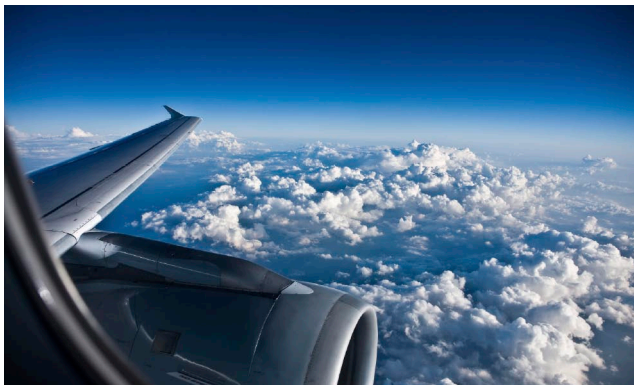
Carbon Concerns:

How Standards And Labelling Initiatives Must Not Limit Agricultural Trade From Developing Countries

Issue Brief No. 3



By James MacGregor
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ICTSD-IPC Platform on Climate Change, Agriculture and Trade

ICTSD
International Centre for Trade and Sustainable Development

International Food & Agricultural Trade Policy Council

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ABBREVIATIONS AND ACRONYMS

B2B	business-to-business
B2C	business-to-consumer
BSE	Bovine spongiform encephalopathy
CO2e	CO2 equivalent units
DECC	Department for Energy and Climate Change (UK)
DFID	Department for International Development (UK)
EC	European Commission
EIO-LCA	economic input-output life cycle assessment
EU	European Union
FFV	fresh fruit and vegetable
G	gram
GHGs	greenhouse gases
GLOBALGAP	Global Partnership for Good Agricultural Practice
IIED	International Institute for Environment and Development
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
Kg	kilogram
LCA	life cycle assessment
MRV	Monitoring, Reporting, Verification
NGO	non-governmental organization
NRI	Natural Resources Institute
PAS	Publically Available Specification
PVS	private voluntary standard
UK	United Kingdom
US	United States of America
W	watt

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FOREWORD

The carbon embedded in internationally traded food and agricultural goods – its measurement, as well as different ways of communicating its climate impact – is a rapidly emerging factor in agricultural production, processing and trade. The emerging, mainly non-statutory, private-sector driven carbon labelling schemes raise a number of issues. They will – by design – alter costs and benefit-sharing across a wide range of stakeholders, including producers and consumers, the public and private sector, and developing and developed countries, along all levels of globally-dispersed value chains. Also, how effective are they likely to be in changing consumption patterns?

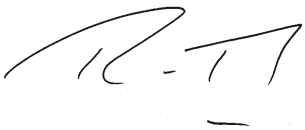
Since 2007, there has been a new raft of carbon labelling initiatives mostly developed as private voluntary standard (PVS) by retailers. The measurement of carbon embedded within individual products is rapidly becoming more sophisticated – and is certainly costly. Early experiments have now been largely discredited particularly those which singled out air-freighting of fresh fruits and flowers as a "carbon hotspot", identified through airplane stickers. Newer initiatives involve more sophisticated life cycle analyses to determine a product's carbon footprint. There is a clear dilemma however, since it is difficult to define the boundaries of where a life cycle analysis should begin and end, but simplified schemes are required to render any scheme workable, and costs bearable – especially for smaller producers.

Technical assistance and support is needed to assist developing country players participate in such schemes, in particular smallholders. Transparency is needed to allay fears that the schemes are not just another developed country form of "green protectionism." Carbon-labelling schemes could provide developing countries with new market opportunities and niches based on carbon efficiency, but also run the risk of restricting their market access.

To be effective vis-a-vis consumers, labels must be developed in a transparent manner, and clearly communicate what greenhouse gas emissions they account for, and which ones they do not. Moreover, they should specify how they interact with other social and environmental standards, and how they affect development opportunities in developing countries. At the same time, labels must also be simple and easy to understand, if they are to be viable.

This paper examines the current status of carbon labelling initiatives in the food industry. It looks at how embedded carbon is likely to be marketed and how this phenomenon may impact agricultural trade from developing countries.

The ICTSD-IPC Platform on Climate Change, Agriculture and Trade is pleased to release this paper trusting that it will contribute to a better understanding of these issues and to an informed debate and to equitable schemes and regulation.



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EXECUTIVE SUMMARY

The existence of standards particularly in food and agricultural produce has expanded rapidly over the last 20 years. Such standards have not only resulted in improved quality of products, but have also allowed greater efficiency by helping producers and other agents in the supply chain access information about what customers want and expect.

These standards can result from public legislation, for example through the EU Food Laws. Or, where specific legislation is missing, it is common for vocal consumer concerns to be turned into labels or standards. A raft of carbon labelling initiatives has hit the market since 2007. Most of these are private voluntary standard (PVS) that are initiated, implemented, and maintained by retailers.

These standards could be expected to benefit many people in developed consumer societies. Governments would benefit from a widespread carbon standard, which would raise consumer (voter) awareness of the carbon implications of their purchases. If governments were ever to find themselves in a position to compel their electorates to emit less carbon in order to comply with international agreements, the required legislation would be easier to implement if the historic data, which such a management system would generate, were in place. In addition, consumers may be more open to such moves if they have already made some movement towards a preference for low carbon products themselves.

Consumers who express concern over the carbon emissions would also benefit from having additional information that allows them to make an informed choice. Retailers would be able to collect the market premium that consumers are willing to pay on low carbon goods, and they would also have an incentive to create supply chain management systems that address carbon issues before it becomes a legal requirement. Early adoption of such systems may well produce first-mover advantage over competitors in the longer-term.

There are a number of difficulties associated with these standards, however. Much of the demand for carbon standards stems from the fear that producers in developed countries will simply outsource their production to developing countries that are not burdened with emission caps. There is often the assumption that imported food and agriculture goods will automatically have a higher carbon footprint due to greater transport emissions. This assumption can often be inaccurate, however, as developing countries often rely on less carbon intensive methods of agriculture by using less fertiliser, mechanisation, and energy for heating. To calculate the true carbon cost of a good, those setting standards might rely on Life Cycle Analysis to gain a more exact measurement. So far, however, methods for fully verifying and monitoring carbon emissions are not fully reliable. They also place an expensive additional burden on producers, who might be expected to pay for this verification.

The second concern is based on the idea of 'ecological space' -- the concept of measuring and comparing countries' current or historical greenhouse gas emissions and calculating each country's share of the total additional emissions that the planet can sustain without serious disruption to climate. The relatively low contribution of emissions from developing countries (less than 15 percent of historical carbon emissions) and the fact that they currently emit far less per capita than developed nations (the poorest are just 2 percent of those in the US) would allow them the ecological space for non-restrictive economic development. When reducing demand for imports (particularly in agriculture) from developing countries, we place the burden of reducing emissions unfairly on to those least responsible for them. This would be contrary to the UN climate change

convention's recognition of global inequity in responsibility for dealing with climate change. The carbon issue needs to be seen in light of the Kyoto Protocol's identification of clear and differentiated responsibilities for developed and developing nations.

The third concern is that carbon standards could result in a trade-off between environmental and development concerns. Agricultural trade and a move away from subsistence style of farming have been promoted in developing countries for many reasons including boosting incomes, encouraging investment in infrastructure and education, improving access to export markets, and creating a source of foreign exchange. Where agricultural development provides high benefits, cutting off demand for these imports for the sake of environmental concerns comes with a high cost to poverty reduction and economic and social development goals.

This paper looks at the existing types of carbon standards and makes the following policy recommendations:

- Carbon footprints can play a role in reducing carbon dioxide emissions in the food systems. Whether this is a problem for developing country exports is unclear.
- It is important to clarify the roles of private standards and public legislation in addressing carbon concerns in the food system.
- It is critical to learn from successes in the sustainable food trade between developing country producers and consumers in the developed nations. These successes should be scaled up and the principles that underlie those successes should be identified and understood.
- Analysis of carbon emissions provides a lens through which one can analyse broader issues affecting sustainable development in agricultural sectors in developing countries.
- Consumer-facing carbon labels and carbon private voluntary standards are unable to limit emissions effectively without appropriately priced environmental externalities.
- The potential for private sector buyers to insist on contractual reductions in carbon for a product harbour the greatest potential for actual carbon reductions in the food system.

INTRODUCTION

This paper examines the current status of carbon labelling initiatives in the food industry and what implications they have for trade with developing countries.

Since 2007, there has been a raft of new carbon labelling initiatives that aim to identify carbon in supply chains of production.[1]

Since 2007, there has been a raft of new carbon labelling initiatives that aim to identify carbon in supply chains of production.[1] This labelling, which has largely driven by consumer nations, is sometimes the result of public legislation, for example through the EU Food Laws. These regulations frame this issue of entry to market for produce from developing countries. Where specific public legislation is missing, however, it is common for vocal consumer concerns to be turned into labels or standards. In this case, the push is for carbon labelling largely as a private voluntary standard (PVS), initiated, implemented, and maintained by retailers.

Private voluntary standards have in fact become an economic tool used by businesses to increase quality and profitability in their supply chains and to comply with public legislation. PVS are flexible and can evolve over time; they can often be adapted to address many issues not envisaged at their inception. For example, in food supply chains that link consumers in the developed world to producers in the developing world, PVS have been used to ensure Europeans access to 'risk-free' (minimal risk) food. PVS have also been widely discussed as posing a barrier to entry for small-scale producers, excluding many poor farmers from lucrative export markets. These PVS tend to be enforced, managed, and verified by other supply chain participants. This paper looks at how our carbon is likely to be marketed and how we can expect this to impact agricultural trade from developing countries.

In order to assess this impact, this paper examines three major concerns with these initiatives. The first concern is that carbon-labelling may not prove to be an effective method of reducing global carbon emissions. Agriculture and food production are a key contributor to global carbon emissions but difficulties in understanding exactly how emissions should be included or measured make it hard to judge different goods fairly, particularly when there is a deliberate focus on air-miles. This paper aims to describe how each of these concerns is likely to arise. Policy recommendations in light of them are provided.

The second concern is the difficulty in assessing where emissions reductions take place, who would benefit from the reduction, and whether this result would be considered 'fair' under the guidelines for differentiated responsibility laid down under the Kyoto Protocol/Copenhagen Accord. This question centres on the notion of 'ecological space' – the idea that each country should be allotted a share of the total additional emissions the planet can sustain without serious disruption to climate, and that that share should be based on each country's current and historical greenhouse gas emissions. The relatively low contribution of emissions from developing countries should allow them the ecological space for non-restrictive economic development.

The third concern is that these carbon issues may result in a trade-off between environmental concerns and economic development opportunities. Agriculture for export has long been hailed as an important contribution to economic and social development and consumers may substitute away from these imported goods, which may have high energy or transport inputs, and instead favour more locally produced goods. It is unclear how trade-offs between local goods and global environmental goods can or should be made, or by whom. This report provides an introduction to the dominant issues surrounding the use of PVS to help supply chains seamlessly link rural farmers in developing countries with consumers in developed ones. Much of this paper focuses on the well-researched fresh

fruit and vegetable (FFV) trade between sub-Saharan Africa and the UK, though it should be remembered that carbon is emerging as a communicable consumer-facing issue in a growing number of countries in Europe and beyond. This report poses the question: In light of apparent development and consumer benefits from this trade, what is the role of PVS in continuing and upgrading this trade, and can carbon dioxide emissions be integrated without risking the local development benefits from this trade?

1. INTRODUCTION TO STANDARDS

1.1 Current Types of Standards

Standards that are currently available come in a number of forms. These can be divided into two broad categories.

1. Public standards

There are a number of general food laws that outline the rules for entry to the market, around maximum residue limits and provenance. For extra-EU countries, EU legislation covers food quality and food safety for fresh produce exports to the EU. First, imports must comply with the general regulations on health control of foodstuffs of non-animal origin. It is the responsibility of the importer to comply with hygiene rules based on the level of hazard and on contaminant indicators (such as maximum pesticide residue levels). Second, EU 'general labeling' rules stipulate a number of indicators including the place of origin of food products, quantity, and its minimum durability. Third, the EU requires compliance with marketing standards, which describe the minimum requirements of quality, size, and presentation.

These are internalised by businesses complying with these regulations and largely resolved business-to-business (B2B), such as between a manufacturer and retailer. Indeed, many important disputes about food safety and market access for developing countries into Europe are handled under the auspices of EU laws between nation states, yet these remain largely invisible to European consumers (Homer, 2009b).

Many of these standards are set by the International Organization for Standardization (ISO), based in Geneva. A non-governmental organisation, the ISO sets worldwide proprietary industrial and commercial standards, which often become law, either through treaties, trade agreements, or individual government-set national standards.

2. Private standards

Private voluntary standards (PVS) are rules that specify how the production process of a given product should be managed; the rules also regulate the nature of the product itself. PVS go beyond public (legislative) standards in their stringency. Moreover, PVS are not always created in a public forum, but rather created by an industry participant.[3] Yet unlike public standards, PVS are in *theory* not mandatory for producers and other players in the supply chain. In *reality*, however, as standards have proliferated firms might feel a growing need to adhere to them as a means to achieve market access. An example of these B2B standards are those established by UK supermarkets to ensure their suppliers meet food safety laws and satisfy consumer demands for safe (and high-quality) produce.

Yet unlike public standards, PVS are in theory not mandatory for producers and other players in the supply chain. In reality, however, as standards have proliferated firms might feel a growing need to adhere to them as a means to achieve market access.

A recent example is the private standards associated with the food system, which have proliferated since the 1990s. This proliferation

has its roots in food safety concerns raised by public authorities in the early 1990s, e.g. BSE. However, the increase in the number of standards is not due to food safety concerns alone.

Private voluntary standards have in fact become an economic tool used by businesses to both increase quality and profitability in their supply chains and to comply with public legislation.

Private voluntary standards have in fact become an economic tool used by businesses to both increase quality and profitability in their supply chains and to comply with public legislation. PVS are flexible, evolve over time, can be used to help streamline supply chains, and often adapt to address many issues not envisaged at their inception. For example, a combination of public concern and lobbying by campaigning NGOs saw PVS being used to deal with perceived problems associated with economic development, environmental concerns, and human rights – including labour rights, child labour, and inclusion of small-scale growers. Compliance to private voluntary standards is usually monitored through a local certification body against benchmarked norms.[4]

PVS operate at a number of levels: at the small-scale producer level, to ensure sequencing of production on multiple small-scale farms and to streamline costs of aggregation of product[5]; and at the consumer level, to ensure UK retailers' shelves are stocked with specific products year-round.[6] These are business-to-business[7] or consumer-facing labels.[8] PVS evolve over time,[9] with some becoming harmonised[10] and some remaining individual (and not harmonized) retailer-led.[11]

Standards, particularly private standards,[12] have greatly expanded in recent years as the gap between consumer concerns and public legislation has widened.[13] Standards vary from international and collective (e.g., the Global Food Safety Initiative, GLOBALGAP), to national (e.g., the British Retail Consortium Global Standard), to company-owned (e.g., Tesco's Nature's Choice, Carrefour's Filière Qualité). They can be business-to-business schemes (B2B) or customer-facing schemes in the sense that they offer visual assurance through the use of labelling and act as a point of difference or unique selling point (B2C) (e.g. Fairtrade, Organic).[14]

1.2 The Reasons for Setting PVS over Food

Standards enable the setter to consider transferring responsibility for compliance to other participants in the supply chain. Risk and competiveness are primary economic drivers; compliance with public laws is a clear catalyst as well.

Standards enable the setter to consider transferring responsibility for compliance to other participants in the supply chain. Risk and competiveness are primary economic drivers; compliance with public laws is a clear catalyst as well. For agricultural trade with developing countries, this means transferring compliance to exporters and small-scale farmers in countries that have public standards and laws that are different from those in the consuming country. Developing country producers may struggle to comply.

The chief economic drivers for setting PVS over international agricultural supply chains are:

Efficiency. High transaction costs are typically encountered in supply chains that span large geographical distances. In these supply chains one challenge is effectively communicating the needs of a diverse, often geographically dispersed, set of consumers to another diverse, often dispersed set of producers. Appropriate PVS can help lower transaction costs by providing access for producers and other agents in the supply chain to information about what customers want and expect. They can also help by allowing information to flow more effectively and by ensuring that changes to production systems and processes made by producers are well informed and well targeted. PVS can help deliver efficiency improvements in line

with what the markets want. Efficiency creates winners and losers. As MacGregor (2009a) argues, "developing a standard is driven by economic efficiency concerns throughout a supply chain but implementing a standard is often motivated by maximising financial efficiency for a particular participant or sector."

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Willingness to pay. Consumers may be willing to pay a pre-mium for a product if it meets the standards they demand. In the UK, consumer research shows that a significant proportion of UK shoppers already associate many ethically sourced products with premium products, and they are willing to pay a premium for ethical attributes.[15] Yet, the association of low-carbon emissions with premium products remains untested.

Privatisation of food safety. The onus of food safety is increasingly placed on retailers and sellers of food, for example, through Article 17 of the General Food Law Regulation (EC) 178/2002, which applies to food business operators. Article 17 specifies that:

> Food and feed business operators at all stages of production, processing and distribution within the businesses under their control shall ensure that foods or feeds satisfy the requirements of food law which are relevant to their activities and shall verify that such requirements are met.[16]

In this case, the key incentives for using PVS include reducing risks. This is well illustrated by GLOBALGAP, a private sector body that sets PVS for the certification of agricultural products at the production stage, originally to reduce risks presented from food safety (see Box 1).

1.3 Current Private Standards to and from the UK

We have chosen the UK as case study since it boasts the world's largest airfreight food hub in its London airport; it imports over half of fresh produce by air from sub-Saharan Africa; and it has been a leader in Europe for the development and implementation of PVS.

In the UK there has been an evolution in PVS for food since the early 1990s (see Figure 1). Most PVS were not designed with the specific needs of the developing country supply chains in mind. Private business-to-business standards dominated the field, with the environmental management system standard ISO 14000 and other private good agricultural practices having direct implications for developing country producers. ISO is currently developing a new standard, ISO 14067, which will examine the 'carbon footprint of products'. The new standard will be available in March 2011. Since 2000, there has been a steady change in emphasis as PVS started to face consumers, bringing them information about labour rights and social conditions.

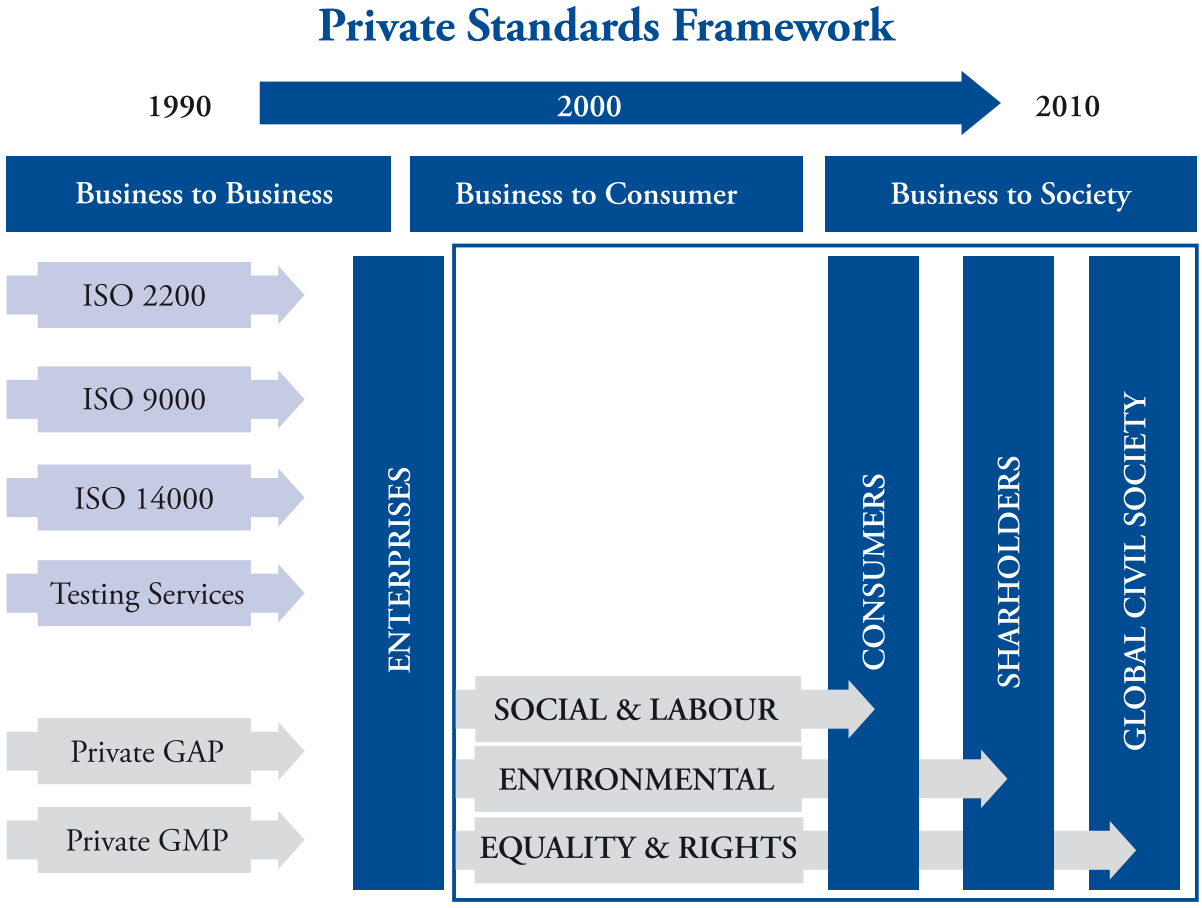
During the 2000s, supermarkets have stopped focusing exclusively on their customers and started to address all citizens, be they direct customers or not. While such steps have been viewed by some as cynical marketing ploys, they have been welcomed by public authorities in the UK, where supermarkets are increasingly working closely with Department for International Development (DFID) and now the Department for Energy and Climate Change

In the UK supermarkets are increasingly working closely with Department for International Development (DFID) and now the Department for Energy and Climate Change (DECC) to address the development and climate impacts of the goods they sell.

(DECC) to address the development and climate impacts of the goods they sell. Supermarket sector has grown to dominate the UK grocery market during the early 2000s and consumers and citizens have become common audiences for super-markets.

Shareholders have also emerged in the last decade as a lobby, demanding environmental issues be addressed. Currently, the emerging themes being addressed are equality and rights and how these apply to development, environment, and access to economic opportunity.

Figure 1. Trends in PVS in Food in the UK



Source: Homer and MacGregor, 2009.

Figure 1 indicates the co-evolution of standards among public and private actors. This evolution is important since it illustrates how businesses have used PVS as a tool to address concerns and threats as expressed by society and which might impact their reputation and, therefore, the viability of their business. Often PVS are used as tools to learn about a given issue and to develop appropriate mechanisms to deal with consumer concerns. One question is how this is being addressed through carbon labelling, which we will look at in more detail in Sec-tion Three.

Since 1990, there has been a transformation in public food safety laws (see Graffham, 2006) but these shifts have been dwarfed by changes to the global PVS infrastructure in the food system – in particular GLOBALGAP (see next section). New PVS have included: the Ethical Trading Initiative; Rainforest Alliance environmental presence in cocoa, tea, and coffee; and Fairtrade in a spectrum of food products.

With so many companies, products, producer nations, and supply chain processes, there is no one dominant direction for these PVS. However, it is clear that successes are being built upon. Mainstream products produced by Multinational Corporations are now being targeted and branded as well. Emblematic

brands include Fairtrade cocoa in Cadbury's Dairy Milk and Rainforest Alliance certified tea in category-leader Lipton's PG Tips, which is a Unilever subsidiary.

Box 1. GLOBALGAP – Example of a Food Industry Standard

For developing countries, the most important PVS during the past decade has been GLOBALGAP, a private sector body that sets voluntary B2B standards for the agricultural products. "The GLOBALGAP standard is primarily designed to reassure consumers about how food is produced on the farm by minimising detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare" (GlobalGAP, 2009).

The scheme covers the whole agricultural production process of the certified product from before the plant is in the ground (origin and propagation material control points) or from when the animal enters the production process, to the non-processed end product. No processing, manufacturing, or slaughtering is covered.[17] It has become the most widely implemented and required PVS for primary production of agricultural products, with over 80,000 certified producers in 80 countries.[18] By the early 2000s, it had become the de facto requirement for fresh produce in the UK.[19]

Its significance for developing countries is that in January 2005, its European supermarket members made GLOBALGAP certification mandatory for its suppliers, including small-scale farmers in developing countries. An option was introduced to allow small-scale farmers to comply as a collective group (GLOBALGAP option 2) and therefore avoid the costs of having to certify as separate units.[20] The criteria are updated every three years to reflect changes in technology and the market. The most recent update to GLOBALGAP (version three) has led to greater challenges for small-scale farmers and "could accelerate smallholder departure from export markets."[21]

At present, carbon is absent from the compliance criteria for GLOBALGAP, in the third and most recent version (2008). The preservation of above- and below-ground carbon stocks is not mentioned throughout the text. Evidence of previous land use is required, but focuses on food safety risks by pollution or contamination. The consultation period for version four began in September 2009, and is hosted through an on-line forum.[22] There is no mention of additional carbon standards to be included. Water use, however, appears to be the newest addition to the standard.

From a practical viewpoint, the emergence of any new standard, public or private, will tend to have several effects:

- Amplify existing inequalities: all standards will impose (direct and indirect) costs on businesses. In general, standards amplify existing inequalities among stakeholders and competing suppliers. Those with fewer assets, furthest from market, least efficient, and recent entrants, are the most likely losers while the larger, asset-rich, market incumbents, tend to do the best and are able to transfer the risks and costs of compliance to the weakest.

- Readjustment to supply chains, business models: standards provide conspicuous incentives to find new ways of conducting business, often incurring costs of learning and

implementation. This might mean some changes in sourcing, changes in contracting, and other elements of a company and even an industry's business model.

- Monitoring, Reporting, Verification (MRV) systems will need to be developed, tweaked, and realigned to enable seamless compliance at crucial points along the food supply chains.

2. IMPACT OF STANDARDS

2.1 PVS Experience in Developing Countries

PVS have also been widely discussed as posing a barrier to entry for small-scale producers, excluding many poor farmers from lucrative export markets. Many industry participants in producer countries argue that PVS are not *voluntary*, but are in practice *mandatory* for export horticulture. This is due to the use of PVS by almost all of the buyers, who are relatively few in number. Refusal to comply with these standards becomes a barrier to securing access to these buyers and their markets. Producers and exporters therefore worry that extra costs from including new standards for reducing carbon reduction in supply chains will increase the cost of entering the market without granting adequate compensatory benefits through improved market share, profitability, or security of trading relationships.

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A lot has been written on the experience of PVS in food supply chains lining consumers with producers in developing countries. There is a spectrum of experience from positive to negative, too abundant to cover here.[23] This section, instead, describes some of the methods by which PVS can have positive or negative impacts and how this wide range of experiences have relevance for carbon initiatives in the food system.

In Africa, trade and technology diffusion often lags behind the rest of the world. This means greater entrenched inefficiencies across the business landscape. There are of course many examples of good practice, but the wholesale uptake, and scalability, of best practice remains sub-optimal. Indeed, the newest donors to assist Africa are the Gates and Rockefeller Foundations through the Alliance for a Green Revolution in Africa (AGRA), which aims in part to address this issue.

Private standards have helped to re-assert the need for other agents in the supply chain to play a more active role in developing innovative ways to address missing institutions, lowering transaction costs, and solving market imperfections. For example, exporters can play a role in helping to overcome capital market failures by providing seeds and other inputs to farmers whose costs can be deducted from the harvested crop (thus the crop serves as collateral for the provision of credit). Exporters can provide extension services and technical expertise as well, to overcome the notorious weaknesses of public sector institutions in providing extension services.[24] These practical solutions have resulted in part from prompts provided by PVS.

There are numerous subtle ways in which trade in agricultural products benefits developing countries. Moving from subsistence farming to agriculture for export through longer, more complex, and diverse trade networks is beneficial to developing world farmers and their communities for several reasons:

- It allows farmers to diversify away from what their neighbours are growing. This reduces the 'feast and famine' cycles and price fluctuations for everyone in the locality – both those producing for export and those still producing for local markets. Reducing price fluctuation makes it easier to plan investments as the return will be less uncertain. And it vastly increases the potential number and geographical scope of buyers for produce. This should reduce demand fluctuation, which allows farmers to better estimate the income they will receive for their crop.
- Access to export markets increases the value of crops. For example, weight for weight, green beans are worth ten times more than maize. This increases local incomes.
- Increasing incomes allows a greater surplus to be reinvested in agricultural systems. This encourages the uptake of technologies to increase output or improve quality.
- Producing for export requires agricultural standards to be raised. This requires education and provides an incentive for governments and communities to invest in it. Encouraging education is likely to have many positive side benefits for communities.
- Export produce is more likely to require some form of processing to make it suitable for export (e.g., packaging). This adds value to the produce close to the point of production and provides more livelihoods and income than staple food produce.
- Trade rarely moves only in one direction; increased access to export markets is likely to increase access to imports. This may diversify local food markets, reducing price variability and aid technology transfer. Trade is one source (often the main source) of foreign exchange for developing world farmers. Without access to foreign exchange, countries cannot access imported products and technologies. Imports of capital products, which are not domestically manufactured, promote development and increases agricultu-ral incomes.

The net costs or challenges of this form of trade can be daunting, however. Despite the potential for win-win situations in this form of trade - with consumers gaining access to exotic and out-of-season products at affordable prices and growers gaining access to lucrative markets - the trading relationship is by no means automatic or easily obtainable. These costs are at the macro level in the form of public investments in standards agencies, upgraded skills required for management in agronomy and infrastructure development, and monitoring of trades. They are also at the micro level through producers and supply chains ensuring and demonstrating compliance in the form of investments in logistics, production, and marketing. In those cases where international development benefits can be demonstrated, there are opportunities to leverage development aid and technical assistance and other support, which can reduce total cost burdens, but also have their own costs through intervention into the private sector, such as cost escalation. This poses important questions in terms of long-term sustainability.

3. CARBON STANDARDS

Carbon is a relatively late and recent entrant into the PVS arena for the food system. It needs to be seen as part of a process change in the supply chain, not as a stand-alone factor. If carbon is to be a persistent concern and private businesses are to be assessed according to their carbon emissions, then PVS will likely help identify hotspots and, where possible, reduce emissions. Private sector responses will include redirecting food supply chains to lower carbon alternatives and might include opportunities to offset outside their supply chains. The best chances for success are if resulting new business models can bring about cost savings or more efficient, secure supply chains.

If carbon is to be a persistent concern and private businesses are to be assessed according to their carbon emissions, then PVS will likely help identify hotspots and, where possible, reduce emissions.

For the purposes of this paper, we are looking at all agricultural trade from developing countries, not just the niche products such as FairTrade or other conspicuous brands. It is crucial to note that for mainstream food products, PVS have been mostly used as business-to-business (B2B) toolkits that help facilitate trading relationships. These tend not to be consumer-facing in the same sense as niche certification schemes. Although these are developed in response to consumer concerns, they are not necessarily used as marketing tools or as a unique selling point to differentiate products (MacGregor *et al*, 2009). Until quite recently, when carbon became a consumer concern, the private sector had not seen competitive advantage in facing the consumer with such information on mainstream products.

A key question is whether standards are the right vehicle to achieve the necessary reductions in greenhouse gases (GHGs). According to the Worldwatch Institute Report, June 2009, "innovations in food production and land use that are ready to be scaled-up today could reduce greenhouse gas emissions equivalent to roughly 25 percent of global fossil fuel emissions and present the best opportunity to remove greenhouse gases already in the atmosphere." On the other hand, the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report has concluded that in the short term soil carbon sequestration (enhanced sinks) is the mechanism with the highest mitigation potential (89 percent).

A key question is whether standards are the right vehicle to achieve the necessary reductions in greenhouse gases (GHGs).

It is clear we should be willing to accept changes both in production and consumption of food production and land use as part of the global effort to increase mitigation of GHGs. With rising concern over carbon and new public laws being implemented in many countries, the food industry is looking to understand and limit its exposure. PVS are typically developed to address specific concerns and carbon is an interesting example of a concern to be addressed since it is a global negative externality and there is no one culprit.

Reducing carbon needs, however, should be seen as an important element of sustainable development. This paper has already discussed how increasing agricultural production and trade can have significant benefits to developing countries. An obvious concern is that reducing demand for imports in an attempt to reduce air-miles and carbon emissions may come at a high social and economic cost. Any publicly or privately set standard should take into account the potential trade-offs between environmental and development concerns.

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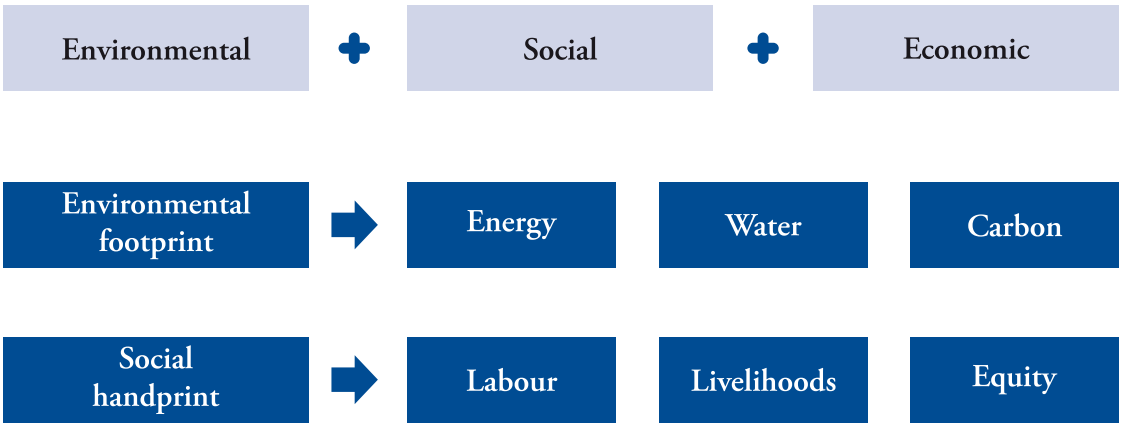
Figure 2. Exploring the Sustainable Development Equation



Source: MacGregor, 2009b.

When judging the suitability of standards as a vehicle for reducing carbon, the second important consideration is where carbon emissions take place and who should be held responsible for them.

When judging the suitability of standards as a vehicle for reducing carbon, the second important consideration is where carbon emissions take place and who should be held responsible for them. For example, for green beans grown in Kenya but consumed in the UK, which country is responsible for the carbon emis-sions? Should it be counted as part of Kenya's carbon emissions (0.2t per capita in 2008) or the UK's (9.2t per capita in 2008)?[25] Under the Kyoto Protocol model, production outsourced to outside its borders counts as reductions in a country's total emissions, even though the same level of end consumption is maintained. This "shaky arithmetic" has been identified as a weakness,[26] which ultimately provides incentives for high emission countries to outsource production to lower emission countries. The fact that this might lead to more production, and hence jobs, technology transfer, and multipliers for developing nations needs to be factored into the discussion. In this way, we can foresee a possible increase in demand for carbon labelling by the private sector as consumers are wary of more producers outsourcing their production abroad to avoid caps on emissions in their domestic production areas. This would not reduce carbon but increase it as the amount of transport increases.

Whether outsourcing production would really result in increases in emissions is a question we address later in the paper, but a primary concern is that by reducing demand for imports (particularly in agriculture) from developing countries we place the burden of reducing emissions unfairly on to them. This would be against the climate change convention's recognition of global inequity in responsibility for dealing with climate change. The carbon issue needs to be seen in light of the Kyoto Protocol's identification of clear and differentiated responsibilities for developed and developing nations. Developing countries are responsible for less than 15 percent of historical carbon emissions and currently emit far less per capita than developed nations (the poorest are just 2 percent of those in the US) and so should not be expected to suffer greater costs from policies aimed at curbing emissions, e.g. reducing demand for products grown in developing countries if they prove to be higher in carbon intensity. According to the idea of "ecological space", a concept that is defined earlier in the paper, it could be argued that the

A primary concern is that by reducing demand for imports (particularly in agriculture) from developing countries weplace the burden of re-ducing emissions unfairly on to them.

relatively low contribution of emissions from developing countries should allow them the freedom to engage in non-restrictive economic development.

In light of UK citizen and consumer concern over climate change, public authorities are taking action through the Climate Change Act 2008, which includes the Carbon Reduction Commitment, a mandatory climate-change and energy-saving scheme. The private sector is also taking action through, for instance, the ClimateTrust. Still, there remains a question over whether there is sufficient evidence for a public regulation approach to carbon emissions in the food supply chain or if we should view this as an example where private standards are better suited to helping provide information and ways-of-working to help design future public policy.

Nevertheless, several governments are addressing climate concerns through label-based initiatives.

A. Japan is aiming to label 30 products by the end of 2009 in line with Fukuda's Cool Earth Initiative.[27] This scheme, drawn up by Japan's trade ministry, offers a uniform method of labelling carbon emissions to avoid fears among some firms that their competitors may use in-house calculations and produce the lowest possible emissions data. The labels will provide detailed breakdowns of each product's carbon footprint during manufacturing, distribution, and disposal.

B. The EU has implemented an action plan on sustainable consumption, production, and industry,[28] which includes plans for displaying information on environmental and energy production and performance. These schemes are not limited to food, but are expected to make carbon savings along all supply chains.

3.1 Who Wants These Standards?

Consumers would appear to have some willingness to pay (without compulsion) to reduce carbon emissions.[29] This willingness to pay, however, may only be present for certain visible perceived high carbon products, for example flights and domestic energy. Every survey completed reports high levels of consumer concern on environmental issues, but at the supermarket check-out this rarely appears to be the case. When there is a lack of clear public legislation on a subject it is common for vocal consumer concerns to be turned into labels or standards. In the food sector, this remains a driver for many PVS around carbon.

The UK-based think-tank Forum for the Future found in 2008 that "carbon labelling every product is not a realistic or indeed desirable goal," especially within the limited window of opportunity for addressing climate change. There is, however, value in a carbon label when it gives the consumer a genuine choice among a range of similar products in a category, rather than simply being 'for information.' If only one firm's product in a category has a carbon label, it is unclear how this informs better decision-making by consumers. Likewise, if consumers are trying to balance their carbon emissions across a range of purchases, it will be useful for their scope of choices to carry information. Currently, we remain a long way from such a situation. Consumers risk being underwhelmed by information or confused, both of which could lead to consumer mistrust in the label and ultimately the product.

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Government, businesses, and other consumer-facing organisations must keep returning to the

question: "What do we actually want consumers to do?". In the event that developed world governments would ever choose to impose and enforce personal carbon allowances on citizens, which were required to purchase goods that would have varying levels of embedded carbon, the system would gain significant demand from consumers. Low carbon products would allow individuals to consume more for their fixed carbon ration, but all products would need to report on their carbon emissions to a standardized and accepted metric.

Retailers have an incentive to create supply chain management systems that address carbon issues in advance of expected government legislation to make such systems a legal requirement. Early adoption of such systems may well produce first-mover advantage over competitors in the longer-term. Retailers would clearly like to be able to recoup some of the costs associated with implementing such a system from the consumer. However, if they are to remain competitive in the short term against their non-adopting competitors, recouping the costs of the system from consumers is dependent on consumers' willingness to either pay for a premium, or find ways of streamlining costs from their supply chains. Plus, emerging consumer preferences reported in surveys include demanding to know more about the carbon emissions associated with their purchases, which provides a conspicuous incentive to provide some relevant consumer-facing information.

Retailers have an incentive to create supply chain management systems that address carbon issues in advance of expected government legislation to make such systems a legal requirement.

Governments would benefit from a widespread carbon standard as it raises awareness with consumers (voters) of the carbon implications of their purchases. If governments find themselves in a position to compel their electorates to emit less carbon in order to comply with international agreements (such as through personal carbon allowances), the required legislation would be easier to implement if the historic data generated by such a management system were already in place. In addition, such moves may be more popular if consumers have already made some movement towards a preference for low carbon products themselves.

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3.2 What Might a Carbon Standard Look Like?

Drawing from the literature and recent experience (Bolwig and Gibbon, 2009; MacGregor *et al* 2009), a carbon standard should encompass some of the following design characteristics:

- Provide a uniform way of calculating the embedded carbon;
- Offer a universal and independent application to all products regardless of their method or location of production;
- Account for a majority of embedded carbon within products; and
- Be simple (and by extension cost-effective) enough to be practically implemented.

Furthermore, it should include some of the following impact characteristics:

- Not favour certain production processes.
- Be recognised and trusted by stakeholders in the industry and customers.
- Facilitate monitoring, reporting and verifying. In particular, a standard should be auditable and a system must be in place so that calculations of embedded carbon can be independently verified to discourage 'cheating'. An independent body would have to uphold the standard and monitor participants to this end. Furthermore, this body has

to have sufficient power to punish offenders in order to ensure that compliance with the standard is known to be more rewarding than cheating.
- Include better market choices for all supply chain participants.
- Reward firms appropriately through competition. A carbon standard would allow consumers and intermediate processors to include embedded carbon as one of the variables by which they make market choices. This allows producers and firms in the supply chain to compete on the basis of embedded carbon. In the event that consumers are prepared to pay a premium for products with low embedded carbon, this should reward firms who lower their carbon emissions.
- Reducing emissions rids the market of the worst offenders and identifies hotspots where change can be made.
- Raise awareness of the cost of carbon with consumers. By attaching a premium, we implicitly value carbon, and since agricultural products are consumed on a daily basis, this raises awareness of the cost of carbon with consumers. It also has the potential to key into carbon markets, enriching them and improving their function.

3.3 Examples of Carbon Standards

Large retailers announce grand plans to identify carbon throughout their stores but are sluggish to deliver. Consumers, when surveyed, say they shop to reduce carbon, but often fail to do so in practice. Life cycle analysts claim to be able to assess accurately the level of embedded carbon within a given product, but such assessments are limited by time, labour, and scientific constraints.

A cynical person might infer that everyone wants, even needs, to be seen to be contributing to the latest global environmental threat of climate change. Large retailers announce grand plans to identify carbon throughout their stores but are sluggish to deliver. Consumers, when surveyed, say they shop to reduce carbon, but often fail to do so in practice. Life cycle analysts claim to be able to assess accurately the level of embedded carbon within a given product, but such assessments are limited by time, labour, and scientific constraints. We are currently unable to hold the existing carbon standards and labels up to the 'ideal' design and impact characteristics above. These are still evolving and best practices are being formulated.

In light of this, the expected future development is a push towards conspicuous consumer-facing labels. Here are some of the more prominent examples:

1. BSI PAS 2050

British Standards Institute's PAS 2050 (Publically Available Specification) is a set of guidelines for an appropriate level of analysis of a CO2 lifecycle assessment. While produced by the British Standards Institute (BSI), it is not a legally binding British or European standard. PAS 2050 is intended as either a business-to-business (B2B) standard or a business-to-consumer (B2C) standard and it is the methodology used by the Carbon Label Company (see below). This defines whether the standard is "cradle-to-gate" and therefore does not consider emissions arising from the use of the product. It differs from a "cradle-to-grave" approach, which accounts for emissions from use and disposal.

By complying with the specification of a respected standard institute, a firm increases the confidence its customers have that the assessment of embedded carbon is correct. This confidence is increased further if the specification is widely used and becomes an industry standard. Like many technologies, there may be room for only one standard in an industry; once one standard is clearly dominant, competing standards may fall into disuse. Currently, PAS 2050 fills this role and it is championed by those stakeholders involved in its development.

Complying with PAS 2050 would be considerably cheaper for firms if a large proportion of their input products are already compliant with this specification. As such, should a firm wish to comply with this specification, it would benefit from its suppliers also being compliant. Compliance by retailers, rather than compliance by initial producers, is most likely to promote a wide uptake of the standard.

PAS 2050 includes guidance on a number of areas of carbon accounting including:

- The coefficients that should be used for comparing one GHG against another by converting all emissions into CO2 equivalent units (CO2e).
- The proportion of embedded carbon that should be covered in the assessment (at least 95 percent).
- How carbon from biogenic (non-fossil) sources should be treated. Emissions from biogenic carbon sources (biofuels) are excluded; however, the embedded carbon (fossil fuel input for example) is included.
- How land use change should be treated. Carbon released is assigned to the firm's production over the next 20 years and requires a 'worst case scenario' to be used if land use changes are not known.
- Soil carbon change is currently excluded from the specification but may be included in future revisions.
- GHG emissions from storage of a product should be included.
- Offsetting may not be used to alter the embedded carbon of a product.

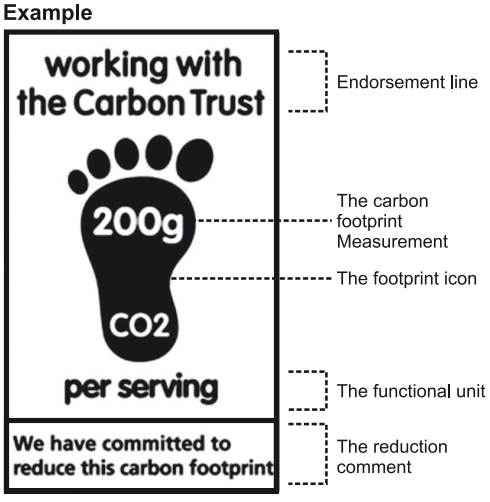
PAS 2050 is very specific about what should and should not be included in a life-cycle assessment. It tends to exclude emissions that would be too technically difficult to assess – for example, soil carbon and capital goods – but notes that these may be included in future revisions of the standard. This will prevent companies from lowering their published carbon footprint through some existing mechanism. For example, companies cannot reduce embedded emissions from energy by paying a renewable energy fee for grid-sourced energy, nor may they offset carbon emissions. This means that lowering reported embedded carbon will mean changing practices within the boundary of the firm itself, rather than by paying for them to be changed elsewhere.

2. Carbon Reduction Label, UK

The Carbon Label Company was set up by the Carbon Trust in 2007 to run the Carbon Trust's product standard. This standard is intended to function both as a business-to-business (B2B) and business-to-customer (B2C) standard. The company aims to measure, certify, reduce and communicate the life cycle green house gas emissions of their products.

The company uses a standard carbon label:

Figure 3. Carbon Trust Label



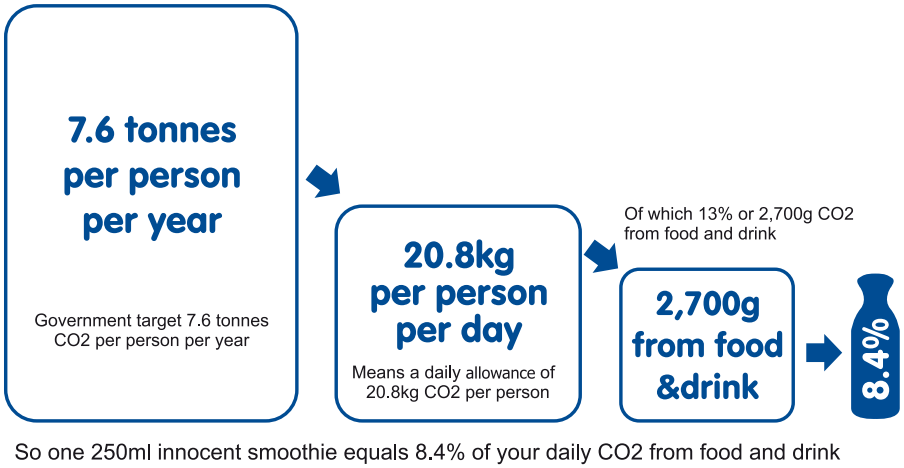
This details the quantity of embedded CO2e in the product, as well as a functional unit, like, for example "per serving" for food, or "per wash" for cleaners. The methodology used to calculate this carbon is PAS 2050 (see above). In addition to calculating embedded carbon using a standard methodology, firms who wish to use the Carbon Trust's standard must commit to reducing the footprint of the product over the two years following certification, or they will risk losing the right to use the label.

Firms and products using this standard include:

- Walkers (crisps);
- Innocent (fruit and vegetable smoothies);
- Cadbury (chocolate);
- Halifax (web saver account);
- Marshalls, paving products (2500 products); and
- Tesco's own brand range of biological laundry detergent, orange juice, light bulbs, and potatoes.

The results were communicated to consumers in a variety of ways, for instance through a carbon footprint label on packets of Walkers Crisps or online as in the case of Innocent, which informed consumers that one 250ml Innocent Smoothie equals 8 percent of your daily CO2 from food and drink.

Figure 4. The Innocent Smoothie Label



Source: Innocent, http://www.innocentdrinks.co.uk/us/ethics/resource_efficient/a_CO2_allowance/

3. Tesco, UK

Tesco is the market leader in the UK grocery sector with a one-third market share and its own PVS, Nature's Choice. This PVS is farm-based and seeks to "ensure that our top quality fresh produce comes from growers who use good agricultural practices, operate in an environmentally responsible way and with proper regard for the health and well being of their staff."[30] It does not include carbon assessments.

In January 2007, it announced a plan to measure the carbon in all the product lines sold through its stores.[31] In his speech, CEO Terry Leahy said "I am determined that Tesco should be a leader in helping to create a low-carbon economy … [but] I do not underestimate the task."[32]

Tesco was part of the initial trial of the Carbon Label Company's standard and included four types of product: potatoes, light bulbs, detergent, and orange juice. Since then, it has expanded the range of products that are included under this labelling system to 100 products.

Its carbon indicators are regularly published[33] showing the carbon footprint per functional unit in grams, as well as estimates for the distribution of these carbon emissions at key nodes along the supply chain – production, distribution, retail store, consumer use, and waste management.

Table 1. Estimates of Carbon Emission Distribution along the Supply Chain, for Four Products sold by Tesco, 2009

Category and Product	Carbon Footprint (C02e gram/ unit)	Carbon Footprint Broken Down into Lifecycle Stages (%)				
		Production	Distribution	Store	Use	End of Life Waste Management
Tesco Non Biological Liquid Wash Detergent	700g per wash	17%	0.2%	1%	73%	9%
Tesco 100% Pure Squeezed Orange Juice	360g per 250ml	91%	1%	7%	0.3%	1%
60W Pearl Light bulb	34kg per 1000 hrs of use	1%	<0.1%	<0.1%	99%	<0.1%
King Edwards potatoes (2.5 kg)	160g per 250g serving	33%	1%	3%	56%	7%

Source: Tesco, 2009.

There are strong commonalities among product categories for carbon emissions and distribution along the supply chain. This provides opportunities to create common carbon emissions ratings for product categories with far fewer variables. For potatoes, these variables appear to have higher emissions for the production for the organic product and lower in consumer use. These initial findings are being built upon, but harbour the possibility for entire store coverage in the next five years.

Table 2. Estimates of Carbon Emission Distribution along the Supply Chain, for Four Types of Potato sold By Tesco, 2009

Category and Product	Carbon Footprint (C02e gram/ unit)	Carbon Footprint broken down into Lifecycle Stages (%)				
		Production	Distribution	Store	Use	End of Life Waste Management
King Edwards (2.5 kg)	160g per 250g serving	33%	1%	3%	56%	7%
Anglian New (2.5 kg)	140g per 250g serving	34%	1%	3%	58%	4%
Organic New (1.5 kg)	160g per 250g serving	40%	1%	4%	51%	4%
Organic Baby New (750 g)	140g per 250g serving	48%	1%	5%	41%	4%

Source: Tesco (2009). Our carbon label findings.
http://www.tesco.com/assets/greenerliving/content/documents/pdfs/carbon_label_findings.pdf

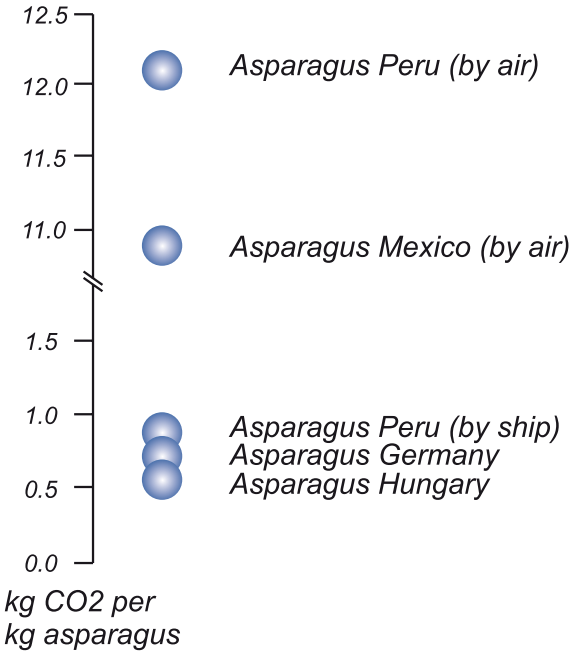
4. ClimaTop, Switzerland

Climatop is a Swiss not-for-profit organisation founded in late 2008.[34] The Approved ClimaTop label is awarded to products that have significantly (20 %+) lower embedded GHG emissions than comparable products. These products are referred to as "carbon champions" within their product group.[35] As such, it is a business-to-consumer standard. Comparisons between products are conducted with life cycle assessments (LCAs) using the Ecoinvent standard database[36] and checked by an independent reviewer. Once certified, a product may use the label for two years; after this point, it requires recertification.

In addition to having significantly lower embedded carbon, a product must also meet additional social and ethical standards of production. Currently there are a limited number of certified products (16 lines), of which only four are food items. The majority of certified products are produced for and sold by a single large retailer (Migros).

Figure 5. Climatop Label

Figure 6. Results from the LCA of Five Asparagus Products at Migros, 2008-9



Source: ClimaTop (2009).

This analysis concluded that transportation by air was a significant contributor to carbon emissions. However, there remains some dispute with the peer review for this product category; the majority of this asparagus was being imported on scheduled tourist and business flights. As such, carbon emissions attributable to it could be considerably lower. However, in most assortment areas, there are no significant product differences with regards to impact on the climate. For instance, among the apple juice products, they were unable to select any carbon champions.[37] Yet, the plan remains to expand the number of product categories and in turn climate labels.

5. Casino, France

The French supermarket chain Casino has launched a carbon labelling initiative on a selection of its private label products.[38] The labels, which the retailer aimed to have on 3,000 of its products by the end of 2008, show the carbon emissions related to a product's production and supply chain. The trial will show an on-pack traffic light carbon label, which highlights whether a product has a high (red), medium (amber), or low (green) carbon impact in terms of waste, packaging, and transport, covering 32 products as of September 2009.

Figure 7. Carbon Assessment of Pack of Eight Vanilla Yoghurts by Casino, 2008

Source: Casino.[39]

6. Wal-Mart, USA

In July 2009, Walmart announced the creation of its Sustainability Index initiative,[40] meant to measure the sustainability of its products in four areas: energy and climate, natural resources, material efficiency, and people and community.

The initiative is broken into three phases:

1. Supplier assessment. A survey of the company's 100,000 global suppliers with 15 questions[41] will commence with Walmart's "top-tier suppliers" in the United States completing the survey by 1 October 2009. Timelines for the remaining suppliers have not been announced.
2. Creation of a life cycle analysis database by a consortium of universities that will work with suppliers, retailers, government and nonprofits.
3. Delivering the information to the consumer on how products rank, possibly through a numeric score, colour code, or other label.

7. Air Freighted Labels, UK

In 2007, Tesco and Marks and Spencer committed to labelling all single-ingredient fresh produce that was transported by air to the UK. Labels displaying 'black airplanes' appeared on all fresh chilled produce. This was launched by Tesco in February 2007.

Figure 8. Air Freighted Label Used by Tesco and Marks and Spencer

Consumers, however, failed to react to these labels in the expected negative way. Sales are reported not to have dipped. Consumers reported a variety of responses, including actively seeking these labels assuming it meant "freshness" and owing to the provenance of the produce from Africa or developing countries. These labels are still being used in several supermarkets, but for information purposes now, rather than as a prominent signal demanding the consumer make a choice. These labels are, however, seen as pre-cursors for later carbon labelling initiatives.

8. Others include:

A. Bilan CO2 Leclerc, France: This recent start-up aims to provide information on a range of food products on kilograms of CO2 per kilogram of food, in the same way that food prices are displayed.

Figure 9. An Example of the Bilan CO2 Leclerc Label for Imported Green Beans

Source: http://www.jeconomisemaplanete.fr/

B. Cool label, Korea

Figure 10. CooL Label, Korea

Source: Kim (2008).

C. Climate Marking, Sweden[42]

D. Climate Conscious Label, USA[43]

E. Climate Declaration, Sweden (6 products)

F. Carbon Counted Carbon Label, Canada,

Many of these are fledgling, but all are expected to grow, and it is expected that other new entrants to join.

3.4 Calculating Carbon: Life Cycle Analysis

As mentioned in the beginning of this section, this increase in demand for carbon standards stems primarily from the fear that producers in developed countries will simply outsource their production to developing countries who are not burdened with emission caps. There is often the assumption that food and agriculture goods that are imported will automatically have a higher carbon footprint due to higher transport emissions. This assumption can often be inaccurate, however, as developing countries typically rely on less carbon intensive methods of agriculture, for example by using less fertiliser, mechanisation, and energy for heating. To calculate the true carbon cost of a good, those setting standards might rely on 'Life Cycle Analysis' to gain a more exact measurement.

To calculate the true carbon cost of a good, those setting standards might rely on 'Life Cycle Analysis' to gain a more exact measurement.

Life Cycle Analysis (LCA) aims to evaluate the contribution on impact categories such as global warming, acidification, etc. from the full industrial processes of producing a good. It seeks to compare the full range of environmental and social damages assignable to products and services in order to be able to choose the least burdensome one. A Life Cycle Impact Assessment can also be used for assessing hotspots and iden-tifying inefficiencies within supply chains and then making suggestions for improvements.

Life Cycle Analysis (LCA) aims to evaluate the contribution on impact categories such as global warming, acidification, etc. from the full industrial processes of producing a good.

Yet, while it can accurately measure impacts of a supply chain, it does not extend to the commercial elements of supply chains, such as dividing the energy consumed in producing and maintaining a truck among its lifetime of loads hauled. As a consequence, LCA is often criticised owing to the choice of boundaries, which affect the guidance an LCA can provide. For supermarkets, this limitation is key, as the inclusion of an indicator of emissions incurred during distribution from farm to store (included above by Tesco) is fraught with calculation issues (e.g., how to account for airfreight in the underbelly of a tourist aircraft without double-counting).

One advance might be economic input-output life cycle assessment (EIO-LCA), which seeks to incorporate fully commercial and technical aspects of cradle-to-grave (non-wasteful) supply chain systems. These must, however, rely on available data and are currently dependent on sector averages for its foundation.

Developing countries lack the skills and institutions to deal effectively with demands of LCA. Industry participants in developing countries are rarely actively involved in standards setting. It is clear that science and decision-making would certainly benefit from a more forensic approach to carbon, but until better data is available for all countries and processes in ways that do not exclude those smaller farmers with lower abilities to pay for such calculations, we remain dependent on available statistics and generalised inferences.

One of the first LCA conducted compared the production of green beans in sub-Saharan African production with that in the UK.[44] The analysis found strikingly similar energy use during the production process. As such, there are available resources to help craft emerging carbon standards in the measuring and in the process of identifying supply chain hotspots. For instance, the LCA within the EcoInvent Standard for agriculture covers seed growing, cultivation, harvesting of basic agricultural commodities, and differentiates between organic, integrated, extensive, and intensive production.[45] But thorny calculation issues prevail, such as dealing with land-use change and the use of secondary standardised data.[46]

International trade is another area where LCA shows its limitations. For example, an estimated 75 percent of fresh produce flown from East Africa to consumers in the UK travels in the spare capacity (or bellyhold) of tourist and business flights. The attribution of carbon emissions associated with this flight is a complex calculation. Attribution among passengers and cargo could be defined by the relative weights in tonnes, the relative prices paid, or the relative space taken up. Each element would attribute carbon differently. Add into this the complexities of including aviation emissions across the 30-year lifespan of each plane, the economics of the aviation industry's landing-slots, and aviation emissions currently omitted from the Kyoto Protocol. Research into an international levy on tourism for adaptation to climate change has shown the feasibility of economic incentive mechanisms in raising carbon efficiencies (Chambwera, 2008), but incorporating the equity issue remains beyond the capacity of existing LCA architecture (Chambwera and MacGregor, 2008)[47].

3.5 Other Emerging Standards

Development. The idea of creating a 'development-based standard' has been mooted many times in discussions between retailers and NGOs. While there is certainly value in examining the point of potential differences in products with a development story attached, the ability to craft a standard or a label has thus far proven elusive. It is clear that it would be difficult to ensure that there are genuine benefits and that any solution promotes upgraded benefits to producers in developing countries. Given that many small-scale farmers operate in the informal sector in rural parts of developing countries where there is little information available at a national level on livelihoods, the building blocks for a standard will need to be imported. It is expected that in the years ahead, however, there will likely be a re-focus on agricultural development in developing countries, as both a mitigation and adaptation issue. It is uncertain as to when a legitimate development standard will be crafted and, also importantly, whether this would promote or hinder trade.

There is increasing interest in folding indicators on carbon and development into a meta-standard for sustainable development (the so-called 'carbon plus' standards). The difficulties, however, in measuring and trading off among the environmental footprint and the social handprints associated with the food system and specific supply chains, render this scientifically unlikely.

Biofuels. Agriculture also has the potential to be part of various mitigation strategies. These include the growing of "energy crops" that can be processed into fuel substitutes (biofuels) or burnt to provide heating (biomass). These crops take up the carbon they release upon combustion as they grow, and, as such, can be considered a short-cycle carbon crop. While it is often claimed that such fuels are carbon neutral, in reality they have other energy inputs during production from fossil fuels, as well having indirect land-use implications, such as displacing food crops onto forest land. This means that the net embedded carbon in some biofuels may be positive rather than neutral. It is possible that the total embedded carbon within a biofuel product is greater than an equivalent fossil fuel hydrocarbon. If this is the case, there is no climate change mitigation justification for the fuel.

Standards applied to agricultural products exist not only for food products. A taskforce has been coordinated by the International Biofuels Forum to look into the practicalities of producing International Biofuels Standards. This is primarily due to differences in the chemical makeup of biofuels in the three leading members of the Forum (US, EU, and Brazil), rather than an environmental focus. All three are producing biofuel products but these are not always compatible with the prevailing technologies (engine configurations) in the

other countries. The aim of this standard is to facilitate trade in biofuels outside of the home markets of the Forum's members.

As noted above, it is possible for biofuels to have a greater embedded carbon than the fossil fuel equivalent that they look to replace. The White Paper on Internationally Compatible Biofuel Standards interestingly does not mention climate change in its 94 pages. A standard for measuring the embedded carbon within different biofuel products would be a useful addition to better allow the assessment of green credentials of each product as well.

International carbon standards and trading. Recently, climate negotiators have placed a renewed focus on the impact of climate change in developing countries. This is drawing attention to production emissions and mitigation potential and could in the future include a focus on soil carbon and the land-use practices that determine carbon content of soils (the potential of carbon storage in soil is now given more attention in international discussions). Soil locks carbon in its structure because carbon is a significant component (57 percent by weight) of organic soil matter. This carbon is released by microbial activity in the soil but is refreshed by plant matter decomposing into the soil. The speed at which carbon is accumulated and loss from the soil determines the stock level of carbon at any time. These flows are affected by many factors, including water regime and farming practices e.g. tilling soil exposes it to air and increases microbial activity, which breaks down the solid organic carbon into carbon dioxide more rapidly, thereby reducing the stock level of carbon. Considerable amounts of agricultural land in the world have been tilled and therefore have lower levels of stock carbon than they could have. If methods are employed to reduce the rate at which these degraded soils lose carbon, they have the potential to act as a carbon sink as soils adjust to higher stock levels of carbon. The role of carbon standards in the future is unclear. Whether carbon standards should or could be deemed an acceptable tool to provide incentives for landuse change in developing countries is an important question.

Whether carbon standards should or could be deemed an acceptable tool to provide incentives for land-use change in developing countries is an important question.

3.6 Potential for Carbon Standards to Impact on Trade

There is concern over how climate change issues could interfere with trade by favouring certain processes or countries. A clause in the US Clean Energy and Security Act passed by the US House of Representatives included wording that – if the bill were made law – would allow the president to impose a carbon tariff on imported products after 2012 if industrial carbon emissions from the country of export are higher than those in the US. This hints at the potential to use carbon as a trade tool.

In the food industry, the private sector has a track record of being ahead of the public sector in taking action over issues of public concern. For this reason, trends in carbon labelling are likely to be led by the private sector. For carbon, labels and standards are an increasingly conspicuous example of a PVS. These carbon standards build upon best practice in PVS but crucially extend the concept to consumers through labels, and as such, are extensions of PVS. Any such extension can result in trade issues and deserves to be monitored for use as a non-tariff barrier.

4. KEY CONCLUSIONS AND POLICY RECOMMENDATIONS

1. **Carbon footprints can play a role in reducing carbon dioxide emissions in the food systems. Whether this is a problem for developing country exports is unclear.**

This issue revolves around whether public standards are developed in ways that promote sustainable development or ease of measurement or maximises some other benefit.

If private standards are developed in industries and supply chains already promote sustainable development, then environmental benefits are not raised while costs increase for exporters.

2. **Clarify the roles of private standards and public legislation in addressing carbon concerns in the food system.**

Both private and public policies currently influence trade and will be integral to achieving trade in the future that supports global low-carbon growth. Leadership on the carbon issue is unclear, though, with a mix of initiatives currently addressing different elements of the issue. We feel carbon agreements and standards harbour the opportunity to be leveraged for genuine progress on the Millennium Development Goals, poverty alleviation, technology transfer, equity, and sustainable development.

Currently, private standards play an important role in optimizing supply chains in the food system. Can these PVS be extended to deal with a global public bad, such as climate change? It is clear that carbon could be reduced in some supply chains and could even be optimised, with a serious upheaval in our existing food system. But there are concerns over the cost it would have on consumer choices, sustainable development, and the efficiency and integrity of the food system.

Privatisation of public legislation needs to be recognised. In food, the private sector is often made responsible for implementing public legislation. It is crucial that a better understanding of the operations of the private food and agriculture sectors is achieved in order to better design public policy and to ensure that trading rules are not adversely interfered with. To achieve this, the interaction between public and private legislation needs to be more clearly understood.

3. **PVS experience in developing export horticulture needs to be learned and ultimately the underlying principles scaled up widely.**

For developing countries, there is a small window of opportunity to ensure that carbon can be appropriately controlled in ways that do not limit (and even stimulate) economic growth in those nations. This window exists because of the ongoing evolution of PVS in food and the looming discussions on global and national legislation over carbon emissions.

In our increasingly globalised world, we expect global trade to accelerate, particularly as global solutions are being found collectively for climate and poverty alleviation. This would deepen the potential impact of introducing new standards. These voluntary standards, as well as the ones enforced under trade agreement's legislation, should also be formulated to maximise positive spillovers into other industries.

Lessons can be learned from the evolution of carbon-concerned PVS from food to other products, though food is a standard bearer in trade from developing countries to developed. The methods that proved most successful in pilot schemes should be replicated and previous mistakes should be avoided. If the evolution of carbon as a public and private standard is not managed appropriately, the cascade into other supply chains and industrial sectors is expected.

4. Analysis of carbon emissions provides a lens to analyse the wider issues affecting sustainable development in agricultural sectors in developing countries.

When setting public standards, governments and bilateral or multilateral trade agreements should aim to identify what developing countries' agricultural sectors really need to achieve low-carbon growth nationally and to contribute to global targets. There is widespread recognition of the potential for low-carbon agriculture export-led growth. However, developing countries need help in this regard to ensure positive uptake of any measure in the agricultural sector. The wider sector needs transfer of productive skills, good agricultural practices, and marketing skills. It is clear that PVS and even Carbon+ standards can deliver for some stakeholders. In addition, on the low-carbon growth side, there is a need for access to locally adapted appropriate technologies. Moreover, in the future, agriculture is likely to be central to the climate agenda with expected global progress on mechanisms and principles over REDD (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries), soil carbon, agriculture, and development linkages.

Designing compliance criteria that are not financially burdensome for developing countries, thereby limiting market access, is a crucial part of a successful trade agreement. Existing compliance systems should be used to keep the cost and administration burden low. Support will be needed to ensure less asset-rich industry participants are not excluded. Evidence from other PVS illustrates this principle. As the International Institute for Environment and Development (IIED) and the Natural Resources Institute (NRI) argue, "it is significant that small-scale farmers who are not well supported by their exporter struggled with GLOBALGAP, and evidence from Kenya has shown that they either fail to certify or drop out of the compliance system within one to two years of first being certified" (2009:69).

The limitations to public trade rules enforced by these agreements in defining market access for developing nations should be recognised however. Private and public sector roles, particularly around food, must be understood, re-assessed, and/or integrated. Protectionism potential (e.g. US and low-carbon growth) must also be viewed through a global equity lens, accounting for the cost and benefit implications to every country and not just the individual rules or targets examined.

5. Consumer-facing carbon labels and carbon PVS cannot limit emissions effectively without appropriately priced environmental externalities.

Consumer reaction to labels in general is low and we expect this to be the case for carbon labels as well. Indeed, the case of consumers viewing 'air freight' labels as indicating freshness is a good example of how messages are interpreted by consumers in unexpected ways. In order to be a more effective vehicle for limiting emissions through consumption choices, carbon labels will require more adequate governance over carbon dioxide emissions. Here, for instance, the true pricing of externalities through, say, a global carbon market would be one additional governance element that would promote the significance of a carbon label on food products. Food is about far more than consumption choices and the transportation taken to buy food is a significant carbon issue that remains un-captured in labels.

6. The potential for private sector buyers to insist on contractual reductions in carbon for a product harbour the greatest potential for actual carbon reductions in the food system.

The enabling system that would need to be in place for this to occur would include a carbon price embedded in global supply chains. Carbon dioxide emissions would also need to be measurable, and as we have pointed out, currently, there is not a universally trusted methodology.

NOTES

1 For reviews of the different schemes, see Bolwig and Gibbon, 2009; Brenton, Edwards-Jones and Jensen, 2008.

2 It is noted here the public forums used by GLOBALGAP in 2007 might provide an example of a trend to more inclusive decision-making by standards setters.

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4 MacGregor et al, 2009.

5 See example of an outgrower system developed by Homegrown in Kenya. Graffham et al 2007.

6 For example, green beans are produced in the UK during May to October, Kenya during September to January, and Egypt during January to April.

7 Such as GLOBALGAP or Field-to-Fork or Nature's Choice.

8 Such as Rainforest Alliance or Fairtrade.

9 In 2009, Tesco took its Nature's Choice retailer-specific PVS and bolted-on a consumer-facing front-end, called Nurture. In 2007, Marks and Spencer built its consumer-facing Plan A around its retailer-specific PVS, Field-to-Fork.

10 Such as GLOBALGAP.

11 Such as Marks and Spencer's Field-to-Fork or Tesco's Nature's Choice.

12 Borot et al 2009.

13 Homer, 2009a.

14 Borot et al, 2009.

15 IGD consumer research in Garcia Martinez and Poole, 2009:18.

16 Official Journal of the European Communities, 2002: 11.

17 GlobalGAP, 2007:8.

18 Garcia Martinez and Poole, 2009.

19 Bell et al, 2007.

20 Garcia and Martinez, 2009.

21 Graffham et al, 2009:24.

22 http://forum.globalgap.org/.

23 Borot et al, 2009.

24 Blackmore and MacGregor, 2009.

25 MacGregor et al, 2008.

26 Helm et al, 2007.

27 http://www.environmentalleader.com/2008/08/21/japanese-govt-launching-carbon-labeling-program/.

http://www.weforum.org/en/media/Latest%20Press%20Releases/PR_26jan_Japan.

28 http://ec.europa.eu/news/environment/080716_2_en.htm.

29 MacKerron et al, 2009.

30 http://www.tescofarming.com/tnc.asp.

31 Garside et al, 2007.

32 Leahy, 2007.

33 Tesco, 2009.

34 http://www.climatop.ch/.

35 Diethelm, 2009.

36 See http://www.ecoinvent.org/.

37 Diethelm, 2009. Labelling top runner products: Experience at Migros. Presentation at 'Communicating the carbon impact of products to customers', at the First PCF Word Summit 2009, Berlin, 26-27 February.

38 http://www.foodproductiondaily.com/Supply-Chain/French-retailer-in-green-labelling-initiative.

39 http://www.produits-casino.fr/spip.php?page=indice-carbone&id_article=1005&code_bdq=109.

40 See http://greenbiz.com/view-term/all/Sustainability%20Index.

41 See WalMart, 2009a. Sustainability Product Index: 15 Questions for Suppliers. WalMartStores.com. 1pp. http://walmartstores.com/download/3863.pdf.

42 http://www.krav.se/sv/Klimat.

43 http://www.climateconservancy.org/.

44 Jones, 2007 – this is fresh insights no. 3?

45 http://lca.jrc.ec.europa.eu/lcainfohub/database2.vm?dbid=119.

46 Kasterine and Vanzetti, 2009.

47 MacGregor et al, 2007.

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About the Platform

In 2008 the International Food & Agricultural Trade Policy Council (IPC) and the International Centre for Trade and Sustainable Development (ICTSD) launched The ICTSD-IPC Platform on Climate Change, Agriculture and Trade. This interdisciplinary platform of climate change, agricultural and trade experts seeks to promote increased policy coherence to ensure effective climate change mitigation and adaptation, food security and a more open and equitable global food system. Publications include:

- International Climate Change Negotiations and Agriculture. Policy Brief No.1, May 2009
- Greenhouse Gas Reduction Policies and Agriculture: Implications for Production Incentives and International Trade Disciplines. Issue Brief No.1, by D. Blandford and T. Josling, August 2009
- Climate Change and Developing Country Agriculture: An Overview of Expected Impacts, Adaptation and Mitigation Challenges and Funding Requirements. Issue Brief No.2 by J. Keane, S. Page, A. Kergna, and J. Kennan, December 2009
- Carbon Concerns: How Standards and Labelling Initiatives Must not Limit Agricultural Trade From Developing Countries. Issue Brief No.3, by J. MacGregor, May 2010
- The Role of International Trade in Climate Change Adaptation. Issue Brief No.4, by G. Nelson, A. Palazzo, C. Ringler, T. Susler, and M. Batka, December 2009
- Climate Change and China's Agricultural Sector: An Overview of Impacts, Adaptation and Mitigation. Issue Brief No.5 by J. Wang, J. Huang, and S. Rozelle, May 2010
- Agricultural Technologies for Climate Change Mitigation and Adaptation in Developing Countries: Policy Options for Innovation and Technology Diffusion. Issue Brief No.6 by T. Lybbert and D. Sumner, May 2010

About the Organizations

The International Centre for Trade and Sustainable Development was established in Geneva in September 1996 to contribute to a better understanding of development and environment concerns in the context of international trade. As an independent non-profit and non-governmental organization, ICTSD engages a broad range of actors in ongoing dialogue about trade and sustainable development. With a wide network of governmental, non-governmental and inter-governmental partners, ICTSD plays a unique systemic role as a provider of original, non-partisan reporting and facilitation services at the intersection of international trade and sustainable development. More information is available at www.ictsd.org.

The International Food & Agricultural Trade Policy Council promotes a more open and equitable global food system by pursuing pragmatic trade and development policies in food and agriculture to meet the world's growing needs. IPC convenes influential policymakers, agribusiness executives, farm leaders, and academics from developed and developing countries to clarify complex issues, build consensus, and advocate policies to decision-makers. More information on the organization and its membership can be found on our website: www.agritrade.org.