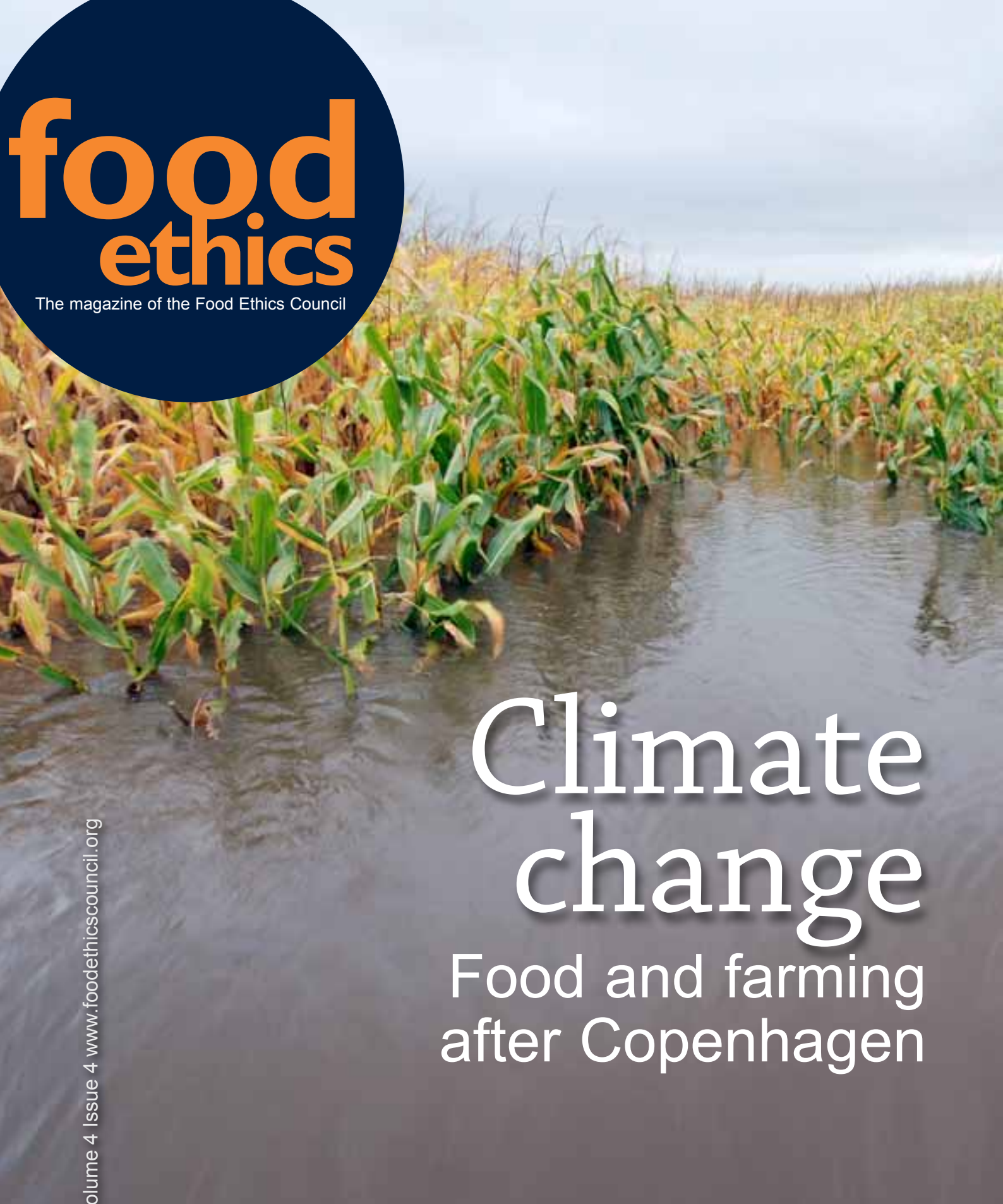
food ethics
The magazine of the Food Ethics Council



Climate change

Food and farming after Copenhagen

Winter 2009 Volume 4 Issue 4 www.foodethicscouncil.org

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FOOD ETHICS COUNCIL

Food Ethics, the magazine of the Food Ethics Council, seeks to challenge accepted opinion and spark fruitful debate about key issues and developments in food and farming. Distributed quarterly to subscribers, each issue features independent news, comment and analysis.

The Food Ethics Council challenges government, business and the public to tackle ethical issues in food and farming, providing research, analysis and tools to help. The views of contributors to this magazine are not necessarily those of the Food Ethics Council or its members.

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Design: Onneke van Waardenburg,
www.ondesign.eu.com

Printed by: Newman Thomson Limited, Burgess Hill.
Printed on 80% post-consumer recycled paper.

Produced with kind support from the Polden Puckham Charitable Foundation
ISSN 1753-9056

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The Food Ethics Council, registered charity number 1101885
Cover image: T. Lindenbaum

The politics of farming carbon

Farmers have always been weather watchers. Now they're the ones under scrutiny. While the outcome of this month's Copenhagen conference is uncertain, we can be sure agriculture will be more central than it has been in any previous round of climate talks.

The transformation is remarkable. Until recently, farming was seen to be at the receiving end of climate change and at the heart of efforts to adapt to changing weather patterns. Now agriculture is also targeted as a major source of greenhouse gas (GHG) emissions – about 30% of the global total – and a huge potential carbon sink.

Only some of farming's emissions are down to fossil fuel use. Much comes from cutting down forests to grow food, from churning up the soil and releasing the CO2 it had trapped, and from the front and back ends of animals.

At Copenhagen, forests and soil look set to cause most excitement. Forests are the focus of REDD (Reducing Emissions from Deforestation and Forest Degradation), a scheme introduced at the Bali climate conference in 2007. As Bruce Campbell (pp. 19-20) explains, the idea is to put a price on carbon saved by not chopping down forests, so the trees are worth more left standing than replaced with ranches or plantations.

The same logic behind REDD can apply to soil. According to Rattan Lal (pp. 11-13) restocking the world's soils with even a fraction of the carbon content we've stripped from them in recent decades could make a noteworthy dent in net GHG emissions. If carbon markets paid farmers the same price to sequester carbon in soil that they would need to pay geo-sequestration projects – it costs about €60/t to inject carbon into old oil fields – then this could prove a handy earner. Unlike burying carbon in rock, trapping it in the soil has the added benefit of improving the biological quality, fertility and productivity of land.

In effect, agriculture is a loophole in current carbon markets and, at Copenhagen, the pressure will be on negotiators to correct that. At one level it's a no-brainer: farming emits a lot of GHGs; allowing farmers to trade emissions could create an incentive to make major savings. But behind this tidy logic is a mess of winners and losers, politics, and real-world experience that suggests we should be careful what we wish for.

A carbon market that includes agriculture may be more rational than one that leaves it out, but how much should we rely on carbon markets to tackle climate change? They are the centrepiece of post-Kyoto efforts by governments, businesses and NGOs alike. Yet argue some critics, they may not be all they're cracked up to be.

Recent reports from The Corner House and Friends of the Earth both see close parallels with the derivatives trading that underpinned the financial crisis, where creating fictional commodities (in that case uncertainties and in this case emissions) gave birth to volatile, vulnerable and unsustainably complex markets. [1]

Aside from the threat this raises of a subprime-style carbon bubble, critics are also concerned that carbon markets simply won't work. The experience of Europe's Emissions Trading Scheme (ETS) - the largest such market in the world - is certainly inauspicious, skewing spending towards quick and cheap cuts, and funding projects that might have happened anyway. The incentive created by carbon markets is to find quick returns through low-cost efficiencies, one-off sequestration projects and innovative financial instruments that work around the profound economic restructuring needed to meet even optimistic GHG reduction targets.

Even if we hope carbon markets can work well, we should ask at what social price. The transaction costs associated with totting up and trading carbon mean that it's a game for big players. The prospect that marginal farmers and rural communities might benefit in any big way from REDD or a soil carbon market seems a bit like hoping pensioners would be the winners from the hedge fund boom.

If we really want solutions that help the world's poorest people, suggest Helena Paul (p.21) and Patrick Mulvany (p.24, we should listen to them. Policies on agriculture and the climate should respect small-scale low-input farming as a boon to biodiversity and sustainable livelihoods. Carbon markets, they argue, do quite the opposite.

The warning from these concerns over carbon trading is that the urgency of brokering a global agreement to tackle climate change should not blind us to the ethics of different options. When agreement is reached, whether at Copenhagen or after, the assumptions negotiators have made about how the world works will become the rules setting how it should.

Key among these are assumptions about the role and power of governments. Carbon trading was born in a world where businesses were expected to obey the law mainly if it paid. A stronger role for governments would see more direct intervention to decarbonise the economy and greater leadership to promote sustainable consumption. Markets are never the only game in town. ■

1. Lohmann, L. (2009) When markets are poison. The Corner House, Briefing 40.

2. Clifton, S-J. (2009) Dangerous obsession. Friends of the Earth, London.

Copenhagen climate change conference

The road to recovery or off the rails?

As up to fifteen thousand people descend on Copenhagen for what some consider the most important international meeting since 1945, DAMIAN RYAN asks how did we get to this point? Why here, why now? What is Copenhagen trying to achieve? What are the obstacles? And what implications, if any, does it have for the agriculture and food sectors?

It may surprise some to learn that international discussions on the issue go back some 30 years to the first World Climate Conference in 1979. This meeting initiated a process of international scientific debate culminating in the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988. The mandate of this new UN body was to provide governments with a scientifically robust and independent assessment of humanity's role in climate change. The IPCC's first assessment report, delivered in 1990, provided sufficient evidence to convince governments that collective international action was necessary. Within two years an international treaty – the UN Framework Convention on Climate Change (UNFCCC) – was drafted and signed at the Rio Earth Summit in 1992, entering into force two years later.

The UNFCCC

As the name suggests the UNFCCC established the basic architecture for how the international community would collectively address the problem of global warming. This included setting an "ultimate objective" of stablising greenhouse gas (GHG) concentrations "at a level that would prevent dangerous manmade interference with the climate system". This level was to be achieved in a timeframe that allowed ecosystems to naturally adapt, ensured food production was maintained, and allowed for sustainable economic development.

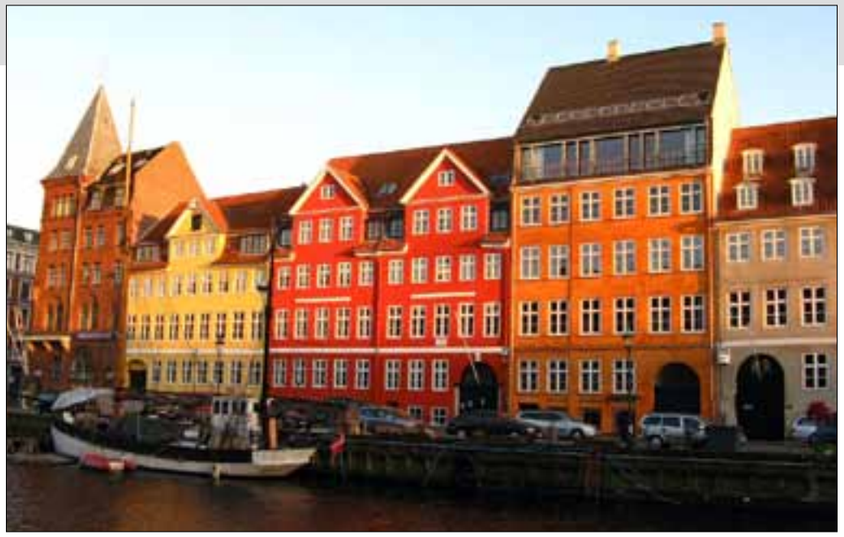
The Convention also established a formal distinction between developed and developing countries based on the principle of "common but differentiated responsibility". This required developed countries to take the lead in combating climate change due to their greater economic capabilities and their historic responsibility for existing atmospheric GHG levels. Under the Convention, these countries "committed" themselves to implementing policies and measures with a goal of reducing their emissions to 1990 levels by 2000. Crucially, this target was largely aspirational rather than binding. Developed countries also made commitments to provide financial and technological support to developing countries to assist their efforts in addressing climate change. No figures, however, were placed on what such support should be.

For their part, developing countries made more general commitments. These related to policies and measures covering such things as technology and scientific cooperation, education, sustainable management and adaptation (these commitments also applied to developed countries). The Convention, however, made it clear that the overriding priority for developing countries remained poverty reduction through sustainable development. Loosely translated, this meant that developing countries were allowed to increase their emissions until they were wealthy enough to take appropriate mitigation action. In the interim, emission reductions beyond those achieved through sustainable development policies, would need to be supported by developed country finance and technological support.

The Convention also put in place the administrative structure for managing the climate regime. This included a dedicated secretariat staffed by UN personnel and agreement to hold annual 'Conferences of the Parties' (or COPs), which would act as the decision making body of the Convention. Copenhagen will be the fifteenth conference and hence is often referred to as COP-15.

The Kyoto Protocol

Within a year of the UNFCCC coming into force the IPCC released its second report. This updated assessment made it clear that more ambitious action was needed to tackle climate change. A new negotiating mandate was therefore agreed at the first UNFCCC conference held in Berlin in 1995. Two years later this resulted in the adoption, in the Japanese city of Kyoto, of a new protocol to the Convention.



All hopes rest on Copenhagen NIOS

The Kyoto Protocol was an important advancement on the Convention. First and foremost it set binding emission targets for developed countries. The overarching target was a 5 percent reduction in emissions relative to 1990 levels over the five year period from 2008-2012. Individual country targets, however, ranged from -8 percent (for most European countries) up to +10 percent (for Iceland). The Protocol also created the framework for emissions trading and the creation of carbon offsets credits in developing countries. It also set out the specific gases to be reduced and the economic sectors in which reduction was to occur. With respect to agriculture this included animal methane production, manure management, rice cultivation, soil management and burning of agricultural residues. Gases covered, of relevance to agriculture, were carbon dioxide, methane, and nitrous oxide. Emissions associated with land-use change, for example switching from forestry to agricultural production and vice-versa, were also dealt with. All of these measures related to developed countries only.

Unlike the Convention's relatively rapid entry into force, the Protocol's ratification process was far more prolonged. In part this reflected the difficult follow-on negotiations dealing with the specific rules on how emission targets were to be met. These were not agreed until 2001 at the seventh UN climate conference in Marrakesh. The other principle obstacle was reaching the level of participation (55 percent of signatories) and emission coverage (55 percent of developed country emissions) necessary to trigger the Protocol's implementation. The Bush administration's decision not to ratify the Protocol in 2001 was a serious (although not unexpected) blow in this regard. In the end, it was Russia's ratification in 2005 that finally saw the treaty enter force – some eight years after it was signed.

The road to Copenhagen

From the beginning of negotiations on the Kyoto Protocol it was always recognized that further emission reduction commitments would need to be made beyond 2012. The Protocol therefore included a provision to initiate negotiations on a second commitment period seven years before the end of the first (that is, before December 2012). This trigger point was reached at the 2005 UN climate conference in Montreal. At this meeting, countries agreed to establish a negotiating process that would set new emission reduction commitments beyond 2012 for those developed countries that had ratified the Protocol.

It was clear by this time however, that developed country action alone – especially in the absence of the US – would be insufficient to deal with the rapidly growing levels of global emissions. The rise of China and other emerging economies as industrial power-houses had greatly altered the source and trajectory of emissions growth. Developing countries, however, were reluctant to agree to new negotiations, legitimately pointing out that developed countries still had far higher per capita emissions and unfulfilled obligations under the Convention and the Protocol (especially with respect to financial and technological support). Poverty reduction and sustainable economic development remained their overriding priorities. The US's lack of participation in Kyoto was also a sore point.

As a compromise, countries agreed to establish a non-negotiating 'Dialogue' in Montreal to discuss how developed and developing country action under the UNFCCC could be proved. The Dialogue dealt with issues relating to mitigation (of emissions), adaptation, technology and financing ,and was held in parallel sessions to the Protocol negotiations through 2006 and 2007.

At the same time as these formal UN efforts were underway, a range of other initiatives and events were also having an impact on the international climate change debate. The publication of the Stern Review in 2006, the release of Al Gore's 'Inconvenient Truth' and the IPCC's 4th Assessment Report of 2007, all added weight to growing calls for concerted and collective global action on climate change.

The 13th UN climate conference in Bali, Indonesia in 2007 was therefore viewed as a critical meeting for establishing a clear roadmap for delivering a new global climate deal beyond 2012. In this regard it largely delivered, with countries adopting the 'Bali Action Plan'. This established a formal negotiating process under the Convention, running in parallel with the existing Kyoto track. This new process was based around four main pillars of negotiation, relating to commitments on emission reductions (by both developed and developing countries), adaptation to climate impacts, technology (both the development and transfer of) and financing (for all of the above). Critically, it brought the US back to the negotiating table and also recognition from the major developing countries that they too needed to address their emissions growth. Countries agreed to conclude both negotiation tracks within two years, that is, by December 2009.

Great expectations: but what can Copenhagen really deliver?

Despite nearly two years of negotiations major divisions still exist between countries, largely along developed and developing country lines. Under the Convention, track officials face a 200-page negotiating text containing multiple options on each of the four pillars. This must be whittled down to a size manageable for ministers to understand and debate when they arrive in Copenhagen for their three days of actual face-to-face negotiation. It is worth bearing in mind that both the Convention and the Protocol are documents of less than 30-pages each, so negotiators have a considerable and unenviable task ahead of them.

The lack of progress has frustrated developing countries

The Protocol negotiations also face an uphill battle. Agreement on new medium-term (ithat is, to 2020) emission reduction targets, for example, was supposed to have been reached well in advance of Copenhagen. The offers currently on the table from some, but not all, developed countries generally fall short of the 25-40 percent cut by 2020 (from 1990 levels) suggested by the IPCC. The EU's 20-30 percent offer is an important exception. Work also remains on issues relating to emissions trading, carbon offsets, and other rules governing an amended Protocol. Developed countries have argued that these rules need to be agreed first, before the targets are set. While there is an obvious logic in this approach, the lack of progress has frustrated developing countries who feel that the industrialised countries are failing to deliver on their obligation to take the lead in combating climate change.

Critical to removing the obstacles to a successful deal in Copenhagen will be the positions and objectives of major developed and developing countries. The US is the lynchpin in this regard, since where it leads others (particularly China) will follow (or at least calibrate their own positions). But much depends on the domestic US legislative process. Climate and energy bills currently making their way through the US Congress will determine the mandate of the US delegation in Copenhagen. it is now almost inevitable that this legislation may not be passed before COP-15 gets underway and that as a consequence US negotiators will not be in a position to take any final decisions. In the absence of substantive US engagement it is highly unlikely that Copenhagen will be able to deliver anything other than a high-level political communiqué and agreement to recommence negotiations early in 2010.

But even if things did come together, what could we realistically expect from a successful Copenhagen conference? The most likely optimistic outcome is a broad framework agreement, light on detail but with enough substance to maintain political momentum for ongoing negotiations and to provide business with the confidence to continue investing in low-carbon technologies and services. Ideally, it would merge the outcomes of the two negotiating tracks into a new, single, coherent text, thereby removing much of the complexity stifling the current negotiations. The agreement would set a long-term (that is, 2050) global emission target (for example a 50-80 percent cut relative to 1990); agree short term (that is, 2020) targets for developed countries (efore example, a 25+ precent cut relative to 1990); require major developing countries to adopt low-carbon growth plans; create a framework for financing activities that reduced and avoided deforestation in developing countries; set up a mechanism for supporting adaptation to climate impacts particularly in least-developed countries; reform key elements of carbon markets in order to increase scale, efficiency and the level of private financing; create a mechanism or mandate for effectively sharing low-carbon and adaptation technologies; and include commitments from developed countries to collectively provide substantial public funding, in the tens of billions of dollars per annum, for supporting many of preceding activities.

Implications for agriculture and the food sector

So what does all this mean for the agriculture and food sectors? What we can say with certainty is that agricultural emissions in developed countries will definitely be covered (as they already are under Kyoto), either through an amended Protocol, or in a new 'Copenhagen Agreement'. How this impacts on agriculture in the UK, or indeed any other developed country, will depend on how individual governments choose to account for emissions from the sector. Ultimately, an agreement in Copenhagen will only provide the high-level architecture for achieving emission reductions. As with most regulation, the real action will occur at national and regional levels. Some countries, for example, may choose to include the agriculture sector in emissions trading schemes (for example New Zealand). Others may deal with the emissions using different forms of regulation or perhaps through subsidising the introduction of new technologies or practices.

By contrast, the agriculture sector in developing countries will almost certainly not face any mandatory emission limitations or reductions. The political sensitivity around food production and the importance of rural development in these economies makes such an idea unthinkable. Voluntary measures, which generate large volumes of carbon offset credits for sale, are however a possibility with the right carbon market reforms. The priority for many developing countries will be securing financial and technological support to allow their agricultural sectors to adapt to the impacts of climate change. The good news is that countries agree on the need to ensure sustainable agriculture production, and there appears to be support for greater developed-developing country cooperation in developing both mitigation and adaptation technologies for agriculture.

One cloud on the horizon is the prospect of so-called 'border tax adjustments' or 'carbon tariffs'. These measures are supposed to address 'carbon leakage' concerns and ensure a level playing field is maintained between countries with different GHG reduction regimes. Most economists generally agree that such concerns have little basis in practice. However, this spectre has been raised at high political levels in both France and the US in response to lobbying pressure from a number of industries. Developing countries have seen these proposals as disguised trade protectionist measures. Regardless of the motivation for their use, they have the potential to add yet another obstacle to securing a global climate deal, as well as cause headaches for the ongoing WTO trade talks.

An outcome of some kind

The prognosis for Copenhagen remains difficult. The chances of a fully fledged, signed, sealed and delivered agreement are certainly receding. But it will be politically unconscionable for negotiators to fail to produce some kind of tangible outcome. Growing scientific concerns about climate impacts, increasing business pressure for policy clarity and raising public expectations for 'green growth' will weigh heavily on ministers' minds. At a minimum, political leaders will be unable to leave Copenhagen without agreeing a timetable for continuing and concluding a deal in 2010. In short, while Copenhagen might not deliver the deal that was envisaged in Bali two years ago, it is certainly not the end of the story. Watch this space. ■

Damian Ryan is a Senior Analyst with The Climate Group's international policy team based in London. His current areas of work include: the Tony Blair-led 'Breaking the Climate Deadlock' project focused on building support for an ambitious new global climate treaty; and the Aviation Global Deal project, an airline-led initiative for reducing CO2 emissions from international aviation. Prior to joining The Climate Group, Damian worked for New Zealand's Ministry of Foreign Affairs & Trade, dealing with international climate change and World Trade Organisation (WTO) negotiations, including both the Nairobi and Bali climate change conferences.

Climate change and food security:
The case for agriculture at Copenhagen

Drawing on a recent report from the International Food policy Research Institute (IFPRI), GERALD NELSON assesses the importance of agricultural adaptation and mitigation in negotiations at Copenhagen and beyond.

Prior to 2009, agriculture was barely a blip on the radar of international climate change negotiators. Although nominally included in the mitigation requirements for developed countries under the Kyoto Protocol, the only significant mandatory emissions reduction programme, that of the EU, exempted farmers from caps. Agricultural emissions from developing countries were entirely excluded. And the Clean Development Mechanism, the programme that generates tradable greenhouse gas emissions in developing countries, essentially ignores agriculture.

Yet agriculture, broadly defined to include pastures and forests, accounts for about 30 percent of total annual greenhouse gas (GHG) emissions, and significant potential is claimed for both above and below ground sequestration of carbon. Furthermore, agricultural productivity is uniquely dependent on the local effects of climate - farmers choose crop varieties and management systems based on their performance under local temperature and precipitation regimes. As climate change occurs, farmers will incur substantial costs in adapting to the changes.

To prevent grave consequences for global food security, agriculture adaptation and mitigation must be a central part of the outcomes of the United Nations Framework Convention on Climate Change (UNFCCC) meetings in Copenhagen this December. Thanks to the efforts of key agricultural sector stakeholders, following the addition of REDD (Reducing Emissions from Deforestation and Forest Degradation) to the agenda, agriculture is now a part of the UNFCCC's negotiating text. However, the extent of its inclusion in any follow-up to the Kyoto Protocol remains uncertain. While there is a growing recognition of the need to support adaptation in developing countries, there is less consensus on whether financial transfers to developing countries to support mitigation efforts should be part of the outcomes.

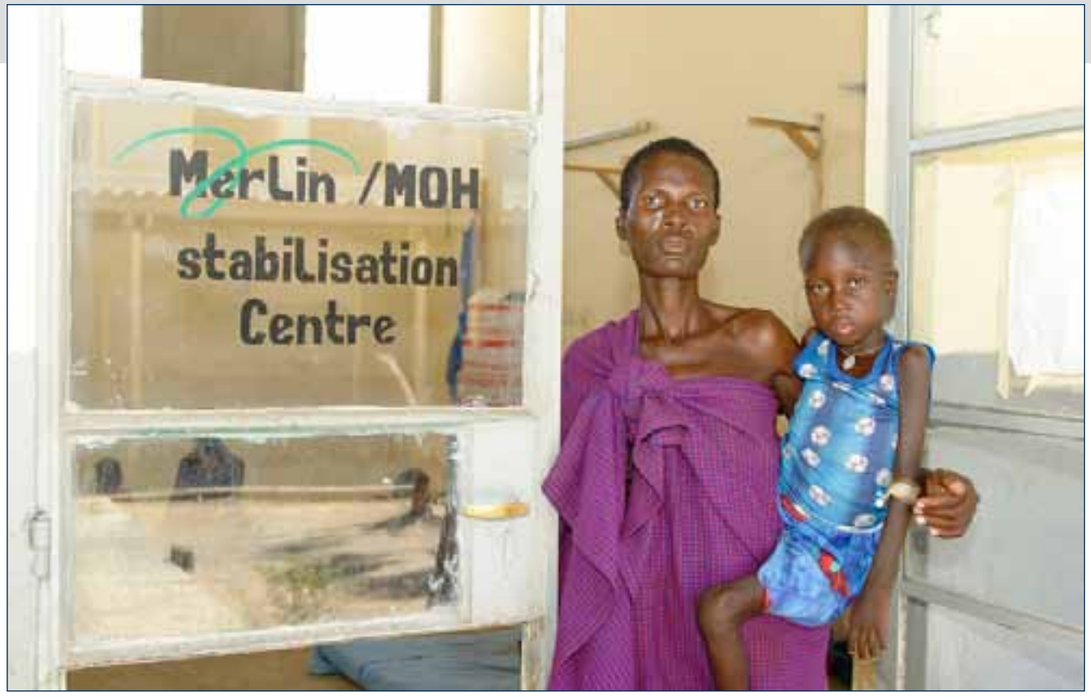
Even if a robust agreement emerges from the Copenhagen meetings, the challenges of combating climate change are daunting. The negative implications of climate change for food security, particularly in developing countries, as well as agriculture's contribution to emissions, must be addressed if we are to successfully minimize climate change's impact on poor people.

What it means for crops and health

A recent report from the International Food Policy Research Institute (IFPRI) - "Climate Change: Impact on Agriculture and Costs of Adaptation" - examines climate change's harmful impacts on crop production, food prices, calorie availability, and child malnutrition. For the first time, detailed modeling of crop growth under climate change is combined with insights from an extremely detailed global agriculture model, using two climate scenarios to simulate future climate. We at IFPRI used our estimate of the number of malnourished children less than five years old - which will increase by 25 million in 2050 under climate change - to determine the dollar amount that will be required annually for agricultural adaptation to avoid the worse impacts. The report focuses on three types of investments that will enhance agricultural productivity, and thus increase food availability and reduce malnutrition: agricultural research, irrigation expansion and efficiency investments, and rural roads.

Climate change will cause yield declines for the most important crops in developing countries, with bigger reductions than in industrialized countries. South Asia and Sub-Saharan Africa will be hardest hit. In developing countries as a whole, without new technology and adjustments by farmers, climate change will reduce average irrigated wheat yields in 2050 by around 30 percent, and irrigated rice yields will fall by 15 percent compared to a no-climate change scenario. These averages conceal great variation at individual locations, and depend on the climate model used.

Even without climate change, food prices will rise - driven by population and income growth and biofuels demand - but climate change exacerbates the extent of the increase. Prices will climb for the world's staple crops. Without climate change, 2050 wheat prices increase by almost 40 percent; climate change adds an additional 90 percent. Rice is projected to increase 60 percent without climate change and an additional 12 to 14 percent with climate change. 2050 maize prices are



Feeding station in Kenya

Amanda Rose

over 60 percent higher without climate change; climate change adds almost 35 percent more. Higher prices affect the poor directly because they spend a larger share of their income on food, and higher feed prices (i.e. for maize) will in turn result in higher meat prices. Without investments to offset the negative effects of climate change on agricultural productivity, climate change will cause a substantial fall in cereals consumption.

The potent combination of reduced crop yields and higher food prices threatens to reverse decades of progress on alleviating malnutrition in the developing world. Calorie availability in 2050 will not only be lower than in the no–climate-change scenario, it will actually decline relative to 2000 levels throughout the developing world. The decline in calorie availability leads to an increase in child malnutrition in 2050 by 20 percent - or 25 million additional children - relative to a world with no climate change.

Higher prices affect the poor directly because they spend a larger share of their income on food

Adaptation: how, and how much?

IFPRI estimates that avoiding the damaging impacts of climate change on human well-being will require aggressive agricultural productivity investments of over US$7 billion annually. The type of investment differs by region. In Sub-Saharan Africa, low road density hinders the ability of farmers to market their produce and purchase inputs; the study suggests road investments there are critical. In South and East Asia, investments in irrigation efficiency are key. In all regions of the developing world greater expenditures on agricultural research and extension are needed.

Substantial uncertainty remains about specific climate change impacts in various locations. Investing in improved and better-coordinated research, systematic global information and data collection and dissemination, and strengthened knowledge of local conditions that can be shared among areas with similar environments are critical to filling these knowledge gaps and improving resilience to climate change.

Global efforts to collect and disseminate data on the location-specific - or spatial - aspects of agriculture are woefully inadequate for the task at hand and need to be strengthened. Regular, repeated observations of the surface of the earth via remote sensing are essential, with systematic complementary ground-based observations. Funding for national statistical programmes should be increased so that they can fulfill the task of monitoring global change. Understanding agriculture and climate interactions well enough to support adaptation and mitigation activities based on land use requires major improvements in data collection, dissemination, and analysis.

In many parts of the world, national research and extension systems lack the human and physical resources to acquire information and translate it into locally useful products. More

and better trained scientists are needed, as well as the facilities to undertake the research. Partnerships with other national systems and international agricultural research centres are part of the solution. Collaboration among local farmers, input suppliers, traders, and consumer groups is also essential for effective development and dissemination of locally appropriate, cost-effective techniques, seeds and animals.

Within countries, extension programmes can play a key role in information sharing by transferring technology, facilitating interaction, building capacity among farmers, and encouraging farmers to form their own networks. Extension services that specifically address climate-change adaptation include disseminating locally-adapted seeds of drought-resistant crop varieties, teaching improved management systems, and gathering information to facilitate national research work. Farmer organisations can be an effective information-sharing mechanism and have the potential to provide cost-effective links between government efforts and farmer activities.

Agriculture's role in climate change mitigation

Globally, agriculture contributed about 14 percent of annual GHG emissions in 2000, and land-use change and forestry a further 19 percent. Agriculture contributes more than half of the world's emissions of nitrous oxide and methane. Overall, the developing world contributes about 50 percent of agricultural emissions and 80 percent of land-use change and forestry emissions, but the mix differs by region. For example, in Sub-Saharan Africa, agriculture's share of total emissions is 13 percent and land-use change and forestry contribute over 60 percent. In Asia, agriculture contributes 14 percent and land-use change and forestry contribute about 27 percent.

The formal inclusion of REDD in the climate change negotiations signals an appreciation of land use as a source of GHGs and initial findings of low-cost opportunities to reduce them. At this point, it is important to identify and support the most promising mitigation actions in farmers' fields and develop inexpensive monitoring mechanisms.

Agriculture has great potential to mitigate GHGs cost-effectively through improvements in agricultural technologies and management practices. These modifications include changing crop mixes to include more plants that are perennial or have deep root systems, using cultivation systems that leave residues and reduce tillage, and shifting land use to pasture and agroforestry. All of these actions help increase soil carbon stocks. Nitrous oxide and methane emissions can be reduced through changes in crop genetics and better management of irrigation, fertilizer use, and soils, as well as using different livestock species and improving feed practices. Again, information exchange is essential to spreading the word about these efforts.

One of the sticking points in the negotiations is the extent to which agricultural mitigation can be effectively MRVed, to use the acronym of the negotiations (monitoring, reporting and verification). Monitoring effectiveness is necessary to ensure that mitigation is actually being achieved, particularly if the actions are included in any new carbon offset programme. Promising technologies are in the works for tracking mitigation programme performance - microsatellites that provide frequent, high-resolution land cover imaging; inexpensive, standardized methods to test soil carbon; and simple assessment methods to quantify the effects of management technologies on methane and nitrous oxide emissions.

> It seems obvious that agriculture must play a key role in addressing climate change

A strong monitoring system will better enable innovative payment mechanisms that encourage agricultural mitigation. Payment mechanisms will have to deal with the fact that agriculture is different from other sources of GHGs, as the sources are individually small, geographically dispersed, and often unsupported by adequate infrastructure. Schemes that take advantage of these differences and can be scaled up beyond project-specific funding might include land retirement contracts, one-time payments for physical infrastructure investments that have long-term mitigation effects, and payments for institutional innovations that encourage mitigating behavior in common property resources. But there remain concerns that the measurement technologies and institutional innovations required are not yet ready for widespread use in a carbon offsets programme.

Copenhagen is only the beginning

To someone with strong roots in agriculture and an interest in the well being of the world's poor, it seems obvious that agriculture must play a key role in addressing climate change. However, the history of the negotiations and the relatively small role agriculture played in their early days suggests that now is not the time for the supporters of agriculture to be complacent. Now is the time to make the case persuasively at Copenhagen and beyond. ■

For more information on both documents go to www.ifpri.org

Climate Change: Impact on Agriculture and Costs of Adaptation.
Agriculture and Climate Change: An Agenda for Negotiation in Copenhagen

Dr. Gerald Nelson is a Senior Research Fellow at the International Food Policy Research Institute, where he leads the organization's climate change research.

Global food security and soil carbon sequestration

Professor RATTAN LAL explains why soil sequestration is so important for restoring soil quality, reducing CO2 emissions, increasing biodiversity and - above all - for global food security.

Global issues during the first decade of the 21st century include: (i) food-insecurity affecting 1.02 billion people mostly in South Asia/Pacific and Sub-Saharan Africa, (ii) soil degradation and desertification in the tropics and sub tropics with adverse impacts on agronomic productivity and environment quality, and (iii) energy demand leading to emissions of CO2 and other greenhouse gases (GHGs) and the attendant emphasis on biofuels which exacerbate food insecurity.

These inter-connected issues (coupled with the fact that the world's population is projected to increase to 9.2 billion by 2050) mutually reinforce one another by reducing net primary productivity (NPP), accentuating emissions of GHGs from terrestrial (soils and biota) biosphere and reducing ecosystem services, and decreasing income of the resource-poor farmers and land managers while exacerbating poverty and jeopardizing access to food. Consequently, the United Nations Millennium Development Goals of cutting hunger and poverty by half by 2015 will not be met.

These three intertwined global issues of food insecurity, climate change, and soil degradation are driven in part by the decline in soil quality caused by severe depletion of the soil organic carbon (SOC) reserves. Restoring SOC reserves of cropland and agricultural soils above the critical level is essential to enhancing food security.

Soil quality and soil organic carbon reserve

The quantity and quality of the SOC pool play an important role in improving and sustaining soil quality. The latter is defined as the capacity of a soil to provide ecosystem goods and services. All four components of soil quality are affected by the SOC pool, its dynamic and inherent characteristics. The SOC pool moderates soil physical quality through its impact on aggregation and stability of aggregates, porosity and pore size distribution and continuity, water retention and transmission, along with infiltration rate and available water capacity, soil air composition and gaseous diffusion, crusting and compaction, and susceptibility to runoff and erosion. The soil chemical quality effects of the SOC pool are through its impact on soil reaction, nature and density of charge on the exchange complex, intensity and capacity factors affecting plant nutrient reserves, and movement/diffusion of soluble nutrients.

Soil biological quality is impacted by rhizosphenic processes in relation to microbial biomass, activity and species diversity of soil fauna (for example earthworms and termites), production and emission of GHGs (that is, CH4, N2O, CO2), and transformation/mineralization of biomass. Ecological processes, at landscape or watershed scale, are important to nutrient cycling, soil and water conservation, NPP at ecosystem scale, ecosystem C pool in soil and biota, and ecosystem services for human wellbeing and nature conservancy.

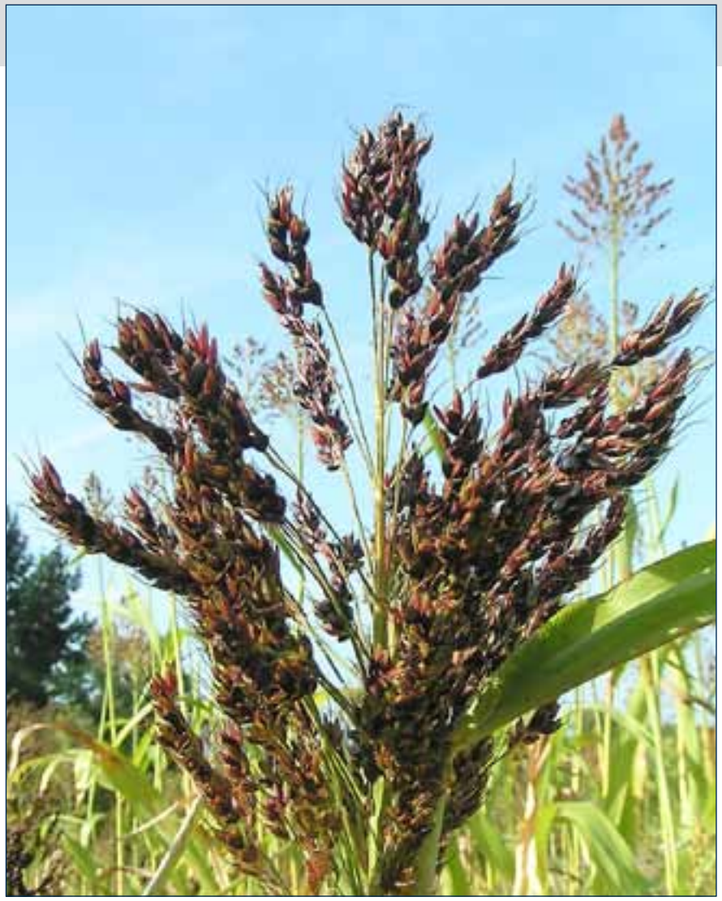
Soil carbon sequestration

The conversion of natural to agricultural ecosystems depletes the SOC pool because of: lower addition of biomass C, higher rate of decomposition of soil organic matter (SOM), and more losses of the SOC pool by erosion, runoff, and leaching. The higher rate of decomposition in agricultural compared with natural ecosystems is caused by changes in the soil moisture and temperature regimes. Consequently, most agricultural soils contain a lower SOC pool than their natural capacity determined by climatic, pedologic, and physiographic characteristics. Transfer of atmospheric CO2 into the SOC pool via the addition and humification of biomass-C is called soil C sequestration (Lal, 2008a). In addition to increase in the SOC pool as humus, C in soil can also be sequestered through formation of secondary/pedogenic carbonates. These are formed through dissolution of CO2 in soil air to form dilute carbonic acid and its reaction with cations (Ca+2, Mg2+, K+), a process important in soils of arid and semi-arid climates. The rate of soil C sequestration as humus is more (50-1500 kg/ha/yr) than that by formation of secondary carbonates (5-10 kg/ha/yr) (Lal, 2004).

The processes, factors, and practices leading to C sequestration in soil as humus and secondary carbonates are outlined in Fig. 1. The rate of SOC sequestration, with a range of 50-1500 kg/ha/yr, is greater in soils of cool and moist than warm and arid climates, in fine-textured and those with expanding lattice (2:1 type) than in coarse-textured and fixed lattice (1:1 type) clay minerals, and in foot-slope rather than in shoulder-slope or summit landscape positions.

The technical potential of soil C sequestration is about 1 Gt C/yr in soils under each of the three cropland, grazing land and degraded/desertified ecosystems (Pacala and Socolow, 2004). With the adoption of recommended management practices (RMPs), technical C sink capacity (maximum/potential capacity) can be filled by 2050. The rate of SOC sequestration for most cropland soils is 250-500 Kg C/ha/yr (Lal, 2004).

The SOC pool to 2m depth in world soils is estimated at 2400 Gt (Batjes, 1999). Both SOC and biotic pools, together called the terrestrial pool, have been the source of atmospheric CO2 ever since the dawn of settled agriculture (Ruddiman, 2003; 2005). The terrestrial C pool has been and is being depleted by deforestation, biomass burning, drainage of wetlands and cultivation of peat soils (Fargione et al., 2008; Searchinger et al., 2008), and soil tillage and tillage-induced erosion and degradation (Lal, 2004). It is the depletion of the SOC pool in soils of agroecosystems which has created the so called soil C sink capacity. Thus, assuming that the soil C pool can be increased by 10% by 2100, it would amount to a gain of 240 Gt C to 2m depth. This amount of soil C sequestration, through the production of biomass via photosynthesis and its conversion into humus, is equivalent to 110 ppm of drawdown of atmospheric CO2 (1 Gt of soil C = 0.47 ppm of CO2). Hansen et al. (2008) estimated that the atmospheric CO2 concentration can be decreased by about 50 ppm through biosequestration. Thus, biosequestration is an important strategy of both adaptation to and mitigating climate change.



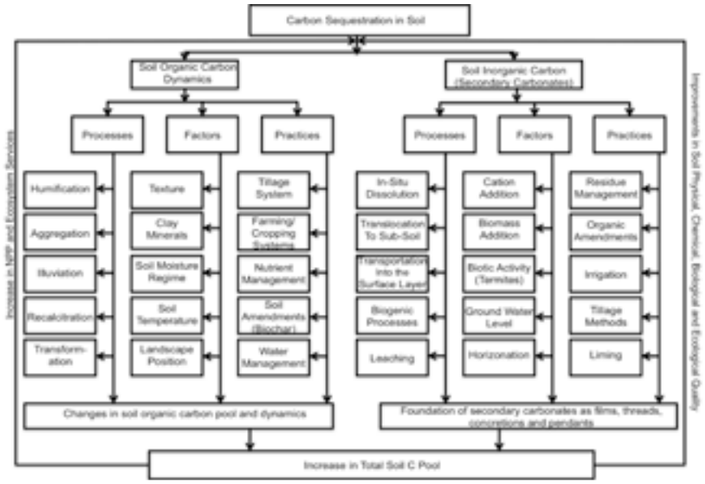
Sorghum

Peter Hanegraaf

Food security

Improvements in soil quality by SOC/ biosequestration can lead to increases in agronomic productivity through the enhancement in use efficiency of input (for example, fertilizers, irrigation). Achieving food security implies increasing average cereal grain yield per hectare, especially in developing countries. Vertical expansion, increasing yield per unit area and unit input into existing agricultural lands, is necessary because of the scarcity of any new land that can be brought under cultivation. Global average cereal grain yield of 2.64 t/ha in 2000 will have to be increased to 3.60 t/ha (+36 percent) by 2025 and 4.30 t/ha (63 percent) by 2050 if dietary preferences stay the same (Wild, 2003). With likely increase in animal-based diet in emerging economies (for example, China and India), however, the required cereal yield is 4.40 t/ha (+67 percent) by 2025 and 6.0 t/ha (+127 percent) by 2050 (Wild, 2003). This jump in food production must come through adoption of those RMPs which restore and enhance quality of soil and water resources so that yield potential of the elite varieties can be realized.

A synthesis of field experiments conducted worldwide shows that increasing SOC pool by 1 t C/ha/yr can improve crop yields (kg/ha/yr) at the rate of 100-300 for corn, 20-50 for soybeans, 20-70 for wheat, 10-45 for rice, and 30-60 for beans (Lal, 2006a). Such an improvement in soil quality in conjunction with ithe ntroduction of improved varieties and appropriate cropping/farming systems, would enhance production of cereals and food legumes in developing countries by 32±11 million t (Mt)/yr (Lal, 2006a). Soil C sequestration and improvement in soil quality would also increase yields of roots and tubers, which are important food staples in Africa (e.g., cassava, yam, sweet potato, taro). The estimated increase in roots and tubers through



Processes, factors and practices leading to formation of humus and secondary carbonates as principal mechanisms of carbon sequestration in soil.

increase in SOC pool by 1t C/ha/yr is 9±2 Mt/yr (Lal, 2006b). In addition to quantity, improvement in soil quality would also enhance the nutritional value of food especially in relation to the micronutrients (Lal, 2009). A healthy human diet must contain seven macrominerals (Na, K, Ca, Mg, S, P, Cl) and 16 microelements (Fe, Zn, Cu, Mn, I, F, B, Se, Mo, Ni, Cr, As, Li, Sn, V, Co). These elements must be supplied through soil, and SOC pool is an essential reservoir for both macro and micro-elements (Lal, 2009).

Commoditization of soil carbon

There is a wide range of RMPs for sustainable management of soil and water resources, especially in relation to SOC sequestration (NRC, 2009). Important among these for soil management are conservation agriculture, integrated nutrient management (INM), cover cropping and complex systems including agroforestry, use of soil amendments including biochar and zeolites, enhancing rhizospheric processes for creating disease-suppressive soils, and accentuating soil biodiversity. The strategy is to create positive C and elemental (N, P, S, K) budgets.

Despite the existence of proven RMPs, the adoption rate has been slow especially in Sub-Saharan Africa and South Asia. Resource-poor and small size land holders can neither afford the inputs required nor are they prepared to take risks under changing unpredictable and harsh climate. Emergency aid, in my opinion a knee jerk approach, and other adhoc interventions, although done in good faith, have proven counterproductive. These measures have suppressed initiative and created dependency.

There is a need to create another income stream for farmer/land managers so that they have resources to invest in adopting RMPs. Commoditization of soil C through trading of C credits is a viable option. The price of soil C (presently ~US $2/t of CO2 or US $7.30/t of C) paid through voluntary organizations (i.e., Chicago Climate Exchange) is an important start. However, the price must be determined with due consideration of the societal value of soil C. The latter encompasses the ecosystem services that soil humus (SOC pool) provides to the world community. Important ecosystem services include mitigation of climate change, improvement in quality and quantity of renewable fresh water resources, increase in biodiversity, and enhancement of terrestrial processes of importance to human well being and nature conservancy.

Sequestration of C in soils and terrestrial ecosystems, as a natural process, is also the most cost-effective option (McKinsey & Co., 2009a; b). In comparison with the cost of aroundEuro 60/t of CO2 for geologic sequestration, SOC sequestration has a net benefit, because it improves agronomic yield and reduces input (fertilizers.) (McKinsey & Co., 2009a; b). Assuming that the price paid to farmers for SOC sequestration is equivalent to the cost incurred in geologic sequestration, it means payments for soil C credits at the rate of around US $100/t of CO2 or $367/t of C. For an average SOC sequestration rate of 250 kg/ha/yr, farmers can receive an additional income of ~$80-100/ha/yr ($32-40/acre/yr). Even if farmers receive $50/ha/yr, this is a strong incentive towards adoption of RMPs, and for restoration of degraded soils and ecosystems. Decisions made at the UNFCCC meeting in Copenhagen in December 2009 towards accepting agricultural soils as offsets to mitigate climate change would be step in the right direction.

A win-win

Soil carbon sequestration is essential to harnessing numerous co-benefits and ecosystem services including the restoration of soil quality, improvements of water resources, increase in biodiversity, and decrease in net emissions of CO2 and other greenhouse gases. Above all, it is also essential to achieving food security. With a potential to reduce atmospheric CO2 concentrations by 50 to 100 ppm over the 21st century, it is the most cost-effective option for mitigating anthropogenic climate change. The adoption of recommended management practices among resource-poor farmers can be promoted through commoditization of soil C and trading credits. Soil C sequestration is a win-win strategy. It is a bridge to the future, leading to low-C or no-C fuel sources. Implementation of this strategy requires political will to accept agricultural soils as offsets for industrial emissions. The time to act is now. ■

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Livestock consumption and climate change

From fiction to fact

MARK DRISCOLL explains the goals behind WWF-UK's One Planet Food programme, and calls for a vision for meat production and consumption that everyone - from farm to fork - can buy in to.

Seven hundred and thirty two. That's the number of comments posted on The Times website on the back of their interview with Lord Stern last month. In two days. It was also covered in every mainstream newspaper - and hundreds of websites besides. Columnists chimed in. Farmers shook their fists. And the phone lines of various radio-based discussions rang red. Everyone got involved.

So, what had Lord Stern, the author of the influential 2006 Stern Review on the cost of tackling global warming, said? According to The Times, he'd advised people to "give up meat to save the planet", before making "a demand for behavioural change". Everyone seized on this as a tidy 'climate chief says go veggie to save the planet' message.

In fact, this isn't what Lord Stern said, as he asserted in a letter to the paper: "It's a fact that the production of meat can be relatively carbon-intensive because of the energy used to rear and feed the animals, and the methane emitted by livestock. I was not demanding people become vegetarians, but instead suggested that they should be aware that the more meat that they eat, the higher the emissions of greenhouse gases that are implied in their diets; it is in this sense of lower emissions that less meat is 'better' for the planet."

We'd agree. Nevertheless, even in this context, the debate over whether we need to consume less livestock-based products (both meat and dairy) sparks frenzied, over-blown and polarised reaction. 'We've got used to eating lots of meat, so why should we give it up?' And 'what about the farmers?' These are both common arguments.

All this hasn't been helped by knee-jerk campaigns to cut meat consumption; some of the campaigns have served only to alienate consumers and over-simplify what's a complicated issue. And it is complicated (something Lord Stern was, no doubt, trying to get across in his interview). Unlike your average dairy cow this issue isn't black and white. Some of the science, however, is.

Food consumption is responsible for around a fifth of the UK's direct greenhouse gas emissions – and livestock is the hotspot. Fact. The UK has 1% of the world's population but accounts for 2% of the world food system. Fact. The food we eat accounts for roughly a third of our environmental impact on the world. Fact.

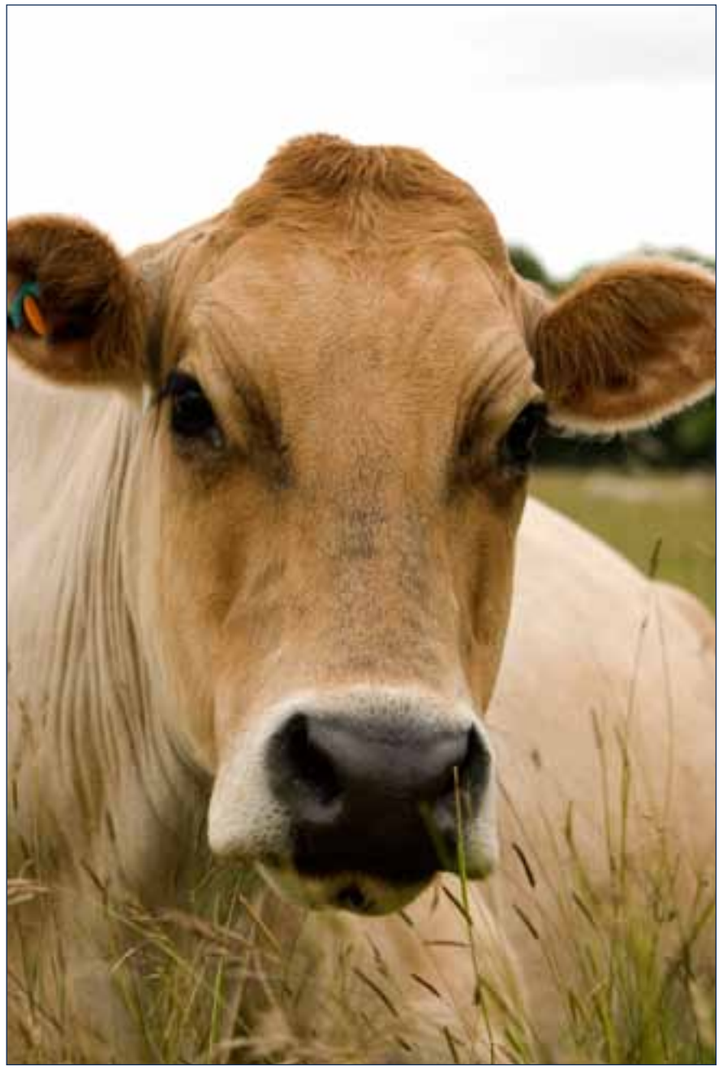
Not only is the energy required to produce our food creating emissions (from pesticides to packaging), there's also a considerable amount of environmental impact from land use change – for instance, deforestation to grow palm oil (for processed products) or soya (to feed livestock). When this is taken into consideration our impact is even greater; the report we'll be publishing with the Food Climate Research Network (FCRN) later this month will, for the first time, detail how much greater. This is one of several reports we have been working on with experts in the field of food and climate change – each geared towards taking another step towards some answers, and our goals.

Our mission at WWF is to stop the degradation of the planet's natural environments and to build a future in which humans live in harmony with nature by conserving biodiversity, ensuring the sustainable use of resources and reducing pollution and wasteful consumption. The transition to a more sustainable food system will be central to achieving that.

That's why we created our One Planet Food programme, incorporating the whole food chain, from the production of commodities (like palm oil and soya) through processing and on to consumption and disposal. The goals of the programme are to radically improve the key environmental impacts of the food that is eaten in the UK, including our impact on the parts of the world richest in biodiversity.

This is a complex task – made more so by the emotion that surrounds livestock consumption. As Lord Stern found out: mention it at your peril. The Government won't: Ben Bradshaw, Defra Minister did so two years ago when he said "if the impacts of climate change are as bad as predicted, we may need to go back to rationing". He didn't mention it again.

We are, of course, a long way off rationing – or even fiscal measures to encourage people to consume less meat. Such measures are enforced behaviour change. What we'd like to see instead is more immediate constructive debate, perhaps led by Government, which will lead consumer change rather than force it.



A jersey cow. Jamie Gordon

And there will have to be a change. Our modelling suggests that emissions from food consumption need to be cut by 70% by 2050 to help avoid serious rises in temperature. Early indications suggest that de-carbonisation of the supply chain will help, as will using low carbon energy for cooking and energy recovery from food waste (as covered in Autumn's Food Ethics). There will also be developments in farm technology – crop yield increases, improvements in animal feed (perhaps to decrease methane emissions from livestock) and more efficient fertilisers. Progress is already being made by the industry in some of these areas – which is to be commended.

But – and here's what many in the industry are reluctant to accept – those advancements, in whatever series of combinations, won't get us to the magic 70% (our report with FCRN will also cover this in more detail). There will be a gap to 'plug'.

Plugging that gap – and reducing emissions further – means talking about consumption. We don't yet know the extent to which our consumption needs to fall – there are issues to consider, such as the role of livestock grazing, or how contraction in the UK might reinforce expansion of livestock farming in low-cost exporting countries which could, in turn, drive further emissions through more land use change.

What we do know is that consumption will have to fall, and we tasked the Food Ethics Council to look at how best to achieve it. Its report, *Livestock consumption and climate change*: a framework for dialogue, was published in September, complete with a series of 27 possible interventions that could help address the impact of livestock consumption on climate change. It's worth noting that the FEC went to great lengths to recognise the concerns of producers.

Encouragingly, they didn't run for the hills. Now the dialogue needs to begin on which of the interventions could work to reduce emissions without penalising producers, harming diets or otherwise causing more problems than are solved. Some caused a little controversy,

while others were well-received. Let's look at the positives.

One was to encourage consumption of 'less, but better' meat – something that one livestock industry magazine picked up on. The Meat Trades Journal, in its editorial, suggested that "the main difficulty for many in [the livestock] sector is that they are tied up in the business of volume supply. As such, the idea of eating less meat is anathema to many". Agreed.

Interestingly, however, the editorial continued: "The concept of eating less, but better meat and paying a fair price for it should not prove the undoing of the meat industry. It may involve some tricky structural changes but the sector has shown in the past that it is more than capable of adapting to meet new challenges over the years, while continuing to thrive. And with pressure constantly growing on all of us to face up to the challenges posed by our changing environment, we need to grab the bull by the horns and lead the charge. Let's not wait for governments, quangos and lobbying groups to force it upon us."

Indeed. The FEC report highlighted the reluctance of anyone (as yet) to 'take the bull by the horns'. The Government may recognise its responsibility to show leadership in promoting sustainable consumption and production, but the report delivers details of (27) ways this might be achieved. These range from those that directly seek to influence consumer behaviour, to fiscal measures and policies that would result in higher prices for products with bigger emission footprints.

When the FEC's framework – which has been described by Sir Don Curry, advisor to the Secretary of State (Defra) on food and farming, as "a strong base for moving forward" – was trialled with those from industry and government, it worked well. Importantly, it enabled all sides to agree that it's important to pursue GHG emissions reductions in the livestock sector through changes in consumption, as well as through technical abatement in production. This means

James Thorpe

Now the dialogue needs to begin on which interventions would work

we can move on to the crucial business of comparing the pros and cons of going about this in different ways.

The industry needs this direction. And we're urging the Government to take a lead role in this – the suggestions are, after all, policy drivers. However, the confidence that's currently building may be vulnerable to a change in government. The next stage of the FEC's work will thus involve a series of mediation and advocacy activities with producers, policy makers and politicians to maintain momentum.

Also involved, we hope, will be retailers and manufacturers. Retailers and processors have enormous influence on both suppliers and consumers, and will be essential partners in our collective efforts to create a sustainable food system. As part of our One Planet Food work we're undertaking a retailer engagement programme, building relationships further and helping to design a collaborative process for change that will involve all key actors in the food system. This will be a challenge, but the retailers and manufacturers can play a huge part: they can't just respond to consumer concerns – they have to help shape them.

Given the complexity of the UK food system (including its links with global trade and its importance to the economic, cultural and social wellbeing of UK residents) we believe that this kind of systemic approach is essential. ■

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The herbiovore's dilemma Balance and ethics at the greengrocer

GARETH EDWARDS-JONES assesses the moral, environmental and social impacts of eating five-a-day.

Much of life is about balance. We worry about how much time to spend on our jobs, our hobbies and our families; and how much money we should spend, save and give to charity. Many people also balance different aspects of their diet, such as impacts on health, wallet and environment. But the one part of our diet that always seemed straightforward was fruit and vegetables. They are typically quite cheap, universally good for our health and not normally associated with media stories of environmental harm. No balance needed here - eating fruit and veg is a 'no brainer'.

However, recent debates around climate have started to shine lights on parts of the fruit and veg story that were not previously considered. Early debate seemed black and white. Vegetables grown overseas and flown into the UK are responsible for the emission of large amounts of greenhouse gases, whereas UK grown vegetables have lower carbon footprints and should therefore be preferred to foreign grown vegetables[1]. Debates about localised food systems, food miles and self-sufficiency seemed to be mutually reinforcing, and the logic of supporting home grown veg seemed unequivocal.

So which are the best vegetables to buy during the UK winter?

Unfortunately, though, some of those promoting 'localness' were rather 'local' in their thinking. The 'unequivocal logic' put forward by UK based campaigners soon fell apart when the boundary of analysis was expanded to consider those people who grow the vegetables. Research showed that the overall health and well-being of those Kenyan workers who worked in the vegetable export sector was significantly better than that of Kenyans who grew vegetables for local markets [2]. The old adage of 'Trade not aid' did indeed seem to hold some truth. It also became apparent that the health of horticultural workers in UK farms tended to deteriorate during the season, and soon reached levels below the average for UK citizens [3,4].

So if all other things stayed constant, a policy of buying more local vegetables would probably remove the demand for Kenyan produce, thereby impacting the health of poor African workers for the worse. Further, if the same policy led to more migrant workers coming to the UK to grow our vegetables for us, then this may lead to a decrease in their health status, at least in the short term. Of course, it could be argued that short term dips in the health of migrant workers do not matter if the money they earn in the UK offers them better life prospects in the longer term. The ethical question then focuses around the level of knowledge the workers had prior to coming to the UK about the effect of the work on their health.

Studies also started to highlight some of the trade-offs needed when considering the movement of vegetables within Europe. The greenhouse gas emissions from trucking produce from Spain to northern Europe, may in some cases be lower than the emissions related to heating glasshouses in the north[5].

So which are the best vegetables to buy during the UK winter: glasshouse grown local food or trucked in 'non-local' food? The answer depends on which environmental issue you are most concerned about. For those consumers who are only concerned with climate change, then maybe Spanish produce is best. However, for those concerned with other impacts such as air pollution and water quality, then maybe UK glasshouse grown is best. Similarly, for those concerned about water resources, it may not seem very logical to export produce that is 98% water from the water scarce regions of southern Spain to the relatively wet climes of the UK. The ethics of water use though, are different to impacts on climate and air quality. The atmosphere is a global good - the classic open access commons - so a pollutant emitted in Spain may cause damage in the UK. But ground water is a natural resource over which people have rights, and in many ways such water resources are akin to minerals which can be mined. Spain is a developed, democratic, sovereign nation, and if they choose to export their ground water to us in the form of vegetables, than what right do the consumers of the UK have to question their decision?

A confounding issue is one of health. Achieving good health status requires the regular consumption of at least 5 portions of fruit and vegetables a day. Achieving this target is a challenge for most people. It tends to be easier in the summer when fruit and vegetables abound, but in January there are few home grown vegetables available, and given that potatoes don't count as one of the 5-day portions, it would probably be difficult for many people to construct a balanced and interesting diet based around winter vegetables in the UK. For this reason, a pragmatist may argue that imported food offers the best way of helping people achieve 5-a-day, and to remove this flow of food into the UK during the winter could have a detrimental effect on the health of individuals, and thereby increase the costs of their health treatment.

So all of a sudden ethical debates abound in the vegetable world. But the one area that remains relatively unchallenged is the role of science and scientists in the whole debate. There are relatively few scientists working in this field, and few studies reporting data on the sustainability of different vegetable supply chains have been published in the peer reviewed journals. In contrast, there are abundant magazine articles, grey literature and internet comments on these matters. In such a hotly contested arena, those few scientists who are active researchers have a particular responsibility to the truth. This is because in such a competitive and commercial environment, an ill-judged word can easily have real impacts on real people. Consider the hypothetical example were a scientist to proclaim that Spanish salad crops are better for the environment than UK glasshouse grown salad crops. The press and media may pick up on this story, and it could soon become 'common knowledge' that Spanish vegetables are better than UK. Consumers may switch their purchasing patterns and preferentially buy Spanish produce, and as a result parts of the UK industry may collapse and people could lose their jobs.

All this could happen on the basis of one scientific report, and while this is a hypothetical example, it is not so far from reality as to be unbelievable (as happened in the case of New Zealand lamb). So before speaking out on these issues scientists need to be really sure of their facts. They need to have collected good data, and to have had their work reviewed by knowledgeable peers. Even then, consumers and Government should not act on the basis of a single study. Rather only when a 'body of work' is pointing towards the same conclusion should society at large start to take note and consider behavioural change.

What is the correct ethical response to all of the issues noted above? It seems right to want to help some of the poorest people in the world by purchasing goods from then. It also seems right to produce food in a way that has the lowest possible environmental impact. Finally it seems right to offer the citizens of our country a healthy diet. The challenge again is one of balance.

At first glance it would seem that science and technology can help ameliorate some of these tough decisions. Recent advances in post-harvest technology mean that fresh produce can now be shipped long distances. The act of shifting the transport from aircraft to ship massively reduces the carbon footprint of the food, and this in turn should make it easier for UK consumers to support farmers in developing countries. In addition enhancements to the design and management of glasshouses are constantly making them more energy efficient. Technologies such as solar power, ground source heat stores and anaerobic digestion offer real hope for a zero energy glasshouse, and this will serve to reduce the footprint of UK grown crops. Finally, the policy of international agencies such as DfID have now realised the importance of primary production to developing countries, and they are once again funding research into agriculture in developing countries. This in turn should make their production systems more sustainable.

As a result of these scientific advances, the overall carbon footprint of vegetables should fall significantly. But at the end of the day this is a zero sum game. In other words the future environmental footprint of UK, Spanish and African vegetables may be half that it is today, and this will be a good thing for the planet, but the vegetables will still be grown in the UK, Spain and Kenya –and because of this there will always be debate. The produce will come from different countries; they will have different tastes and different environmental impacts. There will still be competition for market share, and there will still be political interests. So even though science will reduce the overall environmental impact, it will never do away with the need for humans to argue, judge and compare. Science can never remove the need for a 'balanced' decision. The best we can hope for is that in the future we will be balancing ever lighter weights on the scales of environmental and social impact. ■

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REDD to REDD+

A new dawn for forests and agricultural land?

BRUCE CAMPBELL explores how REDD+ might work, and whether it would benefit rural producers.

Reduced Emissions from Deforestation and Forest Degradation in Developing Countries (or REDD) was born out of an acknowledgement of the extent of emissions caused by deforestation, and the presumed low cost of achieving carbon emission reductions through cutting deforestation.

The burning question is whether cheap carbon will provide enough incentive to forest stewards to change their behaviour on the ground. Evidence suggests it only will if the benefits received by forest stewards through REDD outweigh what they would have received in benefits by not conserving the forests. For example if conversion of forest to agriculture is highly lucrative, then REDD payments (and/or other benefits) would need to exceed the benefits derived from agricultural production.

At COP-13, forest degradation was added to deforestation in the REDD concept. This meant that countries could be rewarded for reducing emissions from forest degradation, extending REDD's reach from the mainly humid tropics, to countries from the dry tropics where populations are denser and poverty is widespread. Question marks exist over whether the inclusion of degradation means more opportunities for smallholders on the ground. Any smallscale farmer faced with the choice of opting for REDD or expanding their fields, will go for the latter unless carbon prices are high and commodity prices low.

The REDD agenda continues to expand. Under REDD+ carbon storage through reforestation and a widening of the remit to manage emissions from agriculture are being considered in the run up to COP-15. It's looking to managing other emissions too, including methane and nitrous oxides.

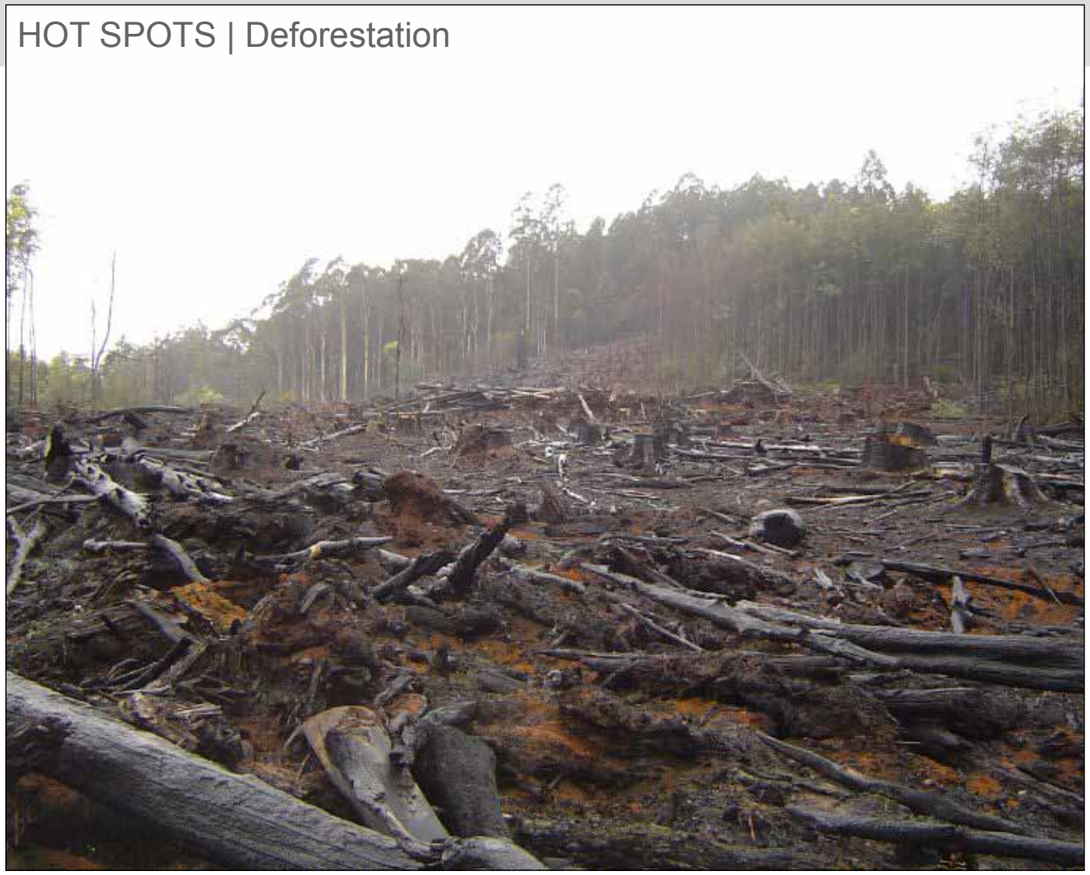
Opening up REDD+ offers huge potential co-benefits. Financial rewards for mitigation under REDD+ could, for instance, help pay for environmental conservation or poverty reduction programmes. However, it's uncertain whether smallholders will benefit – when carbon buyers have to deal with numerous smallholders, transaction costs (the time and effort to make deals) can be high and thus buyers may favour dealing with the larger players - richer landowners with large tracts of land and the state. Perhaps farmers can organise themselves through groupings such as federations of farmers, so that the federations can act as the agent for the carbon deals. Funds derived from the carbon markets will also need to go to the agencies involved in the market chain for carbon, for example the institutions that certify the levels of carbon traded.

Can REDD+ bolster adaptation as well as encourage mitigation? The synergies are clear. Payments for emission reductions can diversify livelihood income sources, and could be used to improve agricultural technologies. Livelihood diversification in the face of climate change helps adaptation to climate shocks.

The burning question is whether cheap carbon will provide enough incentive to forest stewards to change their behaviour

However, engaging with REDD+ isn't always going to produce win-win situations. Any number of trade-offs will have to be faced. Dilemmas may include the financial rewards earned from REDD being ploughed into intensive farming, or agro-forestry projects falling prey to their own success and leading to more pressure on forests. There's also the thorny issue of land rights, and whether smallholders have sufficient rights to ensure that the benefits from REDD payouts flow to them.

It's undoubtedly true that REDD+ will increase opportunities for rural producers. But there will be many challenges along the way. The international community needs to invest research, time and money into making sure that what emerges from COP-15 is workable, manageable, and above all, actively helps the world's poor.



Deforestation Crustmania, Flickr.com

How might REDD play out in Ghana?

While the architecture for a global REDD strategy is still undecided, some pilot REDD schemes have been initiated, amongst them the World Bank's Forest Carbon Partnership Facility (FCPF). Ghana is one of 14 developing countries earmarked by this facility.

Working with colleagues, I helped construct a system dynamics model for a cocoa agroforest landscape in south-western Ghana to explore the likely impact of REDD payments on local farmers. We carried out participatory modelling with a diverse range of stakeholders. The results suggest halting deforestation with carbon payments is likely to be preferred by farmers compared to business as usual (cocoa production at the expense of forest), at least in the short term. However, the likelihood is that REDD contracts may be abandoned after 5-10 years.

REDD's potential in Ghana is much lower if payments are also made for halting forest degradation (because the degraded forest is needed for the expansion of cocoa production). In our model, REDD seems to hold little potential to contribute to poverty alleviation, as it is the wealthier households that control the remaining forest, not the poor. Moreover, REDD holds a risk of creating a poverty trap for the poorest whose access to leased forest land may be restricted if REDD payments happen and the larger landholders restrict access to land by the leasees. In addition food crop area is likely to be more constrained under REDD scenarios than under a business as usual model.

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Copenhagen: what outcome for food and farming?

Peter Kendall is president of the National Farmers Union. He farms in Eyeworth, East Bedfordshire. with his brother Richard.

The agricultural industry in Britain looks forward to a comprehensive international climate agreement in Copenhagen that recognises the role of agriculture in mitigating and adapting to climate change. Our sector is potentially vulnerable to climate change impacts, but it also offers part of the solution to this pressing public problem. We need clear and consistent policy signals from national and international decision-makers in order to invest in agricultural production of both food and non-food commodities.

Climate change has 'turned up the volume' on many problems that already existed in food and farming, in the UK and abroad. In the face of climatic uncertainty and possible shortages of water and energy, we need to revitalise our industry and increase production, satisfying the future demands of a world population of more than nine billion by 2050. That is why the NFU will be represented at the Copenhagen climate talks in December, supported in our lobbying efforts by similar positions adopted at the international level by COPA-COGECA (EU) and the International Federation of Agricultural Producers (IFAP).

As we improve the greenhouse-gas efficiency of our resource use, and respond to the new business opportunities of the low-carbon economy, farmers and growers must be enabled to provide renewable energy services alongside our traditional role in meeting present food needs, without compromising the needs of future generations.

Helena Paul is co-director of Econexus, a not-for profit, public interest research organisation and science watchdog with particular focus on oil exploitation in the tropics, patents on life and genetic engineering.

Climate discussions are increasingly about creating commodities to trade on carbon markets. Not content with seeing forests merely as carbon stocks, there are now plans to do the same for soils. This must not be allowed to happen.

Many of the actions needed for agriculture are beyond the remit of the Climate Convention. They include implementing vigorous government policies to support small-scale, biodiverse, multifunctional agriculture for food security and sovereignty. Such agriculture would make a major contribution towards stabilising the climate, but requires big policy changes and renewing respect for farmers and food production.

If the Climate Convention includes soil carbon in the carbon market, such policies will become even more difficult to implement because the carbon market facilitates intensive livestock, industrial chemical agriculture (including GM crops), monoculture plantations for agrofuels, technofixes such as biochar and large-scale land grabbing. Forests cannot merely be monetised as carbon and traded against emissions from industrialised countries in a brutal carbon market. The value of forests is beyond money. The same goes for soils. We depend upon both for our lives.

Carbon trading and offsets are both corrupt and profoundly corrupting. The threat of a sub-prime carbon market is all too real. A unilateral commitment from Annex 1 countries to deep and immediate emission reductions not predicated on offsets is the only way to demonstrate political will to avoid the devastating impacts of climate change.

If Annex 1 countries will not do this, the best would be for Copenhagen to fail completely and obviously and then the publics of the industrialised countries would see clearly how deeply they are being betrayed by their governments.

The big question

Vandana Shiva is a world-renowned environmental leader and thinker. Director of the Research Foundation on Science, Technology, and Ecology, she is the author of many books, including Soil not Oil (2009). She is the founder of Navdanya ('nine seeds'), a movement promoting diversity and use of native seeds. Before becoming an activist, Shiva was one of India 's leading physicists. She holds a master's degree in the philosophy of science and a Ph.D. in particle physics.

One of the problems with the climate negotiations is that they are based on the false assumption that development can only be based on fossil fuels, and hence on pollution. By default, countries are then pitted against each other in a contest based on the 'right to pollute'. However we can improve human welfare while reducing fossil fuel use and greenhouse gas emissions.

While polluting the atmosphere , the industrial food system is also the primary cause for destruction of biodiversity, water and soil fertility. Further, it's responsible for hunger, by converting food into a commodity, and diverting food grains from food for people to animal feed and to biofuel. Finally industrialised food is responsible for the public health crises of obesity, diabetes, and other diet related diseases.

A shift from the industrialised, globalised food system controlled by five gene giants who control the seed supply, five grain giants who control the trade, and five food processing giants who impose industrial processed on all cultures of the world, to ecological, localised food systems, would reduce emissions by 40%. It would also contribute to mitigation and adaptation by fixing carbon in the soil, increasing resilience of the soil to climate change. Local organic food also addresses the public health disaster linked to eating processed and junk food. It reintroduces diversity on our farms and in our diets, bringing ecological and nutritional benefits. Above all it helps create food democracy.

Local food movements are growing everywhere. All that governments need to do in Copenhagen is recognise citizen initiatives, respect people's will and build on it. Through food that is ecologically produced and fairly shared, it is possible to reduce emissions while increasing human welfare; it is possible to protect both the health of people and the planet.

Paul Willgoss is head of Technology, Marks and Spencer.

Our role as a quality food retailer is to procure the best ingredients and products from around the world to satisfy the high level of expectation of our customers. In order to continue to do this in the future we need to be not only cognisant of the challenges of climate change, but also play our part in creating solutions. The UK Government Chief Scientific Adviser predicts that by 2030 the world will need to produce 50 percent more food, 50 percent more energy from no more land and access 30 percent more fresh water. All this whilst managing the impact of climate change.

Copenhagen, therefore, represents a crucial moment in time to address the challenge of food security within the context of climate change. Our wish list for Copenhagen covers three areas.

Firstly, we need a global agreement to reduce emissions. This will be good for food production in general and farming in particular. However, these agreements need to be structured to drive innovation to reduce emissions and reward farmers for carbon friendly production and not to lead to undesireable geographic shifts in production.

Secondly, we believe it is important that progress is made in incentivising funding and defining standards to reduce emissions from de-forestation. This will have a significant impact on CO2 emissions, but also will create a focus around genuinely sustainable production of some of the world's major commodity crops.

Finally, there needs to be greater recognition of the need for adaptation strategies for key food production regions and, importantly, adequate funding made available to support this.

Success at Copenhagen would mean that the global food industry can proactively work to a future driving improved resource efficiency, through increased R&D and building resilience into supply chains.

It is really crucial that our politicians are aware of public support for a global deal that is both ambitious and fair. We have launched an on-line patchwork petition for our customers, suppliers and employees in the run up to Copenhagen. You can add your patch at http://plana.marksandspencer.com/you-can-do/climate-change/cop15/explore

Copenhagen: what outcome for food and farming?

Ruth Bond has been a journalist and business woman. She joined Barton Women's Institute in 1976. She has been a National Federation of WI trustee since 2003 and was elected Chair in 2009. She is particularly concerned with green issues.

What the WI really wants from Copenhagen, is recognition of the ways in which climate change specifically affects women. From their vulnerability as farmers in the developing world in the face of droughts, to their potential as pillars of strength and knowledge in their communities, helping their families and others to tackle both the causes and effects of climate change.

Women are at the forefront of the fight against climate change and governments need to do more to recognise their plight and support their efforts. Nowhere is this more clearly felt than in the link with food and farming. It's a little known fact that the majority of farmers in the developing world are women. They are also the ones who are responsible for providing food for their families.

But what can be done to help them? Providing women with the tools and knowledge to adapt to farming in a changing climate would mean that fewer families would be hungry. Providing low-cost renewable technology solutions to women (e.g. solar-powered stoves) would ensure that they do not have to walk miles every day for fuel.

There is substantial evidence to suggest that channelling development resources through women leads to significantly better and wider spread outcomes. But agreements reached in Copenhagen need to be reflected in political commitment in this country. Women still make the majority of household decisions in the UK and as effective communicators are adept at raising awareness of issues in their communities.

We want the potential of women's role in tackling climate change to come to the fore, be properly funded and to see more women at the debating table as a result.

Dr Rajendra K. Pachauri has been chairman of the Intergovernmental Panel on Climate Change (IPCC) since 2002. He is also director general of TERI, the Energy & Resources Institute, in New Delhi. India.

The contribution of food production and consumption has been estimated to be 31 percent of all greenhouse gas emissions in the European Union. Direct emissions from agriculture are only one part of the overall impacts of food production and consumption on climate change. Part of the remainder concerns emissions of GHGs that are statistically included in the industrial sector (e.g. emissions caused by the production of synthetic fertilisers and pesticides and the production of manufactured food items and their packaging), and the transport sector (for instance food miles).
The production and consumption of meat and dairy products deserve particular attention, as livestock is responsible for a substantial share of global GHG emissions (18 percent according to the FAO, 1 percent according to the WorldWatch Institute !). It is also an intensive consumer of soy and grain. For instance, 25 kg of feed are necessary to produce 1 kg of edible beef. Livestock, including grazing and production of feed, is also a major user of land (70 percent of all agricultural land).

Accepting changes in food production and consumption patterns requires a call for action at every level of decision-making: for producers, this is a call for more efficient production techniques and products; for consumers, to shift towards a larger share of plant-based diets; and for national and local governments, to provide producers and consumers with the right information, incentives and regulatory framework that would induce these changes.

It would be logical for the negotiators working towards an agreement in Copenhagen this December to highlight this area as a major option for mitigation.

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The big question

Copenhagen: what outcome for food and farming?

Charlie Clutterbuck is an agricultural scientist and research fellow at Department of Food Policy, City University. He runs Environmental Practice at Work and is NW representative on National Rural & Agricultural Workers Union (Unite).

All the talk at COP-15 is around targets, but it is hard to see how we can move on from Kyoto's, most of which have yet to be met. The UK is only meeting its targets because of the smashing up of the steel industry in the early 1990s, rather than any recent development of green technologies. One clear goal could be the adoption/enforcement of the World Business Council for Sustainble Development GHG Protocol used by all sorts of organisations.

There are moves to include forests in carbon counting, but food and farming are not part of any Emissions Trading Schemes – seen by many as the way for markets to help deal with the issue. Perhaps that is in part due to the complexity of counting, but the contribution could be considerable. According to the Working Group of European Climate Change Panel , we could capture enough carbon in the soil to absorb a fifth of all the carbon dioxide that the EU wants to reduce. Where else could carbon dioxide go so safely and effectively?

If trading mechanisms were put in place to properly reward carbon absorption, money might at long last start flowing from manufacturing and financial industries into food and farming - and provide a much more sustainable living for all concerned. Can somebody tell our leaders? It could save us, the planet - and our leaders' jobs!

1. http://www.ghgprotocol.org/standards/corporate-standard
2. http://ec.europa.eu/environment/climat/pdf/execsummary_agricsoils.pdf

Patrick Mulvany is senior policy adviser at Practical Action.

Small-scale food providers and researchers have demonstrated that biodiverse ecological systems of food provision provide opportunities for mitigating and adapting to climate change. Contributing their knowledge of climate-friendly, biodiverse food provision, the worldwide social movements for changing the food system are calling for the implementation of the Food Sovereignty framework that will significantly reduce GHGs. Food sovereignty places local food providers and local consumers at the heart of decision making, rather than corporate agribusiness.

In Copenhagen, governments should keep agriculture out of REDD-type provisions that will exacerbate the situation. Rather, they should urge the competent UN bodies in Rome to implement an international Food Sovereignty regime that would prioritise smaller-scale, low carbon, biodiverse food provision. It should also include commitments to:

* Regulate and sharply reduce the influence of corporate agribusiness that dominates the global food system from seed to sewer, and contributes significantly to climate change through energy intensive monocultures, livestock factories, destructive fishing practices, and global distribution and retail chains.

* Change or revoke existing laws, restrictive property regimes, commercial contracts and technologies that prevent small-scale food providers from developing, saving and re-using their local diverse seeds, livestock breeds, fish species and sharing these with their peers in other communities, countries and continents. This agricultural biodiversity adds resilience in adapting to climate change, underpins low emission food provision, and secures food supplies.

Governments could, however, immediately establish a funding window under the UNFCCC to support Food Sovereignty as a means to reduce emissions. Smaller-scale, biodiverse ecological systems of food provision for local markets can help cool the planet.

UK agriculture: farmers on the front line

MADELEINE LEWIS of Farm Futures explains how farmers and land managers are on the front line of climate change, and how many are already adapting to the challenges ahead.

According to a recent Farming Futures survey, half of farmers said that their land was already being affected by climate change.

Longer growing seasons, hotter and drier summers, wetter and milder winters, coastal erosion, more frequent extreme weather events are all to be expected in the next few decades according to the UK Climate Impacts Programme's 2009 report (UKCP09) released over the summer.

So what does this mean for farmers and land managers? Higher temperatures and lower rainfall is a risk, particularly for irrigated agriculture, which is responsible for producing a third of the UK's potatoes and a quarter of all vegetables. Take the Vale of Evesham in Worcestershire, which is a hub of the UK's horticultural industry and produces a variety of crops from beans to potatoes to fruit. These crops are thirsty, and a 2007 Cranfield report predicted that the demand for water in this area will increase by around 20% by the 2020s and as much as 50% by 2050. Growers are going to have to do more with less – 'more crop per drop'.

Livestock farmers will also need to think about water use. Dairyco estimates that a herd of 200 dairy cows will typically cost a farm £10,000/year in mains water, so investing in water saving practices can make financial sense as well as serving to protect precious water supplies. But while technologies and tools such as sophisticated irrigation systems, rainwater harvesting and building on-farm reservoirs will play a part in improving efficiency, a farmers' management skills and experience of their particular circumstances and locations will be just as important.

With rising temperatures come longer growing seasons and changes in the growing area of crops. One example is sunflowers. Highly sensitive to air and soil temperature and pretty drought tolerant, the area of land suitable for their cultivation is predicted to increase from 22% to 79% of the UK by 2050. So we could be seeing big swathes of yellow fields come springtime in the next few decades.

Sunflowers aren't the only one; there will be more novel crops growing too, such as olives, sugar snap peas, melons and grapes. English wine (now being produced as far north as Yorkshire) may start to be a real contender. And we'll see more tree planting. Sustainably managed woodland sequesters carbon, encourages biodiversity, and provides both a source of clean renewable energy and an alternative to fossil fuel-intensive construction materials.

Another challenge will be some rather more unwelcome new friends. At the Food and Environment Research Agency (Fera) they are studying how changes in climate will affect the kinds and prevalence of pests and diseases in this country. Longer growing seasons give certain pests with rapid breeding cycles an extra one or two generations to do more damage, and others will be able to move outside of the glasshouses where they bed down over winter, or spread north. Potato late blight is one example. Potatoes are the fourth biggest crop in the UK, and late blight is one of the most important diseases growers contend with – climate change could make that a tougher battle.

We've all heard about the food versus fuel debate, so let's not forget energy. An Ofgem consultation paper from September of this year reported that oil prices had quadrupled over the last decade, with gas and coal prices doubling. This is set to continue, and the UK Government has set a target for 15% of our energy to be produced from renewable sources by 2020. So, increasingly, our land is going to have to produce energy too – whether that be through wind, anaerobic digestion (AD), hydro power or biomass.

So in amongst those fields of sunflowers and olives in 2050, you may also spot farms with AD plants using farm waste (and perhaps the food waste from your local community) to create methane which is burned for electricity, and putting the by-products (carbon dioxide, water and digestate – a fertiliser) back into the glasshouses or fields to continue the cycle. If they're in the right spot, you may see them managing wind farms or hydro schemes. Or you may see woodland or high rotation crops such as willow or miscanthus planted for biomass fuels that could be supplying your area with its heat energy.

Government plans to guarantee better prices for electricity generated from renewable sources are making it a much more attractive investment, so there is a lot of interest within the sector to diversify into energy production. And, of course, the energy debate has wider implications for agriculture than just power. Synthetic fertilisers are manufactured from fossil fuels. As energy prices rise, so do fertiliser prices, making intensive food production more costly than before.

Because adapting to the environmental effects of climate change is just part of the picture – as the climatic conditions are changing, so too are the economic, political and social.

By 2050 it's predicted that nine billion people will need feeding across the globe, energy (and fertiliser) prices will continue to increase, and improvements in living standards will mean that more people will want more energy-intensive food such as meat and dairy. Consumer interest (at least in the UK) in the way we produce our food will drive improvements in environmental standards and animal husbandry, and our interest in locally produced food is likely to continue. The required cuts in greenhouse gas emissions will only get tougher in order to achieve the 80% reduction promised across the board by 2050.

So the pressure will be on for agriculture in this new 'low-carbon' world. But farmers and land managers are business men and women who've demonstrated great resilience through the past few decades where the buying power of supermarkets, disease outbreaks such as Foot and Mouth or Bluetongue, and increasingly stringent environmental standards have continually challenged them to evolve and adapt.

Central to a thriving and productive agricultural and land management sector in this brave new world is an integrated and flexible community of practice where farmers, their membership organisations, their advisors, conservation organisations, the academic community, retailers, the Government and even local communities are working together to face the challenges that climate change will bring. The sector is already demonstrating its ability to build strong and successful partnerships – three key organisations have come together to form a Climate Change Taskforce, which is voluntarily leading the charge to reduce greenhouse gas emissions from agriculture. And crucial to this is communication.

That's where Forum for the Future's project, Farming Futures, comes in. A collaboration between the industry (the National Farmer's Union, the Agricultural Industries Confederation, the Agricultural and Horticultural Research Forum, and the Country Land and Business Association), Forum for the Future, and Defra, the project aims to inform and inspire farmers and land managers to respond to the challenges and opportunities of climate change.

After just two years of delivery, 41% of farmers surveyed had heard of the project and we are now reaching more and more through our topical factsheets, case studies, dedicated website and series of practical, on-farm events across England. But the bar has been raised – our challenge is not just to create awareness, we now need to catalyse behavioural change too.

At the end of the Second World War, agriculture embarked on a 'green revolution' that ushered in a period of unprecedented growth in global food output, however unfairly around the world those supplies may have been distributed. As climate change bites, agriculture needs a second revolution – and it's already started. ■

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Madeleine Lewis co-manages the Farming Futures project at Forum for the Future. Before joining the Forum, Madeleine was a broadcast journalist at the BBC in radio and online. www.farmingfutures.co.uk

Case study: harvesting rainwater for use on the farm

Julian Hasler works a mixed 900-hectare farm in the Cotswolds, Gloucestershire, with wheat, oilseed rape, spring barley and pigs. As part of a project to convert redundant farm buildings he needed to move his grain storage and took it as an opportunity to see if he could reduce the 'environmental footprint' of the farm. He identified water management as an area where they could make improvements.

Julian installed a second-hand tank as well as an underground sump to collect rainwater which is used to fill the crop sprayer and washing the farm machinery, and the excess is directed to an open ditch which supplies a wildlife pond. As a result they are drawing less water from the farm's borehole, a supply that will come under increasing stress with the changing climate.

Julian says that he has noticed that rainfall on their land has been much more erratic in recent years. While he is motivated by more than just the bottom line, seeing the cost benefits certainly makes financial investment easier to make. The experience has encouraged him and his wife to think more about the sustainability of their practices and they are currently in the process of converting more farm buildings for residential use – and all will be powered through solar and biomass.

Rural agriculture and climate change in low income countries

Challenges and opportunities

SALEEMUL HUQ and JAMES MACGREGOR assess ways low income countries can build resilience to climate change through agriculture.

Most emerging analysis seems to conclude that agriculture and human wellbeing will be negatively affected by climate change. Current concerns are over how to secure access to food; future concerns will include how to improve access to food in a carbon-constrained world and how to deal with changes to productivity of lands with climate changes. Crafting a resilient future for the food system is crucial to reduce risks of increased hunger and poverty, and lies at the centre of our collective vision for a low-carbon sustainable global economy. Yet, the foundation for this resilience in developing and low income countries (LIC) - agriculture - is one sector that appears fragile, poorly resourced and on the frontline of risks from climate change.

Climate challenges facing developing nations

Climate will likely hit the poorest countries hardest; those who are net importers of food, and with the least leveragable assets. Within nations, it will hit the poorest in communities; those on the most marginal land, most remote from markets, and with the lowest net assets. In Namibia, the world's most economically unequal country, IIED research found inequality endures and is exacerbated with climate change, with the biggest economic impact hitting the poorest – with unskilled wages forecast to drop by 24 percent in twenty years.

Climate change will impact developing nations first through its agricultural system, impacting rural livelihoods first and fast. Combinations of mitigation and adaptation will be required to reduce impacts. With an estimated 70 percent of livelihoods in Africa reliant on the agricultural system, it is vital to build resilient rural economic and agricultural systems.

The politics of agricultural change will play a big part, since many of the initial changes associated with climate might be economically invisible. Some crops will increase in productivity and others will fall. This means that in some countries the net food availability at a national level might not change, even rising in some instances. This will change the comparative advantages of some nations, and change trade flows, particularly regionally in the developing world.

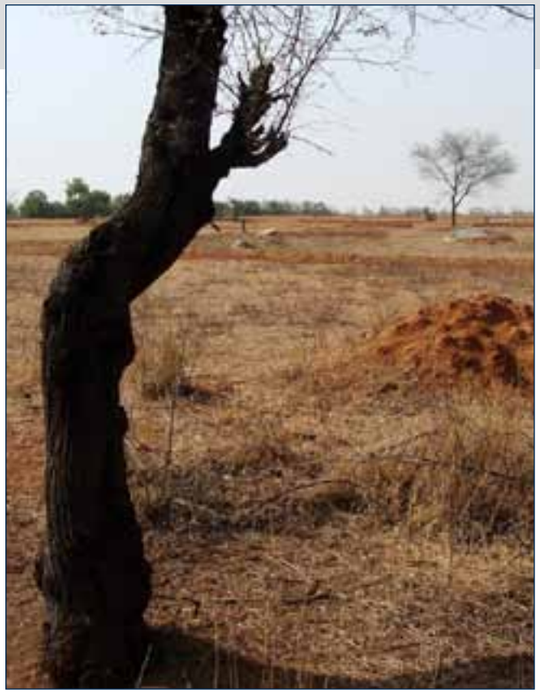
Yet, it is at a local level where food insecurity could be increasing – under the national-level radar. New forms of risk analysis are needed, and better collection and analysis of information at a local level. Furthermore, recent IIED research in Tanzania has shown at a country level that the Stern Review was right; agriculture will be the hardest hit economic sector in developing nations and not necessarily noticeable at a national level until 2030, but is likely to be severe post-2030.

Agriculture needs to be seen in its economic context and addressed as a climate change concern. It is largely a rural, local, small-scale private sector issue. It is intimately coupled to the institutions of household, family, village and market locality. These linkages could be strong, and no doubt enhance resilience and food security, but climate change will likely impact geographically, causing common impacts upon market localities, potentially creating problems at a landscape level.

Systemic vulnerability

At the heart of agriculture's vulnerability are existing systemic inefficiencies which could lead to climate change producing a 'deeper dip' for LICs than for other nations. Existing poor levels of rural economic development and, specifically, agricultural innovation are expected to compound and exacerbate negative impacts caused by climate challenges. These are due to poor delivery of new technologies, poor scalability of good agricultural practices, weak enabling institutions, and a lack of private sector innovation. Inefficiencies remain high at production and marketing levels throughout food supply chains in developing countries. This means higher wastage and lower rents, and can contribute to or exacerbate hunger and poverty. However, production efficiencies dominate the literature and discourse. Recent research has shown that upgrading efficiencies in the supply chain can cut crop wastage, enhance quality, and enable more effective distribution.

There is disagreement over the scale of need for productivity increases. The potential for technological solutions through, for instance, biotechnology is being discussed widely. However, the potential to transfer good agricultural practice, which lies



India: Tree and soil Ben Sutherland

at the core of much rural development work throughout developing countries, remains outside of these main debates. One reason for sub-optimal transfers of knowledge and technology is ineffective institutions. A lower institutional capacity means missed opportunities and lower reaction speeds to growing concerns such as climate change. At a time when the LIC agricultural lobby needs to ensure their voice is heard by, for instance, any future global adaptation funding boards, there is relative silence, raising the volume on concerns about how any funding could operate given existing constraints.

One agricultural lobby with a voice is export horticulture, which is increasingly under forensic carbon spotlights owing to its use of carbon-intensive forms of transport. In seeking to reduce their national emissions, some consumers in developing countries are considering boycotting emblematic goods, such as those from developing nations that are air freighted. This might alter market access. The private sector lobby, such as Fresh Produce Exporters' Association of Kenya (FPEAK) have successfully lobbied along with international NGOs, the British government and Kenyan Embassies for European retailers and consumers to balance equity considerations alongside carbon issues. However, these are private decisions, and by no means across the board – public market access may be altered in the future as carbon concerns dominate.

Learning

Information changes behaviour. Climate change concerns present opportunities in terms of shifting preferences and highlighting the need to revisit our prevailing global development paradigms. Learning from how the private sector deals - or fails to deal - with shocks and risks in the food system are crucial information for planning public interventions at a national level. Yet, currently, this opportunity to learn is often foregone.

It is clear that the significance of the actions, incentives and voice of the private sector in the agricultural system is growing. The development community is increasingly embracing the private sector as a change agent in unlocking incentives for sustainability and poverty alleviation. Successful supply chains tend to exhibit stronger levels of trust among trading partners, higher levels of co-investment along the supply chain, better flows of information, lower wastage, higher rents, and higher, persistently upgraded, quality produce. For instance, high-value horticulture trade with developed nations is booming. This relatively tiny trade brings with it a tangible transfer of skills, good agricultural practice and new business models coupled with injections of funding directly into rural areas of LICs. Private standards are a big part of making these supply chains successful and sustainable. The potential to leverage these private standards for local and national consumption remains largely unexplored. Learning from the deployment of these private standards – a conspicuous form of soft technology – should inform development, guidance and leveraging of the agricultural system for both public and private sectors in LICs.

Rural economic systems appear resilient, flexible and adapted to being impacted by shocks. Climate change will prove another form of shock. For instance, pastoral systems are founded on risk management at a landscape level. Yet, these rural systems often fly under-the-radar of the national level policies and investments. Characterised by informality and subsistence, the rural economy is the backbone of many LICs and the agricultural system is its major shareholder.
In the current recession, the informal sectors of all developing countries have been growing fast – and yet not apparently crumbling or becoming less effective at managing the agricultural system. An indication of national-level ignorance of these rural economic sectors is the low levels of public investment in them. Yet, while national level indicators are flashing red and formal sector jobs are being lost, the rural economy appears to be healthy, even thriving in some instances. Looking at the reasons for this and taking the learnings to a national level should guide government's planning.

Accounting frameworks are key for driving policy. The developing world's environmental assets are getting attention thanks to climate change focus on soil and forest resources. Although the CDM has yet to deliver at scale or at small-scale or for the poor, revised mechanisms which are expected to be implemented in the post-Copenhagen agenda will include soil carbon in tropical nations, REDD projects and REDD+ – all of which require an appropriate mechanism.

Solutions

Building systemic resilience to climate change will not be easy, but many necessary changes and activities only serve to amplify what is needed (typically) to achieve wise development in the absence of climate change. If climate change can accelerate so-called wise development of the agricultural system, there is a potential win-win.

Soft technology transfer

Avoiding the 'deeper dip' is possible through accelerated agricultural development leveraged by technology transfer. In the first instance, developing nations are demanding so-called 'soft technology' – and its transfer to scale need not be expensive. When IIED asks farmers what they need, excepting financial elements, they reply marketing skills, in addition to greater on-farm knowledge, GAP, and other management tools. This chimes with our thesis that both production and marketing upgrades are needed to build systemic resilience to climate change. Investments in institutions, especially markets, are crucial. And it is clear there is ample space for skills transfer, training and other forms of capacity building to be conducted. The export horticultural sector has successfully trialled this through its deployment of private standards. It is clear this model would need adapting to different crops, but it offers an appealing case study for potential scalability.

Finding the most effective way to accelerate transfer of 'soft technology' is key to ensuring continued development of the agricultural sector while building climate change resilience. These 'technologies' demanded by developing-country food systems already exist but will require adapting. Arguably, this is a role for public and private sectors working together, coupled with catalysing funding from future global adaptation funds.

Information base upgrade

Global efforts to collect and disseminate data on the spatial nature of agriculture need to be strengthened. In LICs, funding for national statistical programmes should be increased so that they can fulfil the task of monitoring global change. On agriculture, this means raising capacity to adapt GAP elsewhere, advising the private sector and guiding the public sector to develop and plan in ways that benefit and/or do not limit the opportunities for growth of the agricultural system and its rural economic backbone. There is no better start for this than to begin to strategically and regularly talking with farmers. Further, expansion of agro-meteorological technologies and activities is needed – possibly leveraging existing ICTs.

Public role reassessment

Given the growing current and future significance of the private sector, we ask: what does public policy require to provide the 'technology push' that can scale-up the 'market pull' for private sector investments in the agricultural system? Our suggestions are to reinvigorate national research and extension programs – which collaborate with farmers, industry, and build evidence (on farming, farming needs, efficiencies, GAP and good supply chain practice), build capacity, and more resilient rural agricultural networks. There should be new intelligent institutions such as developing new forms of intermediary and examining the potential for farmer organisation development. For instance, we propose finding ways for the public sector to learn from the practical successes of the private sector for designing public policy. UK-based food retailers reduce risks and secure supply chains, in part, through diverse procurement – they might source apples from Chile, South Africa and Kent. LICs could map the econo-geography of food production at a national level, and use climate change forecasts to determine risks to future food security.

Investment

Separating adaptation and development in agricultural systems may appear an academic pursuit, but in the ability to attract global funding it is clearly important. Here calculating costs of adaptation is a key resource

How we implement the post-Copenhagen agenda will be crucial

In conclusion

How we implement the post-Copenhagen agenda will be crucial. There is an expected interest in developing countries, and this means on agriculture. But we caution that this discussion shouldn't be only at international and national levels. Options for new global funding mechanisms linked with environmental assets are crucial, including REDD, REDD plus, soil carbon, and the re-invention of any of the Kyoto mechanisms.

At national, regional and local levels there are many opportunities and challenges to be faced. In the agricultural system, better agricultural institutions, greater collaboration with the private sector and better information management will enable greater short-run resilience and provide the foundations for long-run resilience.
It is crucial to ensure we build international negotiation capacity around agriculture and climate change. But this also needs to feed into national-level debates and processes. We suggest finding ways of linking international negotiations with community-based adaptation and rural agricultural systems information, needs and experience. ■

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Sustainability throughout the supply chain

A view from Cadbury

DAVID CROFT discusses ways to insulate against climate change through developing a secure business.

Given the extent of the global supply chain that supports our business, it's probably unrealistic to believe that one company alone can insulate against climate change's impacts on that supply chain and the inevitable effects on business. However, that should not stop us considering the extent of that supply chain, the impacts of our business on the environment and the things we can do to minimise and mitigate those impacts, and adapt for a low carbon future that will support our business in years to come.

When we set our targets for our environmental programme, Purple Goes Green, back in 2007, we knew that the stretching targets would not be achieved through "business as usual". In setting a target to reduce absolute carbon emissions by 50 percent by 2020, we wanted to change our approach fundamentally, prepare for a new business paradigm, set a testing roadmap for our future and, in doing so, raise the bar on how the food industry was tackling climate change.

Meeting this target in our own operations is as much about changing culture as it is about technical solutions, and we knew we would need to embark on a cultural change programme, internally and externally. At Cadbury, our culture of being 'performance-driven' and 'values-led' is about delivering the values that have been at the heart of our business for 200 years in a contemporary setting while growing a hugely successful business.

That contemporary setting has to take account of the challenges of climate change and build a business model within which sustainability is a core part, supporting day to day operations and long term strategy. For this reason, our business strategy clearly articulates how our six sustainability commitments, one of which is long term environmental sustainability, are built into our strategy for growth, efficiency and our teams. In this way sustainability in Cadbury is not just CSR window dressing, but about day to day decisions and actions that support our future, with people accountable for delivering it alongside more typical business goals.

Changing business direction, as little as one degree for a business as large as Cadbury, can have profound effects, and we are changing our approach across our global operations. Even so, the challenge of climate change is one that needs widespread support and so, while addressing our own business, we also see the need to advocate sustainable business practices to all those we interact with, our colleagues, customers and suppliers. We also see it as the key way in which we can support change at scale and, in doing so, adapt our business to the risks of climate change.

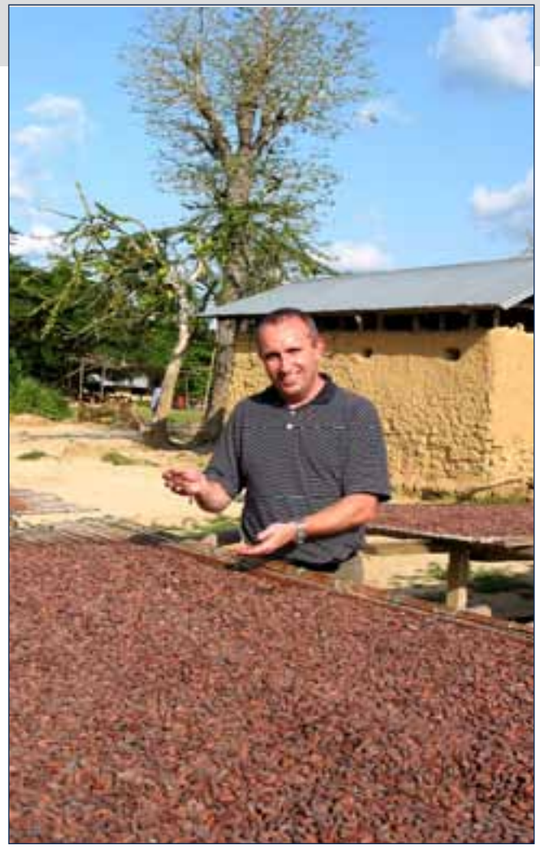
Looking across our supply chain raises a number of challenges where climate change is already having an impact. Agricultural ingredients in many parts of the world are facing unprecedented challenges. That's why, for example, we have been working for 25 years with agricultural universities to naturally select cocoa plants that are more resilient to higher temperatures and higher saline in water. Alongside this, we have been encouraging farmers to use drip irrigation and combine crops to maximise land opportunities. In countries such as India, these are crucial in supporting rural agricultural economies, farmer livelihoods and long term environmental sustainability. Elsewhere, we are working on carbon sequestration, through farming methodologies and charcoal, both of which can add to farmer livelihoods as additional income streams that support thriving rural communities.

Back in 2008 we established the Cadbury Cocoa Partnership – a £45 million investment in cocoa communities in Ghana, India, Indonesia and the Caribbean. This came from an increasing realisation that companies like Cadbury need to play a new, more active role in ensuring the future and sustainability of our key ingredients, right across the economic, social and environmental aspects of cocoa farmers' live. Detailed research through the University of Ghana and the Institute of Development Studies in 2008 conveyed the realities of cocoa production in developing countries, and the resulting Cocoa Partnership is now starting to tackle both the socio-economic and environmental challenges those farmers face, through the Cocoa Partnership, Fairtrade for Cadbury Dairy Milk, and environmentally sustainable cocoa farming.

The challenge of climate change is one that needs widespread support

But the extent of our environmental footprint extends throughout our supply chain, and so must our actions. Our work on product carbon footprinting has highlighted the dairy sector as a key factor in reducing the overall carbon within our portfolio. This is why we launched a low carbon dairy farming guide, drafted with farmers, for farmers. We're working with the Selkey Vale farmers group, our major milk supplier, to help reduce carbon in the dairy part of our supply chain through diet and farm management techniques. The partnership Cadbury has with Selkey Vale is one we're especially proud of, and means Cadbury Dairy Milk is not just the only UK chocolate using liquid milk, it's also using local milk from UK farmers with an increasingly low carbon footprint.

Of course, while our supply chain is a large part of our carbon footprint, it's our own operations where we have most control over and ability to create change that tackles climate change. Our 50% reduction target is certainly challenging, but we're on track because of action plans in all our factories. Tackling simple things is a big start, and we anticipate that low-cost and no-cost solutions will deliver 10% or more. Investment in new equipment, stronger maintenance programmes and training our teams to find low energy options are all delivering reduced energy and water usage. Our transport systems in Europe are more efficient, sharing routes and vehicles with partners effectively to reduce road miles travelled. Our packaging is being reduced. For example we abandoned the packaging on some of our Easter Eggs (the bête noir of over-packaging), and sold them just wrapped. This received great support from consumers. There will be more to follow.



David Croft visits a cocoa supplier in Ghana.

At the outset, I noted that technical changes like these are the easy part. Most people can do them, and they will have an impact. They are doing so for Cadbury. The results are speaking for themselves with carbon down by just under 10 percent, and water use down by 20 percent. Both are investments in long term environmental sustainability. Water reduction for some of our sites, in India and Australia for example, is already not just important, but an absolute necessity. Indeed building long term sustainability into business activity is crucial for any business.

But to be successful, culture change is all important. There is a strong business case for making sustainability a business essential. The consumer-focussed food industry is very aware of what its customers are saying and the day to day business pressures across a global supply chain are a powerful motivator, but even with these, changing hearts and minds to deliver sustainability can be a challenge. Communications that create buy-in, incentivising managers, recognising and rewarding change mean that our sustainability commitments are now part of the lexicon at Cadbury. There is a huge employee network of "Green Advocates" championing sustainability issues and challenging the status quo to find new opportunities. It's all of these that create the appetite for change, an ability to achieve the targets we've set and a desire to tackle the challenges of climate change.

There is a strong business case for making sustainability a business essential

Just over 100 years ago, George Cadbury talked about the potential for business to be a force of good in troubled times. The inevitable impacts of climate change, mean we certainly face troubled times now. The programme at Cadbury brings George Cadbury's sentiments into a contemporary context where business has a role to play in creating change for a sustainable future.

Business and capitalism is often seen to be a force in opposition to development. It's characterised as a one-way relationship in thrall to profit margins and shareholder returns, with no time for longer term concerns. However, history shows that those who operate in this way inevitably come undone, and the recent past has presented numerous examples which we would do well to learn from. Increasingly though, there is a new opportunity that can support sustainable development, with business playing a key role. This is the essence of Cadbury's 'performance driven and values led' culture. It's what is driving our changes and actions, and it's what we know can make for a more successful and sustainable business. ■

David Croft is conformance and sustainability director at Cadbury PLC, having joined the company in 2005 as ethical sourcing director. He is a member of the Food Ethics Council.

Beyond sea walls

Food retailers must lead the charge on the adaptation agenda

DAN CROSSLEY highlights the action food retailers should take to future-proof against climate change.

Building sea walls to combat rising sea levels: that's what climate change adaptation is commonly depicted as being about. That's also why it's pretty low down the shopping list of priorities for food retailers.

Talking about climate change 'adaptation' lets retailers off the hook. A dictionary definition of adaptation is a 'change in behaviour of a person or group in response to new or modified surroundings'. What we need though is proactive change, rather than reactive change – preparing for the future rather than simply 'adapting' to the inevitable after it has happened. We need to ensure food retailers are fit-for-purpose in a world that's experiencing climate change and responding to it.

Forget all this stuff about 'needing level playing fields' and 'needing to respond to what consumers want' for the moment. Let's face up to reality. Retailers influence consumers. And major retailers influence their supply chains too. So who's better positioned than food retailers to take the lead and drive action on climate change with consumers, suppliers and employees – on reducing emissions, but also on the broader agenda of adapting to change?

> Climate change, and society's response to it, will fundamentally alter the competitive context within which companies operate

But how do you prepare for the future? Let's fast forward a dozen years to see what food retail might look like in a world where climate change is affecting not just our environment but our politics, economy and society.

It's 2022. 'Direct from the producer' stores are all the rage, like the one offering coffee and crafts from a Brazilian village cooperative. Supply chains change very quickly, and often use the Internet to organise themselves around price or carbon footprint, rather than being centrally directed by large retailers.

Or it's 2022. Supply chains have had to become more diverse to minimise the risk of disruption from the physical impacts of climate change. There is less 'just in time' delivery, and some raw materials are scarce due to resource constraints. Massive regional distribution centres are out. Instead, many retailers are developing smaller and more efficient forms of transport to respond to the demand for local distribution. Hyper-local products grown in the vertical farms on top of many stores are widespread. Food miles can sometimes be measured in metres.

Or it's 2022. Rural society has been largely corporatised and retail-branded, mixed-use farms ("Tesco farms" and "Asda farms") predominate. Supply chains are typically large, global and co-ordinated by large multi-national businesses through international agreements.

These are all possible future worlds, taken from scenarios in Forum for the Future's Retail Futures report (http://www.forumforthefuture.org/projects/retail-futures-202) and designed as a tool to help retailers think through and prepare for what the future may hold. We don't know exactly what the future will be like, but we do know that climate change, and society's response to it, will fundamentally alter the competitive context within which companies operate. And food retail arguably has more to lose than most from failing to prepare adequately for its potential impacts.

Food retail companies - being dependent on agricultural supply chains - are amongst the most likely to see direct risks from climate change disruption. There is already a shortage of water, soil and land in many areas. Climate change will make this worse and put new areas under stress. More frequent natural disasters will create supply chain shocks, whilst commodities are likely to become much more expensive. Put another way, climate change will fundamentally alter the cost, range and source of much of the food on the shelves of retailers.

On a more positive note, those food retailers that anticipate potential future changes, build flexibility and resilience into their supply chains, and set themselves up to respond more quickly to unanticipated events when they happen, will be more robust and ultimately more successful.

A Tesco store flooded after heavy rains. Ad551, Flickr.com

What does a leading resilient, 'future-proofed' food retailer look like in practice? Firstly, its supply chain will be flexible and diverse, so that it can remain fleet-footed and minimize the risk of disruption. Secondly, it will take products that aren't 'fit for the future' off its shelves, and will focus on selling foods with a low environmental impact and high nutritional content. Thirdly, it will take responsibility for educating its customers about what they can do now to prepare for the changes that lie ahead (which might include re-educating them on seasonality for example). And finally, the stores themselves will be adapted to cope with future climate change (and that doesn't just mean supermarket-sponsored sea defences).

It's encouraging to see that the (Tesco-funded) Sustainable Consumption Institute at the University of Manchester is exploring the last of these strands - how stores might need to adapt - in its programme of work entitled 'Supermarket Adaptation to Future Environments'.

We at Forum for the Future have issued a Climate Challenge {http://www.forumforthefuture.org/projects/climate-challenge-to-business) to business, designed to set out the essential components of leadership on climate change. One key element stresses the importance of developing a full understanding of the risks and opportunities posed by climate change. Climate change induced supply chain disruption should be near the top of every food retailers' risk register. But smart retailers are already recognising that preparing for climate change is an opportunity to get ahead of the curve. Do any of the food retailers have it on their opportunity registers I wonder (indeed, do any even have an 'opportunity register')?

Climate change adaptation remains the poorer relation of mitigation, but that won't be the case for long. According to a survey by our Farming Futures (http://www.farmingfutures.org/) project back in February 2009, 30 percent of farmers are already taking action to adapt to climate change. That's not high enough, but my guess is that the proportion of food retailers taking it seriously is much lower. We need bold leadership from the major supermarkets in driving change with suppliers and shoppers on adaptation, as we're now starting to see on mitigation. Let's accelerate the transition to a low carbon world and let's help food retail be at the forefront. ■

Retail Futures can be downloaded at http://www.forumforthefuture.org/projects/retail-futures-2022. For more information about Forum's Climate Challenge go to http://www.forumforthefuture.org/projects/climate-challenge-to-business.

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We aim to build the definitive directory of people offering research or other consultancy on environmental and wider ethical issues relating to food and farming. To join visit: www.foodethicscouncil.org/researchdirectory

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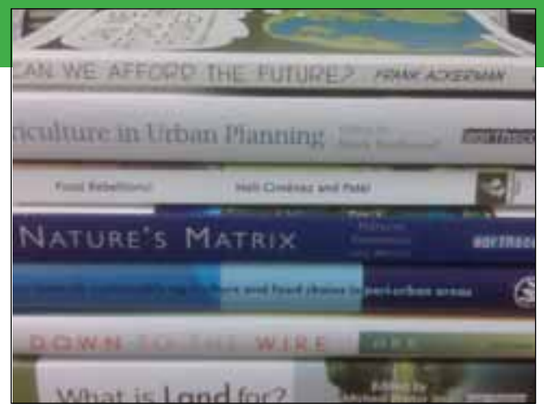

Local Food
Tamzin Pinkerton & Rob Hopkins| 2009 | Green Books
ISBN 978-1-900322-43-0
The revival of local food initiatives has been driven by many agendas, not least the Transition movement's desire to "support community responses to peak oil". In their new handbook, Pinkerton and Hopkins review a spectrum of local food initiatives from garden shares to full blown community supported agriculture. The result is an inspiring set of case studies with practical, informed advice on how to 'make it happen' in your community. ABC

Food Rebellions!: forging food sovereignty to solve the global food crisis
Eric Holt Gimenez and Raj Patel| 2009 | Fahamu Books
ISBN 978-1-906387-30-3
Food Rebellions! analyses the recent food crisis, detailing the systematic uprooting of the agriculture systems of the Global South by capitalist food production systems, dominated by multinational corporations. Unequal trade regimes, industrial export-led development, and unjust property laws have undermined availability and access to food, in both developing and 'developed' countries. SR

Transitions towards sustainable agriculture, food chains and peri-urban areas
Krijn J. et al Eds. | 2009 | Wageningen Academic Publishers | ISBN 978-90-8686-117-0
Holland's high land prices and competing demands for land use have created a wealth of expertise in research on global agriculture in peri-urban areas. This book brings together that expertise, collating experiments, and sharing with a wider audience Holland's transitional journey to sustainable agriculture. EB

Environment, development, and sustainability
Gordon Wilson et al eds. | 2009 | Oxford University Press
ISBN 978-0-19-956064-6
A must for students and practitioners alike, this book brings together sustainable development examples from around the world. Designed to be read as a whole or in part, each section draws out key messages and conclusions from the multiple case studies, making it a fantastic resource for a holistic learning approach to environment, development and sustainability. EB

Down to the wire
David W. Orr | 2009 | Oxford University Press
ISBN 978-0-19-539353-8
'Down to the Wire' is a comprehensive guide to all aspects of how we have to face climate change, including the political, economic and lifestyle choices. As well as drawing sometimes shocking parallels with historical events it offers potential solutions for brightening our future. AD

Nature's Matrix: linking agriculture, conservation and food sovereignty
Ivette Perfecto, John Vandermeer and Angus Wright | 2009 | Earthscan | ISBN 978-1-84407-782-3
Agricultural ecosystems are key to conservation and biodiversity. As ecosystems become fragmented, organisations must migrate from one fragment to another to ensure survival. The bridges between them are agricultural land. However, industrial agriculture doesn't allow this to happen. Alternative agro-ecological production models are the way forward. SR

World Hunger Series: hunger and markets
World Food Programme | 2009 | Earthscan
ISBN 978-1-84407-838-7
Left alone, markets can cause hunger on an alarming scale - forcing food price rises and trapping people in a spiral of poverty. Controlled by government they can be equally damaging. This book seeks a middle way, calling for wise government supervision of markets to ensure they work for the poor. EB

Prosperity without growth
Tim Jackson | 2009 | Earthscan
ISBN 978-1-84407-894-3
Economics Commissioner for the Sustainable Development Commission, Jackson argues the case against economic growth in developed nations. The ecosystems that sustain our economies are collapsing due to a rise in consumption that adds little to human happiness and may even impede it. This book highlights how society can prosper within our planet's ecological limits. VB

What is land for?
Michael Winter and Matt Lobley eds. | Earthscan | ISBN 978-1-84407-720-5
How we use land impacts our climate, and as the climate changes, so does the way we use land. Is it right to turn land over to biofuel production, wind farms and anaerobic digesters, or is there another, better way? This collection explores how land use and food security will affect global and local research, policy and practice in the years to come. EB

forthcoming events

2nd - 4th Dec '09	Earth system governance: people, places and the planet | International Human Dimensions Programme on Global Environmental Change | www.earthsystemgovernance.org/ac2009 | Amsterdam, The Netherlands
2nd Dec '09	The Rachel Carson memorial lecture 2009 | birds and pesticides | is the threat of a Silent Spring really behind us? | PAN UK | www.pan-uk.org | SOAS University, London
3rd Dec '09	Westminster Food & Nutrition Forum Keynote Seminar: Obesity 2009 | Food and Drink Federation | http://www.fdf.org.uk/event.aspx?event=2093 | London
5th Dec '09	Feeding the 5000 London UK | The Mayor of London, ActionAid, London Food and others | www.feeding5k.com
7th - 8th Dec '09	SCAW's Annual Winter Conference | http://www.scaw.com/Winter%20 | Conference%20pr%202009.pdf | San Antonio, TX, USA
7th - 18th Dec '09	United Nations climate change conference | www.cop15.dk/en | Copenhagen, Denmark
11th - 12th Dec '09	AgriLIVE Smithfield – a new technical event for British farming | http://www.agrilivesmithfield.co.uk | Royal Agricultural Society of England
14th Dec '09	Food and its meaning for asylum seeking children and young people in foster care | British Sociological Association (BSA) | www.food-study-group.org.uk | London
17th - 18th Dec '09	International conference on food security and environmental sustainability Department of Agricultural and Food Engineering | http://www.agri.iitkgp.ernet.in/fses2009/index.html | Indian Institute of Technology, Kharagpur, India
4th - 6th Jan '10	The Oxford Farming Conference | http://www.ofc.org.uk | Oxford, UK
5th - 7th Jan '10	International Advances in Pesticide Application 2010 | The Association of Applied Biologists http://www.aab.org.uk/contentok.php?id=82&basket=wwsshowconfdets | Cambridge
7th Jan '10	Organic Producer's Conference 2010 | Organic Inform | http://www.organicinform.org | Harper Adams University, Shropshire
16th - 17th Jan '10	Annual DBV International Agri-business and Food Forum at the Green Week | http://www.ifap.org/en/newsroom/documents/IFAPCalendarforExecutive_April29.pdf | Berlin, Germany
20th - 23rd Jan '10	Ecofarm Conference | www.eco-farm.org/efc | Pacific Grove, California
3rd - 5th Feb '10	2010 Managing Excellence in Agriculture Conference | Canadian Farm Business Management Council | http://www.farmcentre.com/EventsAnnouncements/Events/ManagingExcellence/2010 | Canada
23rd - 24th Feb '10	Environmental Management and Crop Protection | CPNB | www.cpnb.org | Dundee, Scotland, UK
16th - 17th Feb '10	European Biowaste Forum | http://www.agra-net.com | Brussels, Belgium
16th - 18th Feb '10	Innovations in Value Added Dairy | Agra Informa | http://www.agra-net.com | Kingsway Hall, London
25th Feb '10	After Copenhagen: How can business face the climate change challenge? | The Economist Conferences | http://www.economistconferences.co.uk/event | London, UK
23rd - 24th Feb '10	The 4th Annual European Nutrition and Lifestyle Conference 2009 | Forum Europe http://guest.cvent.com/EVENTS | Brussels, Belgium
8th - 10th Mar '10	Bio Europe Spring 2010 | EBD Group | http://www.ebdgroup.com | Milan, Italy
21st - 24th Mar '10	Event: Food & Drink Expo | Food and Drink Federation | http://www.fdf.org.uk/event.aspx?event=2020 | Birmingham, UK
22nd Mar '10	World Water Day | http://www.worldwaterday.org
22nd - 24th Mar.'10	Phosphates 2010 Conference & Exhibition | British Sulphur Events | http://crugroup.com/Events | Belgium