Coffee Barometer 2014

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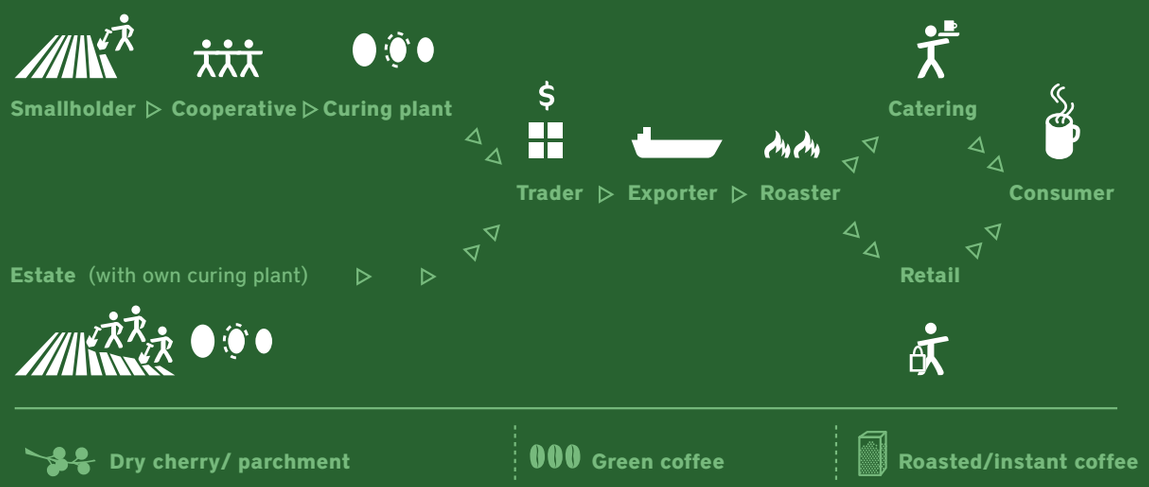
Figure 1 on the cover: **Top ten coffee production countries in 2013 and volume per hectare**

Figure 2 **Coffee supply chain**



1 Introduction

Coffee, cultivated in more than 80 countries in Central and South America, Africa and Asia, ranks among the world's most valuable agricultural commodities. Coffee cultivation provides livelihoods for 20-25 million farming families [4]; and engages over 100 million people in its producing and processing. Smallholder coffee farmers, together with their families and rural workers produce over 70 per cent of this labour intensive crop. Women comprise half the productive workforce and play a crucial role that often goes unnoticed. However, to retain the involvement of rural youth is a challenge as they often aspire to a different future and seek employment outside the coffee sector.

Historically, declining terms of trade and price volatility have plagued coffee production. This makes poverty reduction, which is essential to ensure the sustainability of the sector, both an important and difficult challenge. Figure 3 presents an overview of the main social, economic and environmental challenges for smallholders and plantation labourers. These problems at the production level are compounded by the effects of changing climatic conditions. The International Coffee Organization [9] acknowledges that the world coffee sector is facing major challenges from climate change. Prolonged droughts, raised temperatures or heavy rains make the harvest seasons unpredictable.

The situation is alarming. Erratic temperature and rainfall can affect coffee plants directly, by bringing about sub-optimal growing conditions, and indirectly, by providing favourable conditions for pests and diseases such as coffee rust and the berry borer [1]. These changes affect yields and quality, and increase production costs leading to drastic reductions of producer income. Due to the interconnected nature of livelihoods climate change impacts, it aggravates existing problems in food security, water supplies and agricultural production. Especially vulnerable are poor households with small coffee landholdings, who generally depend on this crop and have few other sources of income. For many smallholder coffee farmers, climate change impacts are already outpacing their ability to cope [11,16].

Coffee is regarded as a lead indicator for sustainable commodity crops; it often sets the pace and others follow. The world market share of sustainable coffee that adheres to social, environmental and economic standards has grown rapidly in recent years. Coffee companies, traders and roasters are making significant investments in coffee farming through partnerships with public and private institutions in many countries. These developments can make coffee farmers less vulnerable to the market's boom and bust cycle. Nevertheless, major players in the sector have a collective responsibility and leadership role in adapting to and, in some cases, mitigating further climate change. Clearly, the effects and consequences of climate change must be tackled sector wide which no doubt poses a severe challenge to our current concepts of sustainable coffee production [2]. The question that arises then is: can our standard systems provide comprehensive solutions?

Coffee Barometer 2014 explores the global and local dimensions of the coffee production system, by observing how the social,

economic and ecological aspects are intertwined. On the one hand we have noticed that coffee producers are experiencing different climate change related impacts, on the other hand there are only few and fragmented adaptation and mitigation measures being implemented in the coffee sector to cope with this new reality. We will examine recent developments in the coffee market to trace the main trends. An attempt will be made to identify the consequences of climate change in different coffee producing countries and present an overview of case studies advocating adaptation strategies. In view of the challenges faced by the coffee sector, market development for sustainable coffee and its procurement by the world's top ten coffee roasters will be discussed. In conclusion, diverse aspects of a sustainable coffee sector will be linked to an agenda that places coffee farmers at the centre of strategies for change.

Figure 3: **Overview of the social, economic and environmental issues at the producer level**

	Smallholder level	Estate level
Social issues	Food insecurity Malnutrition Poor access to education and healthcare Gender inequality Ageing farmer communities Migration & young people leaving coffee farming	Labour abuse Limited access to clean water Poor living conditions Discrimination Gender inequality Sexual harassment
Economical issues	Green bean prize volatility Low productivity Lack of farm credit Lack of market information Lack of direct market access Rising cost of living Ageing coffee trees Land tenure uncertainty Limited access to insurance instruments Poor services through farmer organisations No living income Taxation	Green bean prize volatility High casualization of labour Un- and under-employment Low formal minimum wages No living wage Lack of income diversification (especially for temporary workers) Taxation Partial freedom of association Limited collective bargaining
Environmental	Conversion of primary forest habitat – deforestation - loss of biodiversity and habitat destruction – soil erosion and degradation – agrochemical use and run-off – degradation of water quality and supply – limited waste water management – eutrophication - coffee pests and tree diseases – mono-culture sun cropping	

2 Ecological, economic and social aspects of coffee production

In crop year 2012/13, coffee farmers produced a record crop of 145.1 million 60-kg bags [10] (see Figure 4). Arabica and Robusta are the two main types of coffee. Arabica, mainly grown at high altitudes in Latin America (including Brazil) and Northeast Africa, accounts for 60 percent of world production. A high proportion of this high quality coffee is grown by small-scale farmers who produce in high altitude growing areas. Robusta has a much stronger taste than Arabica, and is grown in humid areas at low altitudes in Asia, Western and Central Africa, and Brazil. It is more resistant to diseases and produces a higher yield per tree. Production of Robusta, which is well suited for instant coffee, has over the last decade, increased significantly up to 40 percent of world production [3].

Total land dedicated to coffee production covers a relatively small area of agricultural land, around 10,5 million hectares [3,20]. Four countries dominate global coffee production: Brazil (35 percent), Vietnam (15 percent), Indonesia (9 percent) and Colombia (7 percent), (see Figure 1) [10]. The production per hectare differs greatly from respectively 24 bags per hectare on average in Brazil, to 40 bags in Vietnam and only 7 bags in Indonesia [17]. Coffee cultivation is expanding in a big way in Vietnam and Indonesia, with mono-cropping and sun-grown coffee as the norm [1,3], and to a lesser extent in Ethiopia, Peru and Honduras [3]. In China, multinationals such as Nestlé and Starbucks are assisting farmers, in cooperation with the government in Yunnan Province, to undertake a large-scale shift from tea to coffee production [15]. Given that many coffee growing regions are home to some of the most delicate ecosystems on earth, expanding coffee cultivation tends to replace habitats of particularly high biodiversity value. The potential of serious damage to critical ecosystem services is disturbingly high, because of deforestation to expand land under coffee cultivation. Furthermore, the intensification of coffee cultivation per hectare will increasingly take place in more marginal production areas with unstable production conditions, including lower soil quality, erosion and more limited access to water. Deforestation and erosion are examples of environmental impacts associated with cultivating coffee (see Figure 3).
In other countries, there are signs of coffee plantations being abandoned, especially in Central America, which has been hit hard by roya, the coffee rust disease. In recent years, roya affected nearly 600,000 ha (55 percent of the total area). This will reduce employment by 30 to 40 per cent during the 2013/2014 harvest. At least 1,4 million people in Guatemala, El Salvador, Honduras and Nicaragua depend on the coffee sector [10]. Many of the smaller producing countries are heavily dependent on their coffee exports. For example, coffee accounts for more than half the total export income in Burundi, Rwanda, and Ethiopia and more than 20 per cent in Guatemala, Honduras, and Nicaragua [10].

The volatile nature of green coffee prices is well known. The causal factors, largely systemic, include new plantings having a lengthy unproductive period as well as changing production conditions; speculative trading is also an element. Around 2002, producer prices plummeted to an all-time low. Green bean coffee prices were often below the cost of production.

This unleashed a series of adverse consequences among rural workers and small-scale farmers, including hunger, break up of families and communities, and migration to cities [18]. Despite significant increases in the international price of green coffee (see Figure 4: Price spike in season 2010/11), the dynamics of the coffee market have not shifted in a ways that guarantees long-term stability for those at the bottom of the supply chain. The decline in 2012/13 coffee prices is apparently due to an oversupply of green beans to the market reaching levels that harm growers. The average of the ICO composite indicator price fell to 119,51 US cents/lb in 2012/13 compared to 156,34 US cents/lb in 2011/12 and 210,39 US cents/lb. in 2010/11 [10] (see Figure 4).

In all coffee producing countries small-scale farmers, men and women, face particular challenges in building their livelihoods from agriculture and in overcoming poverty.

Generally, these coffee growers are not well organized, as a consequence they lack market information and bargaining power. Low and volatile prices for their green beans and increasing production costs, due to rising prices of key inputs, such as fertilizers, transportation and labour, discourage entrepreneurial activity and necessary long-term investments in their farms. Since, coffee producers receive only a small share of the final market value, this poor deal may limit their incentives to farm sustainably and adopt good agricultural practices. [6,8]

Over 80 percent of the coffee produced in the world is traded internationally. Its export value amounts to US$ 33.4 billion and retail sales are estimated to fetch over US$ 100 billion [20]. Coffee's popularity is steadily increasing and in 2012 global consumption totaled 142 million bags [10]. Consumption of specialty high quality coffees has expanded. The demand for low-quality coffee beans has also increased reflecting the popularity of instant and flavored coffees. Coffee consumption is highest in Brazil, USA and Europe. Rising consumer income and increasing standards of living, especially of the growing middle class in Asia, have given coffee a boost. More and more consumers in Asia are drinking coffee; projected growth in India and Indonesia is high and expectations from China are even higher [10]. Instead of the coffee producers, buyers, processors, traders, roasters and retailers capture much of the value in the coffee supply chain.

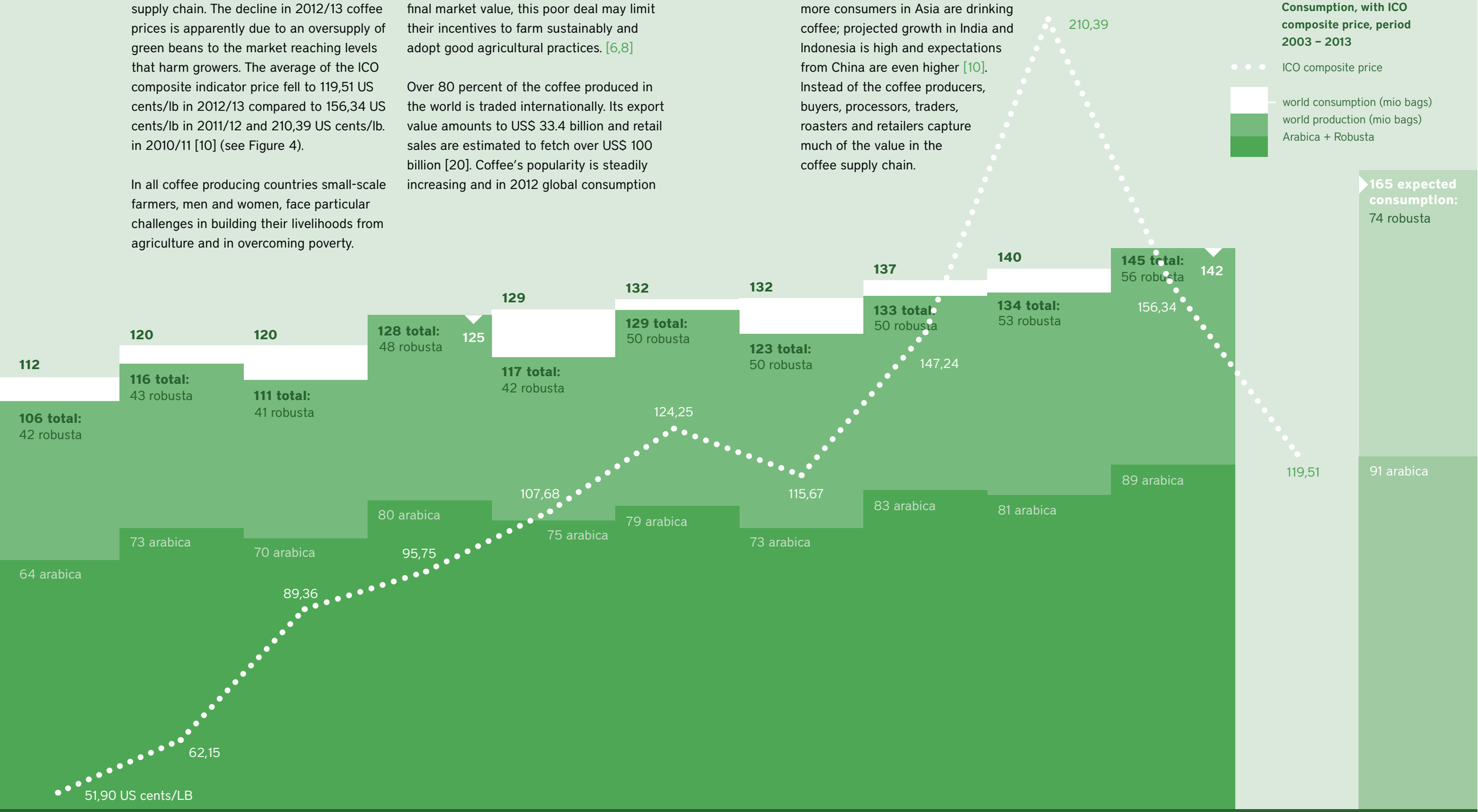


Figure 4: **Arabica and Robusta Production and Consumption, with ICO composite price, period 2003 – 2013**

3 Climate change and coffee

There is growing evidence that coffee cultivation is under threat in some regions that are most vulnerable to climate change. Areas currently suitable for coffee will decrease substantially by, as soon as, 2020, with the potential to disrupt current production and trade practices significantly [1,2,13].

The ideal temperature range for growing coffee is 15-24°C for Arabica coffee and 24-30°C for Robusta. Although Robusta can flourish in hotter and drier conditions it cannot tolerate temperatures much below 15°C, as Arabica can for short periods. Whereas, Robusta coffee can be grown from sea level to about 800 meters, Arabica flourishes at higher altitudes and is often grown in hilly areas. Coffee needs an annual rainfall of 1500-3000 mm. The pattern of rainy and dry periods is important for growth, budding and flowering. A combination of spells of high temperature, dry weather and heavy rain has stimulated outbreaks of roya, the coffee rust disease [10].

We present below overviews of eight case studies with the evidence for observed impacts and forecasts of potential effects of climate change on coffee production in Central and South America, Africa and Asia. The evidence base includes project reports, peer-reviewed journal articles and grey literature, and meet the following criteria:

1. Open access of the full text online
2. Focus on the coffee sector
3. Focus on the production level and/or value chain impacts
4. Geographic diversity.

It is beyond the scope of this publication to discuss all in detail, but the examples communicate a number of issues on which there is general agreement, [see also 1,12,13,14,21]:

› The only certainties regarding the impact of climate change on coffee are increasing uncertainty and variability, and an increase in frequency and severity of extreme events (storms, hurricanes, droughts, etc.).
› The diversity of ways and environments in which coffee is grown means that the effects of climate change will be very diverse, impacts at smaller scales (intra-regional and within countries) may be severe but hard to predict.
› Climate change will affect the global coffee trade patterns, prices and volumes, with wider macroeconomic consequences. Some African countries are particularly vulnerable to additional impacts of climate change, due to their unfavourable positioning in international trade.
› Understanding the implications of these changes is essential for smallholder farmers to develop and adopt adaptation strategies. Successful adaptation in the coffee sector will require collaborative networks, sharing knowledge and collective investments.
› Production decisions should be based on long-term scenarios of change, because coffee is a perennial crop requiring high levels of initial capital investments, with a 10-15 year time horizon.

Haiti

Prediction of the impact of climate change on coffee and mango growing areas in Haiti

Country: Haiti **Year:** 2013 **Authors:** Eitzinger A; Läderach P; Carmona S; Navarro C; Collet L.
Organization: Centro Internacional de Agricultura Tropical (CIAT)

The altitude of coffee plantations in Haiti ranges from 400 meters in the North to 1,300 meters in the South. Changes in temperature and rainfall patterns will generally decrease the areas suitable for coffee and reduce the extent that currently possesses high suitability. Models predict that coffee will lose suitability in lower altitudes and will gain suitability in higher areas by 2050. Changing climatic conditions in Haiti is likely to lower coffee quality and yields, especially in farms at the lower end of the altitude range. For those coffee farms whose suitability will drop, but not drastically, proactive adaptation is crucial. Coffee agroforestry systems are not only an important cash crop for smallholders, they also provide ecosystem services. A decrease in coffee suitability will threaten the environmental services coffee systems provide, such as soil cover, carbon sequestration, biodiversity and water storage. Therefore a key adaptation strategy needs to focus on maintaining the environmental services with a different agroforestry system. In this context cocoa is a promising option.

Retrieved from: http://dapa.ciat.cgiar.org/wp-content/uploads/2014/03/CC_impact_coffee-mango_Haiti_CRS-CIAT_final.pdf

Uganda

The impact of climate change on coffee in Uganda. Lessons from a case study in the Rwenzori Mountains

Country: Uganda **Year:** 2013 **Author:** Jassogne L; Läderach P; Van Asten P.
Organization: Oxfam Research Paper

In Uganda, climate change mapping shows that areas suitable for growing Arabica coffee will reduce drastically in the future. Future production losses are estimated to reach tens of millions of US$ annually. Adaptation strategies will be necessary if coffee is still to be grown in the areas where suitability has declined. The lower altitude areas (<1300 m) appear completely unsuitable in the future under the current agricultural practices. Farmers observe that droughts are becoming longer, and even during the rainy season rainfall is more and more erratic. This affects the flowering stage and consequently the coffee yield. Certain pests and diseases (e.g. leaf miners, coffee berry borers, mealy bugs, and leaf rust) seem to be increasing. An adaptation strategy locally used by farmers is to plant shade trees, e.g. banana trees, in the coffee systems. Shade can reduce temperatures in the coffee canopy by up to 2°C and help to adapt the systems to increasing temperatures. These trees also provide short-term benefits to farmers in the form of additional food and income, an important prerequisite for adoption by smallholder farmers. To adapt successfully, the downside of adding shade, e.g. lower productivity, has to be managed with good agronomic practices.

Retrieved from: http://policy-practice.oxfam.org.uk/publications/the-impact-of-climate-change-on-coffee-in-uganda-lessons-from-a-case-study-in-t-277813

South Sudan, Ethiopia

The Impact of Climate Change on Indigenous Arabica Coffee (Coffea arabica): Predicting Future Trends and Identifying Priorities

Country: South Sudan, Ethiopia **Year:** 2012 **Author:** Davis AP; Gole TW; Baena S; Moat J.
Organization: Royal Botanic Gardens KEW

Precise modelling of the influence of climate change on Arabica coffee is limited; data are not available for indigenous populations of this species. In this study we model the present and future predicted distribution of indigenous Arabica, and identify priorities in order to facilitate appropriate decision making for conservation, monitoring and future research. Using distribution data we perform bioclimatic modelling and examine future distribution with the HadCM3 climate model for three emission scenarios (A1B, A2A, B2A) over three time intervals (2020, 2050, 2080). The models show a profoundly negative influence on indigenous Arabica. Based on known occurrences and ecological tolerances of Arabica, bioclimatic unsuitability would place populations in peril, leading to severe stress and a high risk of extinction. This study establishes a fundamental baseline for assessing the consequences of climate change on wild populations of Arabica coffee. Arabica coffee is confirmed as a climate sensitive species, supporting data and inference that existing plantations will be negatively impacted by climate change.

Retrieved from: http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0047981

Brazil, Guatemala, Tanzania, Vietnam

Coffee and Climate Change: Impacts and options for adaption in Brazil, Guatemala, Tanzania and Vietnam

Countries: Brazil, Guatemala, Tanzania, Vietnam **Year:** 2012 **Authors:** Haggar J; Schepp K. **Organization:** NRI

Stakeholders in the coffee value chains, in all four countries, already perceive changes in coffee production that can be linked with changing climate conditions, although only two of the countries can count on specific climate predictions. In Guatemala and Brazil, where scientific institutions provide suitability maps, large changes in the distribution of the coffee are expected over the next forty years with a smaller net loss in the total area suitable for coffee production. These predictions serve very well to start the development of adequate adaptation strategies. In Vietnam, climate impact scenarios are accessible for agriculture, but there are no estimates of impacts on Robusta cultivation, while Vietnam is the world's largest Robusta producer. Nevertheless, the institutional framework in Vietnam appears to be very supportive of climate change initiatives and representatives at governmental and academic institutions are highly motivated to cooperate. In Tanzania climate change data based on international research are generally available, but coffee impact scenarios only exist for the neighbouring countries of Kenya and Uganda. Also the institutional framework is rather weak.
Without question, all four pilot countries are still suffering from climate change impacts and are expected to experience more or less severe changes in the suitability of their current coffee cultivation areas. Surprisingly there are few practical adaptation and mitigation measures being implemented to cope with climate change. The only coffee specific adaptation actions are in Guatemala and Central America, and some agricultural initiatives in Tanzania.

Retrieved from: http://www.nri.org/images/documents/publications/climate-change/D5930-11_NRI_Coffee_Climate_Change_WEB.pdf

Rwanda

Planning and costing adaptation of perennial crop systems to climate change: Coffee and banana in Rwanda

Country: Rwanda **Year:** 2011 **Authors:** Chrysostome Ngabitsinze J; Mukashema A; Ikirezi M; Niyitanga F.
Organization: NUR – IIED – SEI

This study mainly focuses on coffee and banana farming systems to analyse climate change related shocks and policy maker perspectives. Changing weather patterns have an adverse impact on Rwanda's agricultural production and the country's GDP. The following stumbling blocks were identified: Lack of research and reliable climate data; Limited knowledge about mitigation and adaptation strategies; Poor farming, storage and processing practices; Limited access to technologies; Inadequate financial mechanisms.
The adaptation options were then formulated accordingly, including the following efficiency-enhancing agricultural interventions: Adaptation of crop calendars to new climate patterns (more effective distribution of inputs such as fertilizers and pesticides); Investments in farming equipment; Improvement of extension services and research; Restructuring of the institutional frameworks and development plans.
However, primary requirements for agricultural adaptation to climate change include: integrated water resources management (IWRM); setting up information systems for early warning systems and rapid intervention mechanisms; and research on climate-resilient varieties. In addition, developing alternative energy sources (e.g., substituting firewood) and the promotion of non-agricultural income-generating activities should be part of any climate change adaptation strategy

Retrieved from: http://pubs.iied.org/G03174.html

Costa Rica

Intensification of coffee systems can increase the effectiveness of REDD mechanisms

Country: Costa Rica **Year:** 2013 **Authors:** Noponen, M., Haggar, J., Edwards-Jones G., Healey J.
Organization: School of Environment, Natural Resources and Geography, Bangor University,

In agricultural production systems with shade trees, such as coffee, the increase in greenhouse gas (GHG) emissions from production intensification can be compensated for, or even outweighed, by the increase in carbon sequestration into above-ground and below-ground tree biomass. Data from a long-term coffee agro-forestry experiment in Costa Rica is used to evaluate the trade-offs between intensification, profitability and net greenhouse gas emissions through two scenarios. First, by assessing the GHG emissions associated with conversion from shaded to more profitable full-sun (un-shaded) systems, we calculate the break-even carbon price which would need to be paid to offset the opportunity cost not converting. Second, as an alternative to intensification, the production area can be extended onto currently forested land. We estimate this land-use change required to compensate for the shortfall in profitability from retaining lower intensity coffee production systems. It is concluded that instead, by intensifying production, mechanisms similar to REDD that are based on reducing emissions through avoided land-use change could play a major role in increasing the climate change mitigation success of agro-forestry systems at the same time as aiding REDD through reducing pressure for further forest conversion to agriculture.

Retrieved from: http://www.sciencedirect.com/science/article/pii/S0308521X13000395

Honduras

Analysis of climate change impacts on coffee, cocoa and basic grains value chains in Northern Honduras

Country: Honduras **Year:** 2013 **Author:** n.a. **Organization:** FIC & IEH

This study applies an innovative methodology designed to analyse climate change impacts and make recommendations to strengthen the resilience of project beneficiaries in the coffee, cocoa, maize and bean value chains. The methodology applies a range of minimum requirements for the reliable generation of climate change scenarios through the use of the most advanced models and historical series of daily data. It quantifies uncertainties, verifies and validates the methods and applies regionalization to downscale the projected changes to a local scale. By mapping the value chains and consulting experts, this methodology identifies the critical elements vulnerable to climate change, formulates and verifies indicators to predict how future climate will affect the value chains and analyses its impact, proposing adaptation measures.
The expected impacts for coffee are negative due to the increases in temperature that will provoke changes in the crop cycle, with higher vulnerability to some diseases and more complicated (post-) harvest tasks. Recommendations include improving the existing varieties and crop management, supporting investment in infrastructure like irrigation systems or drying facilities, encouraging more efficient associations, and doing research on the relationships between crop and climate. In general terms, more investment in meteorological stations is suggested to collect meteorological data

Retrieved from: http://www.eldis.org/vfile/upload/1/document/1302/FIC_IEH_Honduras_final_report_2013.pdf

Brazil

Potential Economic Impacts of Global Warming on Two Brazilian Commodities, According to IPCC Prognostics

Country: Brazil **Year:** 2008 **Authors:** Zullo Jr J; Silveira Pinto H; Delgado Assad E; De Medeiros Evangelista S.R. **Organization:** UNICAMP – CEPAGRI - EMBRAPA

Global warming as predicted by IPCC will cause a significant decrease in the production of commodities in Brazil in addition to moving crops to different regions. It appears that the extreme scenario of +5.8oC will transform some states of the tropical area into "rainy deserts" since most crops will not develop due to excessive heat despite water availability. Independent of the increase in rainfall across the country due to elevation in temperature, it seems that the effect of excessive heat will be the cause of the substantial decrease in the production of commodities in Brazil. The principal cause can be considered the incidence of high temperature during the flowering phase of crop plants, which kills the flowers. Another factor that must be considered is the possibility of a strong increase in soil salinity that can also cause a decrease in yield. On the other hand, there is a possibility that some areas in southern Brazil could be favoured due to the diminishing possibility of frost. Adaptive solutions such as the development of cultivars adapted to higher temperatures must be considered by policymakers dealing with the effects of climate change.

Retrieved from: http://www.ige.unicamp.br/terrae/V3/PDF-N3/T_A3.pdf

Adaptation

The case studies illustrate that building up resilience to increasing climate variability is the most significant challenge facing coffee farmers. Perhaps most significantly for farmers, they can no longer depend on their own experience, making it harder for them to plan and manage production when planting seasons and weather patterns are shifting. Support strategies to enhance and sustain coffee production must take into account the diversity of farming environments, the complexity of livelihood strategies of marginal communities and the uncertain impacts of climate change combined with market pressures facing coffee farmers [7,8].

A coherent response to climate change requires continued emphasis on, for example, community-based natural resource management, gender awareness, dealing with land tenure issues, improving access to financial services and markets, increasing sustainable productivity, and institutional and human capacity building. It remains essential to empower and recognize the relevance of farmers' traditional and indigenous knowledge and the differences between women's and men's knowledge and roles in responding to climate change.

For many coffee smallholders their ability to adapt to climate change is limited by insufficient or no access to the resources required, including technical assistance, access to finance and capacity-building support at the local level. Short-term adaptation strategies include support to community-based adaptation strategies. This can help rural coffee communities strengthen their capacity to cope with disasters, improve their farming skills (e.g. pruning, shade, nutrient and waste water management) and diversify their livelihoods [7]. Longer-term adaptation includes capacity building, improved monitoring of climate data, enhancement of soil fertility, introduction of shadow trees, and the development of drought and disease resistant varieties. Another solution may be to convert from coffee to other products or shift production to more suitable areas.

Mitigation

At the same time, coffee production itself contributes to climate change through greenhouse gases (GHG) that result from deforestation and breakdown of organic matter, and the inappropriate or excessive use of agricultural chemicals. Mitigation strategies include calculating and reducing greenhouse gas emissions on the farm, and enhancing carbon sequestration in soils and biomass (e.g. shade trees).

There are potential synergies between climate change adaptation and mitigation. Large areas of coffee have been converted from agroforests into lightly shaded or full-sun coffee production systems with few or no trees, to increase the exposure of coffee plants to sunlight and thereby boost yields. If an adaptation project has a positive impact on ecosystems and carbon (e.g., forest conservation, afforestation of degraded areas with coffee agroforestry systems), it can integrate explicit mitigation objectives. This can help farmers overcome financial barriers to adaptation by benefiting from carbon funding (like voluntary carbon markets, e.g. the Gold Standard for which Hivos and Solidaridad are developing a coffee farming methodology); such funding is an attractive incentive to include mitigation into adaptation projects.

Measuring coffee's carbon footprint is complex and there is no consensus on what exactly the calculations and reporting imply. This hinders access to payments for the environmental services that coffee farmers provide. To address this issue, the SAI Platform's Coffee Working Group and IDH developed a Green Coffee Carbon Footprint Product Category Rule (CFP-PCR) in collaboration with stakeholders in the coffee value chain. Industry stakeholders include coffee roasters like Illycafe, Nestlé, Tchibo, Mondelēz, DEMB, Lavazza. This Coffee-PCR may benefit mechanisms that minimize environmental impacts, maximize carbon sequestration and thereby reduce the costs to be incurred at (smallholder) farm level, in reaching the massive scale of adaptation that is required.

4 Voluntary coffee standards systems

The implementation of voluntary standards systems (VSS) in the coffee sector to address environmental and social issues is regarded as one way to overcome many of the unsustainable aspects of coffee production outlined above. Certification is a means for coffee farmers to upgrade their production system and improve productivity, reduce costs and increase quality, all of which can lead to financial benefits and increased profits. The conditions under which certification will be a viable option for farmers are highly context specific, their existing links to markets, the ways in which they are organized, and if there is a market for their certified coffee [5,6,8].

In the coffee sector, there are seven key VSS [18,20], no two VSS are the same. Although their concerns increasingly overlap, all embody some combination of environmental, economic and social goals, and require suppliers to meet standards on food safety, working conditions and environmentally friendly production. This adds to the confusion for producers and consumers as well as others in the supply chain pertaining to the different social and environmental credentials of coffee. To complicate it further the coffee sector applies two different conformity assessment processes: certification and verification. Certification is used to make claims with respect to external stakeholders (e.g. communication with a label), whereas verification is used to define conformity assessment for internal processes and assurances [20,22].

Independent monitoring and certification are central to the four major coffee production standards: Fairtrade Labelling Organisation (FLO), Organic (IFOAM), Rainforest Alliance (RA) and UTZ Certified (UTZ). Starbucks has its own private standard for quality and sustainable coffee production, termed Starbucks' Coffee and Farmer Equity Practices (C.A.F.E. Practices). Nespresso's private AAA guidelines have a similar approach and focus on quality aspects like origin and taste. The 4C Association initiative relies on self-assessment and a three-year external verification cycle. The 4C Code of Conduct is positioned as a baseline standard, that enables producers to step up to more demanding VSS like FLO, RA and UTZ.

The stated objectives of these major coffee VSS suggest a broad, but often loosely defined, notion of sustainability. In practice, they advise farmers on how to implement better farming practices, establish protocols for dealing with environmental and social issues, implement auditing and (third party) verification on these issues, and communicate with consumers at the end of trade chains to give them the necessary assurance. The International Trade Center (ITC) is managing a web-based database to enable users to quickly review many different VSS's on every aspect of their specific thematic qualities - **www.standardsmap.org**

The supply base of certified and verified coffee remains highly concentrated, with over two-thirds coming from the more organized and developed Latin American producers. In Colombia, more than 60 per cent of its total production is either certified or verified as sustainable. Peru has a high level of sustainable production (over 30 percent) with a high diversity across all the initiatives. By contrast, Brazil's 40 percent standard compliant production relies heavily on 4C verification, e.g. 23 large cooperatives in Brazil are the main supplier base. The growth and concentration in the Latin American region contrasts with the sparse growth in African countries. Excluding Kenya and Tanzania, Africa is inadequately represented as a supplier to sustainable markets [20].

Figure 5 illustrates not only the rapid growth of certified and verified coffee production volumes in 2013 (40 percent of global production), it also highlights the quantities actually purchased (15 percent). There is a growing gap between the volumes of standard compliant coffee available at producer level and the volume actually procured as standard compliant coffee with the buyer.

Besides the obvious reason - demand for sustainable coffee is less than the volume produced, some other factors play a role in explaining this gap. Firstly, the demand for green coffee depends on various attributes of quality, including taste and origin. Not all the sustainable coffee available matches the buyer's criteria. VSS's indicate that to meet the demand it is paramount to have on offer a broad range of qualities and origins [18]. Secondly, the statistics pertaining to sustainable coffee volumes are blurred, because figures and forecasts do not allow for overlap between the systems; double and triple certification is not properly recorded [18,20]. This is a critical element in judging the market penetration of VSS; it can lead to an over-estimation of the total volume available. Especially difficult to interpret are the figures of IFOAM, said to overlap some 50 to 70 percent with FLO certified coffee.

Although some oversupply in sustainable coffee production might be unavoidable, figure 5 also shows an increasing imbalance between supply and demand. Only 20 percent of 4C verified coffee is sold as such and 28-35% of FT, RA and UTZ certified production. Organic is the exception with 50% market uptake. When VSS compliant coffee is produced but not sold as a sustainable product, the potential benefits of preferential market access, more direct commercial relations and premiums may not be available to the producers and could limit opportunities for entry of new producers not yet certified or verified.

All VSS expect the market for sustainable coffee to grow significantly. Given this, it is critical to objectively evaluate the impacts of VSS and adjust their strategies to optimize performance. Effective leveraging of voluntary standards within the sector should be based on a better understanding of their performance - which initiatives are having the desired impacts, and where.

The Committee on Sustainability Assessment (COSA) recently published "The COSA Measuring Sustainability Report" [5], which assesses sustainability initiatives in the coffee and cocoa sectors, without singling out a particular sustainability standard or comparing standards. The report highlights the findings from nearly 18,000 farm and

village level surveys, carried out from 2009-2013, in 12 countries in Africa, Asia and Latin America, on the impact of certification on the economic, social and environmental situation at farm level.

The COSA study confirms that certified coffee and cocoa farms, on average, perform better economically, and their farmers are better trained and pursue more environment-friendly practices compared to non-certified farms. Nonetheless, the success of a particular sustainability intervention often depends on the local context. The application of the standard can result in modest or no improvement and sometimes it offers measurable benefits. There are also entry costs, not just monetary, that can be challenging for smallholders. **VSS are not a magic formula and require a commitment to ongoing capacity-building and long-term investment if they are to improve the conditions of farmers and their communities.** COSA concludes that despite their imperfections, *"VSS are among the best tools currently available in agriculture; in part because they serve as viable market mechanisms to transmit value (perhaps even to convey ethics to some extent) and in part because they can play diverse roles in the food and agriculture value chains"* [5].

ISEAL (the global association for sustainability standards) emphasizes that the future credibility of the standards movement depends on the contributions of standards systems to climate change solutions. VSS can contribute to restructure the coffee supply chain, develop new partnerships, and invest in tools in order to mount a comprehensive adaptation response that is commensurate with the scale of the crisis.

Since most of the VSS were designed before the threat of climate change became apparent [2], they need to define their climate change role and strategy. For VSS, this provides a window of opportunity to stimulate linkages and multipliers in the coffee value chain and to enable farmers to become more resilient. Nonetheless, VSS still have to ensure they are actually able to deliver on this new reality. FLO, RA, UTZ and 4C are all full members of ISEAL, which could ensure a comprehensive approach to develop generic criteria for best management practices to foster agricultural adaptation and mitigation. Alternatively, all VSS are working with their own modules (and pilot-projects) to cope with rapidly changing conditions in the field.

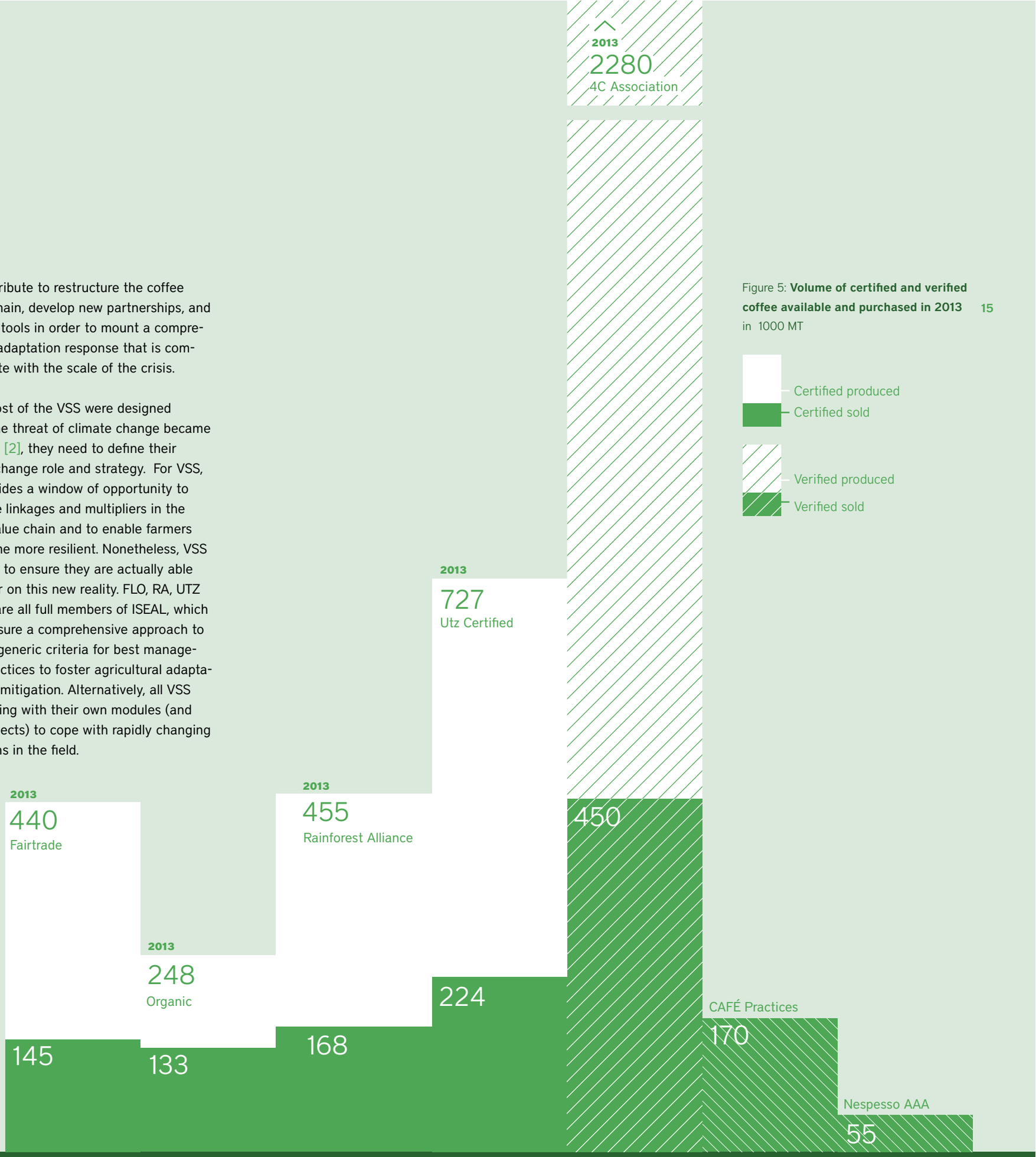


Figure 5: **Volume of certified and verified coffee available and purchased in 2013** in 1000 MT

5 Top ten coffee roasters

The world coffee market is dominated by three very large transnational corporations – Nestlé, Mondelēz and DE Master Blenders 1753 - and a few big coffee roasters such as Smucker's, Strauss, Starbucks and Tchibo. The ten largest roasters process almost 40% of all the coffee that is consumed worldwide. Their individual shares range from 1% (Keurig GM) to more than 10% (Nestlé). The recent merger announcement of Mondelēz's coffee division with DE Master Blenders will create the world's largest coffee business in 2015: Jacobs Douwe Egberts. While Nestlé remains the world's leader in terms of revenue from its coffee business, in volumes traded Jacobs Douwe Egberts will take the first place and become a formidable competitor for Nestlé in developed and developing markets.

Coffee roasters have gained increasing control of the marketing chain in recent years, despite strong competition from supermarkets and their own label coffees. In answer to the challenge of specialty coffee chains (e.g. Starbucks) and the proliferation of small-scale roasters with their promotion of high quality coffees, the mainstream roasters are focusing on developing more individualized products for their consumers.

Currently, a key driver of growth in developed coffee markets is the single-serve systems, which allow consumers to brew single cups of coffee (e.g. Nespresso, Senseo, Tassimo). This coffee market segment is unique for the diverse partnerships formed between coffee roasters and kitchenware manufacturers to produce, distribute, and brand the machines. Nestlé is the main player in this segment, capturing 50% of the global market; the company makes both the machines and coffee capsules. In the USA, Keurig Green Mountain is the market leader with a top-selling single-serve machine to make coffee, tea, and milk drinks using the K-Cup pack system.

Although the consumer's taste and price-quality considerations are the dominant factors, intangible aspects such as the sustainability of coffee are becoming a factor in driving brand choice. All of the top ten coffee roasters have developed strategic alliances with a number of international standards initiatives, like FLO, RA and UTZ, or developed their own private coffee standards systems (e.g. Starbuck's C.A.F.E. Practices and Nespresso's AAA Sustainable Quality Program) as part of their overall corporate strategies. Figure 6 shows the total volume of coffee purchased by each company, the volumes of certified and verified coffees purchased, and the VSS initiatives they dealt with in 2013.

The large roasters tend to rely heavily upon coffee trading companies to obtain their supplies of green coffee [18]. These companies are large players and include Neumann Gruppe (Germany), Volcafé (Switzerland) and ECOM (Switzerland); 50% of the world's green coffee beans are traded by them. In recent years, international traders have strengthened their supply network especially, to guarantee a minimum amount of certified coffee to their major clients. Traders are the closest to the farmer and have to secure the required volumes of quality produce. To source a growing share of sustainably produced coffee they are actively involved in the design and implementation of training programmes to improve and protect the economic, social and environmental conditions at the beginning of the coffee chain.

The decisions of the 10 roasters and 3 traders have a significant impact on the investments in, and overall demand for, sustainable coffee. In 2013, the sales of sustainable coffee have grown to 15 percent of total consumption. Although an impressive market share, this is only a fraction of the 40 percent of certified and verified coffee available (see Figure 5). Given the pledges of the top ten coffee roasters to make the coffee sector more sustainable there is room for growth.

Addressing climate change in the coffee sector requires enhanced cooperation and communication between companies, donors, farmers and researchers, going beyond existing certification and verification activities. Despite the potential to establish successful adaptation strategies through VSS, the major challenge is how to generate collective action across the coffee chain to find lasting solutions to these global issues in the coming years. The coffee chain as such needs to become more aware of the potential effects of climate change on the entire system and find ways to encourage strategic research and adaptation strategies at different scales.

In 2010, an interesting mixture of private, development and research stakeholders founded the initiative for coffee&climate (c&c - www.coffeeandclimate.org). The original group has expanded over the years and since the Sustainable Coffee Program (SCP) joined in 2013, the initiative gained more ground in the sector. Today the group includes traders like Neumann Gruppe and ECOM Coffee, roasters like Nestlé, Mondelēz, DEMB and Tchibo, and a funding base with support of GIZ (German Development Agency), Sida (Swedish Development Agency) and IDH (Dutch Sustainable Trade Initiative).

The partnership addresses the challenges posed by changing climatic conditions to the entire coffee value chain, especially to coffee-farming families worldwide. In practice, the Hans R. Neumann Stiftung (HRNS) and the Centre for Agricultural Bioscience (CABI) collect and consolidate best practices for adaptation in four project regions. These include pilot projects in Brazil, Tanzania, Trifinio (Guatemala, Honduras, El Salvador) and Vietnam. These regions have been chosen because of their relevance as key coffee producing areas, representing Arabica and Robusta production, intensive and diverse growing system as well as wet and dry processing. Coffee farmers take part in hands-on training activities, assisting them to find strategies, which suit their needs. Furthermore, coffee farmers and other stakeholders have access to the c&c Toolbox: http://toolbox.coffeeandclimate.org
This is a compilation of methodologies, guidelines and training materials which enable farmers to cope with climate change. It provides a platform to exchange knowledge on known and innovative adaptation practices and bridges the gap between science and farmer know-how.

Nestlé

In 2010, the world's largest coffee manufacturer, announced its "Nescafé Plan", to optimize Nestlé's coffee supply chain by supporting coffee farmers. The multinational committed itself to purchase 180,000 tonnes of 4C verified green coffee by the year 2015. In 2013, the company already sourced 200,000 tonnes of 4C verified coffee.
The company continues to invest in farmer capacity building programmes, currently reaching over 170,000 coffee farmers in several countries. In addition, Nescafé (Nespresso) planned to source 90,000 tonnes of Nespresso AAA verified coffee by 2020. By the end of 2013, Nespresso sourced 84% of its coffee from the Nespresso AAA Program, in close collaboration with Rainforest Alliance.

Mondelēz

In 2012, Mondelēz launched its "Coffee made happy" initiative, to support one million small-scale coffee farmers, especially the next generation of coffee farmers. The plan is designed to increase farmer productivity and the viability of small-scale coffee farming, improving agricultural practices and helping to build more sustainable coffee communities,(e.g. projects in Vietnam, Indonesia, Peru and Honduras).
All its European coffee brands will contain 100% sustainable coffee by 2015, which is about 55% of Mondelēz global coffee volume. To reach this target, Mondelēz is purchasing coffee from Rainforest Alliance and the 4C Association. In 2013 the company sourced around 60% of its European coffees according to 4C and 20% certified by RA.

D.E. Master Blenders 1753

Douwe Egberts Master Blenders 1753, is the number one buyer of UTZ Certified coffee and sourced 90,000 tonnes of this coffee in 2012. DEMB planned to procure more than 25% certified coffee across all its markets and product segments by 2015. However, this target was achieved in 2013, two years ahead of schedule. Although UTZ Certified is DEMB's main partner for certified coffee, the company is also procuring some certified Organic and RA coffee. The company will continue building a more sustainable coffee industry in 2014 and beyond through investing in further sector development together with the roasters and other partners under the IDH Sustainable Coffee Program umbrella; working with trading partners in countries of origin to make coffee production better traceable and more sustainable; working with the DE Foundation on projects with high impact in countries of origin.

Smuckers

Smuckers' goal is for certified coffees to reach 10 percent of its total retail purchases, by 2016. Currently, Smucker's procures certified coffee from RA, Fair Trade Certified and UTZ and plans to increase purchases of UTZ Certified coffee. The Smucker's 2012 corporate responsibility report highlights its partnership with coffee&climate,.

Starbucks

Starbucks' goal, set in 2008, was that by 2015, all of its coffee will be third-party verified or certified, either through its own code, C.A.F.E. Practices, FLO or another program. In 2013, 95% of its total green coffee purchases, of almost 180,000 metric tons, were C.A.F.E. Practices verified. Some coffees had received multiple verifications or certifications including 15,000 tons (8%) of FLO certified coffee and 2,000 tons (1%) of certified organic coffee. Starbucks collaborates with Conservation International and farmers in three coffee communities.
To test effective strategies for improving the sustainability of coffee production processes, the conservation and restoration of natural habitat and opportunities to facilitate farmer access to payment for environmental services.

Strauss

Strauss Coffee has a strong market presence with its different coffee brands in Israel, Brazil and Eastern Europe. Strauss committed in 2011 to increase its European purchasing volumes of 4C verified coffee by 20% per annum. In absolute terms, it planned to purchase 3,800 metric tons in 2012, 4,500 metric tons in 2013, 5,400 metric tons in 2014 and 6,500 metric tons in 2015. In 2013, the company actually procured 4,280 tons of 4C verified i.e., 6% of its European volume.

Tchibo

Tchibo has committed itself to a fully sustainable path; it plans to procure 25% sustainable coffee by 2015 and has a future commitment of 100%. In 2013, the company achieved the procurement of *30 percent* certified coffee, either RA, UTZ, FLO, Organic or 4C verified. Tchibo is one of the main buyers of 4C verified coffee, but does not disclose the amounts of certified coffee and verified coffee it procured.
The company has developed 'Tchibo Joint Forces!', a programme to promote the sustainable development of the coffee sector. The programme consists of five modules to increase sustainability and it can be applied to individual countries, regions and projects.

UCC Coffee

UCC Coffee (active on the Japanese market and since 2012 also on the EU market) manufactures both brands and private label coffees.
UCC Coffee has not published a specific commitment on sourcing sustainable coffee. In 2013, the company purchased 25,000 MT of certified coffee, of which the majority for their European customers (32% of its total European coffee volume). This volume included 98% certified green coffee of FLO, RA, UTZ and Organic and 2% 4C verified coffee.

Lavazza

Lavazza, Italy's market leader, purchases a total of 150,000 tonnes per year of which, about 2,300 tonnes are certified coffee, either RA or UTZ. Lavazza has not published any commitments, but affirms it will increase the amount of certified coffee according to market demand.
Lavazza states that greater benefits can be achieved by coordinating various players in the coffee chain in order to create synergies and strengthen the impact of each project. Therefore, it participates International Coffee Partners and in the coffee&climate initiative.

Keurig Green Mountain

In 2013, Keurig Green Mountain procured 26% (almost 26,000 metric tons) FT USA coffee, and 5% (almost 4,800 metric ton) RA coffee, totaling 31% of its green coffee from a certified source. The goal is to increase the number of coffees that meet these standards, particularly FT USA and FLO, through the introduction of new product lines, and by achieving certification for their existing product.

The company is committed to increase the share of coffee products that meet the standards of FT, Organic, and RA certifications. By 2020, the company plans to purchase 100% of its coffee pertaining to the Keurig Green Mountain Responsible Sourcing Guidelines (an internal verification guideline).

Figure 6: **Top ten coffee roasters: marketshare in 1,000 MT and certified and verified coffees purchased in 2012/13 and future commitments**

market share **860**

market share **500**

market share **360**

market share **300**

market share **230**

market share **180**

market share **180**

market share **177**

market share **150**

market share **98**

Nestlé

30%

2 FLO/Org certified
55 AAA verified
200 4C verified

Mondelēz

44%

55 RA certified
165 4C verified

D.E. Master Blenders 1753

25%

90 Utz certified

Smuckers

2016: 10%

4 4C verified

Strauss 2%

Starbucks

2015: 100%

future: 100%

95%

15 FLO certified
2 Org. certified
154 CAFE verified

Tchibo

30%

not specified:
Certified RA,
FLO, Org
Verified 4C

UCC

25 FLO, RA, UTZ certified
0,4 4C verified

14%

Lavazza 1%

2 RA certified

Keurig Green Mountain

31% 26 FT
5 RA

2020: 100%

6 Conclusion

World coffee consumption is growing steadily at around 2.5% per year, and the demand for coffee is on the rise. Growth is fastest in the emerging markets, such as those in Eastern Europe and Asia, and in the coffee producing countries themselves. **The demand is expected to reach 165 million bags in 2020 and calls for around 15 percent increase in green bean production over the next 5 years.** Thereby a shift in demand preference towards Robusta coffee has to be factored in. Global production averages 12 bags per hectare. If the production shortfall is to be met by expanding the land under coffee cultivation, it will necessitate opening up at least one million hectares of mostly forest covered land. With the increased pressure on land resources, a more sustainable solution is to produce more coffee per unit of land, water and agrochemicals. To increase and maintain quality and quantity in the long-term, it is of paramount importance to focus on ensuring that women and the next generation of farmers remain in, and benefit from coffee production.

Climate change is already affecting coffee production in many ways. Two good examples, with clear impacts on the coffee trade patterns, are the extreme drought in Brazil in 2014, and the outbreaks of coffee rust in Colombia in 2011/12. The underlying drastic changes in land suitability for coffee production – in terms of quantity and quality – is worrisome. **The climate change impacts in countries as diverse as Brazil, Honduras, Uganda and Vietnam, signal that areas suitable for coffee will decrease substantially by as soon as 2020.** The case-studies illustrate that climate change adaptation is vital in coffee producing countries. Adaptation is understood to include efforts to adjust to ongoing and potential effects of climate change. **Building up resilience to increasing climate variability is the most significant challenge facing coffee farmers.**

Smallholders produce most of the world's coffee but for many their ability to adapt to climate change is limited due to having poor or no access to the required resources, including technical assistance. Many different potential farm-level innovations are available, but their location specific suitability is difficult to predict. Coffee cultivation and processing contributes to GHG emissions, especially when land-use change is included (e.g. deforestation). Companies should commit to a time-bound plan to prevent further deforestation and degradation of forests in their coffee supply chain, while protecting the rights of communities living on these lands. If an adaptation project has a positive impact on ecosystems and carbon sequestration, it can become a source of funding in adaptation trajectories.

Current priorities to ensure the livelihoods of both men and women coffee farmers are also largely applicable in the context of climate change. **It appears that most adaptation measures are in line with sustainable development approaches common in the sector.** These include access to better farm management techniques, to markets, to finance, to insurance, to information (like weather forecasting and prices) and technology.

Nonetheless, climate change and the challenge of adaptation question our concept of sustainable coffee production. Voluntary Standards Systems (VSS) aim to promote a socially and ecologically sustainable coffee production system for millions of smallholders. Adhering to a VSS for export is a tool for supporting producers in the coffee value chain, to promote environmentally sustainable farming practices, and create market access for quality produce. These are important and worthwhile objectives, but evidence that certification achieves these benefits is not always clear-cut. **It is important to back claims of impact at the producer level, measure real time progress and create sector wide credibility for the efforts of the stakeholders involved. Clearly, VSS alone are not the solution, but there are many entry points that provide a window of opportunity to stimulate linkages in the coffee value chain and to enable farmers to become more resilient.** VSS are yet to demonstrate their ability to deliver on the challenges posed by climate change. A breakthrough is required to bring about genuine collaboration at the producer level and avoid wasting limited resources on promoting different VSS climate modules and approaches. However, VSS generic criteria for best management practices to foster agricultural adaptation and mitigation in the coffee sector are not available, as yet.

Increasing the share of sustainable coffee is still the dominant pursuit, especially for the 4C baseline verification standard. 4C positions itself as a stepping-up mechanism, that offers a low barrier for entry. Collaboration between 4C and the higher bar VSS like UTZ, RA and FLO could support the continuous improvement trajectory from 4C baseline requirements to the more demanding certification level. This stepping-up mechanism can be particularly relevant if it enables small-farmers to enter the standard systems. **Regrettably, all VSS show an increasing imbalance between supply and demand. Although roasters are committed to procure more sustainable coffee, the current situation is not beneficial to the producers: it could even limit entry opportunities for producers yet to be certified or verified.**

All VSS have experienced growth in the production of sustainable coffee and made significant penetrations in the EU and USA mainstream coffee market. Generally, the large coffee roasters are buying one or more kinds of certified or verified coffees, although for some of them (e.g. Lavazza, Strauss, Smuckers) this represents only a minimal part of their total coffee procurement. **However, their communications are not always clear or transparent.** Some companies publish impressive pledges for only the EU market or do not differentiate between the baseline 4C verified volumes and the higher bar certified coffee volumes. **Comparing the roasters' present commitments to the size of their operations reveal there is much room for growth.**

Despite the potential, steering collective action across the coffee chain to develop lasting solutions to sustainability issues is a difficult yet pressing challenge. The coffee chain as such needs to raise its awareness of the potential adverse effects of climate change on the entire system, and encourage strategic research to develop adaptation strategies to suit different scales of production. Bringing about sector wide support for the Coffee&Climate initiative, and the Green Carbon Footprint Coffee Category Rule would be a promising first step. **It is clear that the coffee industry has to take more responsibility to invest collectively in the adaptation process, communicate transparently, and ensure effective and long-term support for coffee farmers in all producing countries.**

Building capacity at the producer level, in the demanding environment of unorganized smallholders in Africa, Asia and Latin America, is an arduous task. It needs a comprehensive effort from all involved stakeholders with substantial contributions, both monetary and in-kind. **The plans and investments of key stakeholders, including producer governments, roasters, traders, VSS, NGOs, producer organizations, unions and financial institutions should be coordinated, in order to build a shared understanding and approaches to sustainability at the global level.** Furthermore, a much broader focus is called for, such as shifting the current farm-by-farm certification and verification to a broader perspective, by taking into account the coffee-based landscape and community level to enable sustainable production practices, diversification of income for women and men, and natural resource management far beyond the level of coffee production activities.

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Figure 1 **Top ten coffee production countries in 2013 and volume per hectare**

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Figure 5 **Volume of available and purchased certified and verified coffee in 2013**

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Figure 6 **Top Ten Coffee Roasters**
All company data: Annual reports 2012 or 2013, interpretations verified by personal communication

Green coffee conversion

1 bag = 60 kilogram
1,0 tonne = 1,000 kilogram = 16,67 bags

Colophon

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Coffee Barometer 2014

Sjoerd Panhuysen & Joost Pierrot

Figure 1: **Top ten production countries 2013**
Circle = Country production volume in mio 60-kg bags
Square = Country production average 60-kg bags/ha

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