and processors along the green coffee value chain up to export level. The initiative furthermore plans to screen and further develop effective adaptation strategies and mitigation approaches. Once formulated these will be widely disseminated in the form of a toolbox that will also identify suitable financing mechanisms. The results and the implementation thereof will likely be tested in four coffee producing countries in Africa, Asia and Latin America.

2.4.10 Starbucks and Conservation International's Sustainable Coffee and Climate Change Partnership is supporting projects in the Sierra Madre de Chiapas in Mexico, and amongst communities living within the Northern Sumatra Biodiversity Corridor in Indonesia. The aim is to address local climate change challenges through sustainable land-use including forest conservation, and by helping create different mechanisms to enable local communities to participate in the growing international carbon market. Ultimately, Starbucks and CI hope to leverage their global scale to pilot such projects across all coffee-growing regions: Asia-Pacific, Africa and Latin America. Duration 2008 – 2013.

See this website for more:
http://dev2.conservation.org/learn/food_security/Pages/ci_starbucks_partnership.aspx

2.4.11 Genetic breeding initiatives are ongoing worldwide but to mention just two:

The Instituto Agronomico de Campinas in Brazil – IAC (http://www.iac.sp.gov.br/) and others are working on the possibility of transferring some of the characteristics of robusta to arabica, such as resistance to pests, vigour and above all, better resistance to higher temperatures.

The Indonesian Coffee and Cocoa Research Institute - ICCRI (www.iccri.net) and Nestlé's R&D Department in Tours (France), announced that starting 2009 they will work jointly on developing higher yielding robusta plants with improved resistance to drought and disease.

3. The coffee industry and carbon credits

3.1 Origin and limitations

A frequently encountered assumption is that coffee growers can (easily) benefit from what is called the carbon-offset or carbon-credit market. This because supermarket chains, other retailers and consumer organizations are, sometimes publicly so, asking the coffee distribution chain (roasters, importers, others) to move to what is called a *carbon-neutral product footprint.* This is a situation wherein the *carbon emissions* (carbon-dioxide or CO2) that the coffee chain produces *are offset by carbon-reducing activities*. And yes, in principle coffee growing offers potential for this but it must be stressed that agri-based offsets are not widespread as yet. For reasons that will be explained below.

But first…

Different ecosystems each have a distinct potential to trap carbon atoms. A tropical forest will isolate more carbon than a temperate forest, or grasslands or an agricultural ecosystem. In the same way, different agricultural coffee systems have distinct potential to trap carbon atoms: forest coffee, smallholder plots, commercial plantations, coffee with or without shade, with or without intercropping etc.. But, whereas coffee production is often assumed not to contribute to GHG emissions, the fact is that auditing of an entire farming operation will reveal GHG *leakages*, the most obvious of which are the use of tractors, vehicles, electric motors, burning of firewood and the like that contribute to GHG emissions - see also section 3.3 of this paper.

The Kyoto Protocol referred to in section 13.01 of this paper created what is known as the **Clean Development Mechanism or CDM.** This allows developed countries to invest in projects in developing countries to reduce GHG emissions, and to promote sustainable development by structured projects that can result in the selling of Certified Emission Reductions or CER. CDM projects must demonstrate their *additionality*, i.e. they have an additional/added value effect in the GHG scenario. Under the additionality concept, coffee farms would have to prove that they create GHG savings that are additional to anything that might happen anyway. The additionality margin is always confronted against a baseline that is traced comparing the farms with and without the CDM Project.[18]

[18] **Defining mechanisms for isolating GHG from the atmosphere and goals for limited GHG emissions were needed and the global response was materialized in a document called the Kyoto Protocol.** The most publicised source of global warning are fossil fuels (electricity generation, manufacturing, transport etc) but

What does this mean?

- *Established stands* of both coffee and shade trees are not taken into account as they are part of an already existing situation. However, the conservation of existing forest cover and improvement of general agricultural practices, resulting in more eco-friendly coffee stands, are other avenues towards earning carbon credits, provided net GHG gains can be shown**.**

- *New activities* such as the introduction of intercropping with suitable GHG absorbing plants, the planting of additional shade trees and the rehabilitation of degraded lands and hillsides can count. This could include the planting of additional coffee and shade trees but only if it can be proven that the land in question had previously been in a prolonged state of degradation…

- *The calculations* to determine the net result of different activities are complex and the final result may only justify the effort if larger areas are covered. This makes it difficult if not impossible for individual smallholders to participate directly in carbon offsets.

The advantage of the CDM process is that it results in "certified" carbon credits that offer the traceability and credibility as set out in the Kyoto Protocol procedures. These credits can be traded on established, formal markets with transparent pricing procedures.

In practical terms however the CDM approach may not be the best suited for smallholder coffee because of the difficulty to measure the different coffee production processes accurately in terms of GHG impact.

3.2 Carbon credits defined

Carbon credits are a key component of national and international attempts to mitigate the growth in concentrations of greenhouse gases (GHG's). One Carbon Credit is equal to one tonne of carbon equivalents.[19] Carbon trading is an application of an emission trading approach

Greenhouse gas emissions are capped and then markets are used to allocate the emissions among the group of regulated sources. The idea is to allow market mechanisms to drive industrial and commercial processes in the direction of low emissions or 'less carbon intensive' approaches than they would use when there is no cost to emitting carbon dioxide and other GHGs into the atmosphere.

Since GHG mitigation projects generate credits, this approach can be used to finance carbon reduction projects between trading partners and around the world.

There are also companies that sell carbon credits to commercial and individual customers who are interested in lowering their carbon footprint on a voluntary basis.

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deforestation in non-industrialised countries also contributes quite considerably as it reduces the available tree park. Trees are efficient absorbers of CO2 whereas burning them releases carbon dioxide into the atmosphere... Industries and others that produce GHG can calculate their emissions and offset these against certificates of emission reduction or CER. For example by investing in planting new trees or sources of renewable energy, either directly or (mostly) through the purchase of offset or renewable energy certificates generated by others who engage in these activities. The international market for such certificates is developing rapidly and is generally referred to as the emissions offset market. Much background information is available at www.v-c-s.org

[19] In order to have a basis for comparison all Greenhouse Gases are calculated in CO2 equivalents.

These offset traders purchase the credits from an investment fund or a carbon development company that has aggregated the credits from individual projects. The quality of the credits is based in part on the validation process and sophistication of the fund or development company that acted as the sponsor to the carbon project. This is reflected in their price: Non-CDM or *voluntary units* typically have less value than the units obtained through the Clean Development Mechanism.[20]

There are two distinct types of Carbon Credits:

- **Carbon Offset Credits or COC's**: generated by clean forms of energy production, wind, solar, hydro and biofuels.
- **Carbon Reduction Credits or CRC's**: generated by the collection and storage of Carbon from the atmosphere through biosequestration (reforestation, forestation), ocean and soil collection and storage efforts.

Both approaches are recognized as effective ways to reduce the Global Carbon Emissions crisis.

3.3 Product Carbon Footprints or PCFs

Industry in developed countries, including the coffee industry, is increasingly looking for ways to reduce their carbon footprint but, if the footprint cannot be reliably measured, how can it be managed?

Product Carbon Footprint describes the sum of greenhouse gases accumulated during the full life cycle of a product (good or service) in a specified application.

This definition was developed by participants in the PCF Pilot Project Germany (http://www.pcf-projekt.de), an initiative that aims to draw up recommendations for the methodical development and international coordination for implementing a transparent and scientifically substantiated method for measuring Product Carbon Footprints. With the added objective to adapt this within the coffee community to a common or at least a benchmark standard that will facilitate PCF measuring by coffee growers and others.[21]

Example of a PCF analysis in the coffee value chain

A pilot study, entitled *Privat Kaffee Rarity Machare,* has been carried out on Tanzanian coffee. The results, together with other reports, are available at http://www.pcf-projekt.de/main/results/case-studies

The major German roaster Tchibo GmbH - www.tchibo.com - partnered in this study which identifies a number of stages in the coffee chain as contributors to emissions to the air, to the water and to the soil and offers schematic overviews of what takes place where, and what generates what in terms of GHG.

Of interest here is:

[20] Prices are risk-driven: more risk for the seller = higher price whereas more risk for the buyer = lower price. Voluntary market standards try to define quality by setting criteria: the stricter these are the better the quality of the certificate and, therefore, the higher the potential price.

[21] Currently there is a lack of consistency in methods for calculation and reporting of PCFs, meaning that it can be difficult to compare published footprints. See www.carbontrust.co.uk for more.

- The contribution to GHG emissions of the different processes within the producing country, i.e. on-farm cultivation, processing, transport, milling, packaging.
- And within the consuming end of the chain, i.e. overseas transportation, roasting, packaging, distribution, grinding/purchasing, consumption and waste disposal.

The authors conclude that in this particular case study the on-farm processes (production/processing and upstream processes, including the production of agro-chemicals) and the actual consumer phase (shopping, preparation) are the main CO2 emission drivers. They point out however that the production methods on the two farms studied are of a very high standard and more conventional production systems may produce different results. Nevertheless, the study offers detailed insight in the PCF analysis process and should be of considerable interest to the industry at large.

The authors also comment that in many instances it is difficult to trace individual coffees back to their original production site given that so much coffee is mixed at origin and is shipped overseas in bulk. They recommend that the coffee industry should develop harmonized standards for compensation methods within the coffee chain and stress the importance of ensuring both transparency and credibility when it comes to making public statements regarding PCFs.

Some examples of individual initiatives to reduce PCFs

For an example of how one small individual roaster reduced their company's carbon footprint visit www.bewleys.com. This company reduced its contribution to GHG emissions through a number of internal measures and purchased carbon credits to cover the remainder as evidenced by the Carbon Neutral Certificate on their website. Direct link: http://bewleys.com/about-us/our-certifications-awards.

The Nestlé Company currently uses some 800,000 tonnes of coffee grounds produced by 20 soluble plants worldwide as supplemental fuel, instead of sending it to landfills as in the past.
http://www.nestle.com/CSV/CSVinAction/AllCaseStudies/RecyclingCoffeeGrounds.htm.

Nestlé in the US works with a producer of fireplace logs who uses Nestlé's spent coffee grounds to produce and market "coffee firelogs" for use in domestic fireplaces. More information on this product at http://www.pinemountainbrands.com/

The same company's 'Creating Shared Value Report' offers insight in how Nestlé deals with environmental issues generally. Other major roasting companies as the Sara Lee Corporation - www.saralee.com, and Kraft Foods - www.kraftfoods.com offer similar web-based information.

*To note here that the **Carbon Disclosure Project*** - hhtp:// www.cdproject.net - *collects information on the carbon footprint of some 2,500 large companies worldwide, including the world's leading multi-national roasting companies. Participants measure and disclose their greenhouse gas emissions and climate change strategies through CDP, in order that they can set reduction targets and make performance improvements. To access these reports one has to register with the CD project.*

Of course there are many initiatives that deal with PCF reduction in industry generally, not limited to coffee. Slower vessel speeds, more efficient use of transport, using recycled packaging material, cleaner fuels, reduced energy use etc.. but these are not within the scope of this discussion.

3.4 Clean Development Mechanism projects - where to start?

Of course there are different options and avenues to follow to obtain the necessary information but to avoid Guide readers 'drowning' in resources we will highlight only one. This is the World Bank's Carbon Finance Unit website at http://go.worldbank.org/9IGUMTMED0 that offers a huge amount of detailed, practical information.

The Carbon Unit provides information and tools in respect of the development and financing of CDM projects, it offers assistance with both capacity building and project preparation and it lists registered service providers.
Project assistance includes preparation of the carbon documentation necessary to create a 'carbon asset' that will deliver marketable VER's (Verified Emission Reductions) or CER's (Certified Emission Reductions).

Also available are a CDM Methodology Overview, a CDM Methodology Database and CDM Methodology Paper (reports on methodological issues, workshops etc.). These provide easily accessible information that helps to understand the CDM rules of procedures and basic concepts of approved methodologies for CDM projects. However, the information provided in this section does not eliminate the need always to consult the approved methodologies and the guidance provided by the CDM Executive Board, which is recorded on the official CDM website and can be accessed at http://cdm.unfccc.int/. Work is also ongoing on the development of a Validation and Verification Manual.

CDM Projects are also listed at http://carboncatalog.org/projects/

The UNFCC site lists a substantial number of CDM projects in developing countries but only one, the Coopeagri Forestry Project in Costa Rica, is located in a coffee growing area and lists coffee growers amongst the project's beneficiaries.[22] Project documentation: http://wbcarbonfinance.org/Router.cfm?Page=Projport&ProjID=9632

Also of interest to coffee producers is the Forest Carbon Partnership Facility or FCPF at http://www.forestcarbonpartnership.org/fcp. This assists developing countries in their efforts to reduce emissions from deforestation and forest degradation (called REDD) by providing value to standing forests.

CIAT – the International Center for Tropical Agriculture is engaged in an ongoing Clean Development Mechanism land reclamation project in Colombia - the Caribbean Savannah Carbon Sink Project. The objective is to pilot the use of carbon sinks (through sylvo-pastoral and reforestation systems) as a tool to arrest the process of land degradation and to develop a project cycle map showing the road to marketable CER's. Whilst not directly linked to coffee, once the feasibility of the approach is proven the project is also expected to serve as a catalyst for future such initiatives elsewhere. The detailed project appraisal report is available at http://go.worldbank.org/9CQ0H62MA0 or visit http://www.ciat.cgiar.org

[22] As of end 2009. It is generally accepted that for (most?) coffee growers the CDM route is too cumbersome and may be out of reach.

NB: To date the majority of CDM projects have gone to Asia and Latin America, in particular China, India and Brazil. As a result the Carbon Finance Assist facility was created to promote a more widespread flow of CDM projects by offering assistance with the identification and creation of CDM projects. Visit http://go.worldbank.org/T93VFJSRL0.

Other websites offering relevant information on carbon and CDM matters are listed in section 3.7 of this paper.

3.5 The voluntary markets for carbon offsets.

Voluntary markets do not require as much documentation and financial investment as do the mandatory (CDM) markets. However, prices are highly variable because the project developers have the freedom to adopt standards or not, to create new methodologies, and to have or not have third party verifications. As of end 2009 we are not aware of any full-scale application in the coffee sector as yet.

Furthermore, this freedom of negotiation affects the prices of the credits as these are directly related to the quality and credibility of the methodology that was used, and the degree of verification by third part audits or other assurance mechanisms. Critics refer to a lack of regulated methodologies for setting up the credits and the impossibility of tracing back the volume of GHG alleged to have been sequestrated.
Lack of regulations could possibly result in double counting of credits, intentionally or unintentionally, and having to trust that already purchased credits will be accounted for in the future. After all, projects can fail whereas the standards or verification systems used could turn out to be inadequate.

Nevertheless, the voluntary route is more appropriate for small or medium sized initiatives (projects) that may lack the capacity and knowledge to develop fully fledged CDM type coffee carbon credits.
Widening the sphere of activities and extending the target areas might also result in more people or communities being able to participate. Additionally, investing in social or producer organization would facilitate smallholder access to the potential benefits offered by the carbon markets.

Standards leading to verified carbon credits that could potentially be adopted by coffee growers are listed below. For more details and comparisons on how they differ look for the report entitled *'Making Sense of the Voluntary Carbon Market: A Comparison of Carbon Offset Standards'* at http://www.co2offsetresearch.org

- *The Voluntary Carbon Standard* (http://www.v-c-s.org) has a section on Agricultural Land Management (coffee trees, vegetation, soil and waste water).

- *Plan Vivo* (http://www.planvivo.org) whose Scolel Te project in Mexico includes a section dealing with shade trees in coffee plantations.

- *CarbonFix* (http://www.carbonfix.info), whose CarbonFix Standard was developed for climate forestation projects.

- *The Chicago Climate Exchange* (http://www.climatex.com), sets standards (protocols) for a number of offset disciplines, including Forestry Carbon Sequestration.

The Climate, Community and Biodiversity Alliance Standards (http://www.climate-standards.org) includes three kinds of credits: Approved, Silver and Gold depending on the findings of the audit process. However, if verified carbon credits are to be issued then these must be verified by one of the other voluntary standards.

3.6 Voluntary market projects – where to start?[23]

Coffee farms generally and smallholdings especially do not contribute greatly to GHG emissions but this is not to say that growers should not engage in mitigation measures, i.e. reduce their carbon footprint. However, coffee farms in many if not most countries often also offer potential to increase their tree cover, either through the planting of (more) shade trees or by extending the total forest cover on a farm or in a demarcated area.
Provided this is an additional activity, i.e. it would not happen without the incentive of earning carbon credits, such plantings can generate marketable carbon credits through the carbon sequestration process that the additional trees generate.[24]

Environmental services. A particularly interesting discussion, potentially of great importance for the coffee sector, is whether maintaining shaded coffee farms, i.e. conserve existing shade trees and their carbon stocks, should count towards earning carbon credits. After all, coffee farms under shade conserve more carbon than coffee grown in direct sunlight but at the cost of lower yields. There is therefore potentially an opportunity cost to adopting such conservation measures over sun grown coffee.
Although in some cases this can be compensated for if linked to premium prices like for organic, the lack of incentives for farmers to provide environmental services in this way is evident. Furthermore, should farmers not be rewarded for conserving existing shade grown coffee as is proposed for forests under REDD (Reduce Emissions from Deforestation and Forest Degradation)?

The current requirement that farmers growing shade coffee plant additional trees before they may qualify for any carbon credits in effect means that the environmental services they already provide are being ignored.

As of end 2009 we are not yet aware of any coffee projects that already generate marketable carbon credits, but there are a number of ongoing projects that are leading the way. For example:

- **CATIE**, the **Centro Agronómico Tropical de Investigación y Enseñanza** in Costa Rica – www.catie.ac.cr in 2004-2006 developed a technical manual on how to estimate carbon - *Carbon Capture and Development of Environmental Markets for Indigenous Cocoa Farms and Other Agroforestry Systems***.** For more information contact Eduardo Somarriba at esomarri@catie.ac.cr.

- **CATIE** is also working with the Costa Rican Fondo Nacional de Financiamiento Forestal (FONAFIFO) on a *Payment for Environmental Services Scheme* to establish criteria for environmental payments to shaded coffee farms. For more information on this contact Elias de Melo at eliasdem@catie.ac.cr. or Jeremy Haggar at jhaggar@catie.ac.cr

[23] It is important to note that credible reporting and verification of carbon credits requires that one 'carbon credit unit' is always the same, regardless of where or how it was produced. To be credible a project therefore needs to be based on accepted standards and procedures, including transparent accreditation, validation and verification. It needs to be properly structured and adequate records must be kept.
For more on this visit http://www.adapcc.org/download/LPedroni-Carbon-Credits.pdf

[24] An interesting aspect of forestry projects is that plantings etc. can be monitored through satellite imagery, e.g. through GoogleMaps.

- **The Rainforest Alliance -** www.rainforest-alliance.org, with funding from the International Finance Corporation, completed a two year project (2008/2009) entitled '*Creating and testing a credible carbon monitoring methodology for Coffee Farms'* with the objective to combat climate change while promoting reforestation; enable farmers to sell the carbon these incremental trees take out of the atmosphere; avoid the high transaction costs usually associated with carbon offset projects; and develop methodology that can be used in other regions and sectors.[25] A project outline is available at http://www.rainforest-alliance.org/climate.cfm?id=carbon_coffee

- **The same Rainforest Alliance project** produced a manual entitled *'Guidance on Coffee Carbon Development using the simplified Agroforestry Methodology'*. This comprehensive Guide deals with the entire project sequence, from identification to marketing carbon credits In other words, a complete review of carbon project development. Download the complete Guide (in English or in Spanish) from http://www.rainforest-alliance.org/climate/documents/coffee_carbon_guidance.pdf

- **Adaptation for smallholders to Climate Change** is a public-private partnership project between Cafédirect plc (www.cafedirect.co.uk) and the German Technical Cooperation (GTZ - http://www.gtz.de/en) that aims to strengthen coffee and tea smallholders' capacities to adapt to climate change and enhance their access to respective financing mechanisms. Implementation commenced in 2009 with pilot producer groups in Peru, Nicaragua, Mexico and Kenya. The overall objective is to disseminate the results and lessons learned internationally and to scale up to a much wider footprint with more international partners. The adaptation strategy of the Peruvian pilot group focuses around an afforestation carbon project that, although located in a higher water catchment area, is providing adaptation effects in the lower coffee producing regions.

  For details including a complete set of project documents, project fact sheets and relevant background presentations visit http://www.adapcc.org/en/downloads.htm

- **The World Bank's BioCarbon Fund.** Precisely because of the difficulties many developing countries face to participate in the Clean Development Mechanism - CDM, the BioCarbon Fund provides carbon finance for projects that sequester or conserve GHG in forests, agro - and other ecosystems. Visit http://go.worldbank.org/IVUUKC9210. Currently the fund supports approx. 25 Reforestation Projects, three REDD Projects (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries) in Colombia, Honduras and Madagascar - details are provided on the website - and is embarking on Soil Carbon Pilot projects. The BioCarbon fund is also working with Kenya's Green Belt Movement (GBM) on the reforestation of degraded land. This pilot project will pay local communities and provide them with the technology and knowledge to reforest these lands and manage the new forest. Carbon payments will allow GBM to expand this technique and its benefits to additional areas.[26]

[25] See also The Global Forest and Trade Network - http://gftn.panda.org. GFTN is a World Wildlife Organization initiative and offers information, contacts and tools in respect of sustainable forest management and forest certification.

[26] Registering with the BioCarbon Fund website gives access to a number of documents, including reports on the state of the carbon markets (both CDM and Voluntary).

All the foregoing suggests that more detailed information and actual examples on how coffee growers could progress into the voluntary carbon market system will become available during 2010 or, latest, 2011.

3.7 Selected websites offering information on GHG emission issues, standards, offsets, product carbon footprints, project preparation and financing

http://www.ipcc.ch -The Intergovernmental Panel on Climate Change – IPCC is the leading scientific body for the assessment of climate change. It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. Very informative technical insights in the origin, potential effects and mitigation of GHG emissions are available at
http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf

http://cdm.unfccc.int/index.html - The Clean Development Mechanism allows emission-reduction (or emission removal) projects in developing countries to earn Certified Emission Reduction (CER) credits, each equivalent to one tonne of CO2. These CERs can be traded and sold, and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol. Overview, regulations, methodologies, project activities.

http://www.usaid.gov/our_work/environment/climate/country_nar/index.html - The United States Agency for International Development - USAID supports Climate Change initiatives in a number of countries - visit this website for an overview.

http://www.pcf-projekt.de - The Product Carbon Footprint Pilot Project Germany aims at the methodical development and international coordination for implementing transparent and scientifically substantiated methods for measuring Product Carbon Footprints. Site offers explanations of how PCFs are measured and a number of downloadable studies, including one on coffee from Tanzania. Provides links to websites dealing with product labelling.

http://www.v-c-s.org - Voluntary Carbon Standard Association - VCS aims to standardize and provide transparency and credibility to the voluntary offset market, thereby enhancing consumer and government confidence in voluntary offsets, by creating a trusted and tradable voluntary offset credit: the Voluntary Carbon Unit. (VCU). Provides much information on standards for the reduction of GHG, project regulations and certification, and the marketing of Certificates of Emission Reduction or CER.

http://www.climatestandards.org - The Climate, Community and Biodiversity Alliance – CCB is a private sector/civil society partnership that aims at setting standards to be used for the identification of projects that simultaneously address climate change, support local communities and conserve biodiversity. Current standards can be downloaded from this website.

http://www.co2offsetresearch.org - The Carbon Offset Research and Education Initiative - CORE is a project of the Stockholm Environment Institute and provides an analysis and synthesis of the most influential offset programmes and activities. It reflects on lessons learned, and aims to inform consumers as well as participants and designers of current and future offset programmes.

http://www.carbontrust.co.uk - The Carbon Trust is a United Kingdom Government initiative to accelerate the move towards a low carbon economy. It offers advice on reducing carbon footprints and helps develop low carbon methodologies and products. In particular look for the report entitled 'The Carbon Trust three stage approach to developing a robust offsetting strategy'.

http://www.cdmgoldstandard.org - The Gold Standard Foundation is a civil society initiative that operates a certification service for premium carbon credits. Apart from the Gold Standard itself the site also lists accredited service providers in different fields, including project development financing.

http://www.carbonneutral.com - The Carbon Neutral Company - a private sector carbon offset and management business. Site offers interesting perspectives on modern day carbon management issues and systems.

http://www.carbonfootprint.com - Carbon Footprint Ltd is a carbon management and offset consultancy. Site offers a range of interesting insights and includes calculator and management tools.

http://www.ieta.org - The International Emissions Trading Association aims to develop a functional international framework for trading in GHG emission reductions. Site offers a number of publications and explanations.

http://www.chicagoclimatex.com/ and http://www.ecx.eu are formal exchanges for the pricing and trading of carbon offsets. Offer information on how and by who this can be done.

http://www.ecosystemmarketplace.com/ The Ecosystem Marketplace, a private initiative of Forest Trends, is a leading source of news, data, and analytics on markets, prices and payments for ecosystem services (such as water quality, carbon sequestration, and biodiversity). The site offers wide-ranging information on environmental markets, ecosystem markets and carbon markets, including a comprehensive glossary. Also offers a number of tools.

Finally, a very useful listing of a large number of annotated and thematically sorted links to websites focusing on climate protection and development is available from the German Technical Cooperation (GTZ) website - http://www.gtz.de/en/index.htm or, directly
http://www.gtz.de/en/themen/umwelt-infrastruktur/umweltpolitik/4859.htm.

Climate Change and the Coffee Industry

Q&A 235: Does (organic) coffee production affect climate change?

Background:	How can coffee production affect climate change? As known we in Ethiopia are the original growers of organic arabica coffee and as such we did not contribute to climate change, especially in coffee.
Asked by:	Producer/Trade Association - Ethiopia
Answer:	**To some degree coffee production, including organic, contributes to climate change. The extent will depend on how it is grown, processed, exported and consumed.** First, for coffee to be certified organic it must be grown as part of an intensive, holistic agricultural production management system that includes the composting of organic materials, mulching, shade regulation and biological pest control. Such a system is based on the principle that a value corresponding to that harvested should be returned to the soil. It excludes the use of agro-chemicals (a major contributor to climate change in coffee production). Of course, in this respect organic production contributes (much) less to climate change than does the industrial type growing of commodity or mainstream coffee. Nevertheless, there are other activities, also in the organic coffee chain, that contribute to the emission of Greenhouse Gases (GHG) or Carbon Dioxide (CO2). Within the producing country for example: using tractors, processing equipment, transport vehicles and shipping abroad. And at the consumption end: roasting, packaging, distribution, grinding/brewing, consumption and waste disposal. All these contribute in different ways to GHG emissions and so the coffee industry as a whole should not only focus on coping with climate change (helping producers to adapt), but also on mitigation (reduce its own contribution to GHG emissions). * **Coffee growing, especially that by smallholders, is of course not a great contributor to GHG emissions.** In fact the industry should be able to earn marketable Carbon Reduction Credits (CRCs) through the biosequestration of carbon, for example through afforestation and reforestation since trees capture CO2. Such carbon or GHG saving activities are possible in many coffee-growing areas but, they will only qualify for CRCs if it can be proven that they are additional to anything that might happen anyway. This concept of additionality makes it difficult for coffee growers, especially smallholders, to benefit from the growing carbon-offset or carbon-credit market. **But, requiring coffee farmers to plant additional trees (at a cost!) before they may qualify for any carbon credits seems not only to ignore the environmental services they already perform, but also disregards the fact that for the vast majority such additional investments are hardly feasible in today's coffee economy.** This raises the question why, as is the case for conserving existing forests, maintaining shaded coffee farms, i.e. conserve existing shade trees and their carbon capturing potential, should not count towards earning carbon credits. After all, it can be argued that coffee farms under shade capture and conserve more carbon but at the cost of lower yields and, therefore, lower farmer incomes when compared with coffee grown in direct sunlight.**

	The foregoing is but a very brief resume of the complexities coffee growers face when aspiring to develop carbon projects, also for organic coffee. Nevertheless more tools and credible monitoring methodologies are now coming to the fore, including a number of ongoing pilot projects that should facilitate extending carbon projects to the majority of coffee producing countries. Provided that the necessary capacity building and legislative support in those countries is forthcoming it may be assumed that progress will accelerate from 2010 onwards. **For more information and resources on Climate change and the coffee industry please read Chapter 13 of the Coffee Guide. Posted early January 2010 this provides not only an overview of how climate change may affect the industry, but also lists ongoing initiatives and information sources that may assist coffee growers.** * **The total contribution to GHG emissions, from tree to cup, is called the Product Carbon Footprint or PCF.** This describes the sum of greenhouse gases accumulated during the full life cycle of a product (good or service) in a specified application. For an example of how to calculate a PCF for coffee, in this case Tanzania, visit http://www.pcf-project.de/main/results/case-studies. ** **CATIE, the Centro Agronómico Tropical de Investigación y Enseñanza in Costa Rica** - www.catie.ac.cr, is working with the Costa Rican Fondo Nacional de Financiamiento Forestal (FONAFIFO) on a *Payment for Environmental Services Scheme* to establish criteria for environmental payments to shaded coffee farms. Posted 08 January 2010.
Related chapter(s):	13 - Climate change and the coffee industry 03 - Niche markets, environment and social aspects 01 - World coffee trade
Related Q & A:	Q&A 192

Q&A 235 is an example of an Answer posted in the Q&A Archive at www.thecoffeeguide.org

www.thecoffeeguide.org

The Coffee Guide website, www.thecoffeeguide.org is based on one of the International Trade Centre's most demanded publications over time: ***Coffee – An exporter's guide***.

The website contains more than 500 continuously updated text boxes in 14 Chapters:

01 World coffee trade
02 The markets for coffee
03 Niche markets, environment and social aspects
04 Contracts
05 Logistics and insurance
06 E-commerce and supply chain management
07 Arbitration
08 Futures markets
09 Hedging and other operations
10 Risk and the relation to trade credit
11 Coffee quality
12 Quality control issues
13 Climate change and the coffee industry
14 Training and the coffee industry

The website has an inter-active Question & Answers service, which has posted over 200 detailed answers to questions primarily from coffee producing countries.

The entire website is available in English (www.thecoffeeguide.org), French (www.leguideducafe.org) and Spanish (www.laguiadelcafe.org)

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