

THE CLIMATE CHANGE AND FOOD NEXUS

Climate change poses a huge challenge for food security worldwide, due to drought, floods and irregular weather patterns. At the same time, food production, distribution and consumption are all making a significant contribution to greenhouse gas emissions. With nearly 870 million people suffering from hunger, the pressing question is: can we build sustainable, resilient and equitable food systems that can meet the nutritional needs of present and future generations in a world constrained by limited land, water and energy resources, and threatened by the potentially devastating impacts of climate change? If we can, then there could be enough food for everyone, for generations to come.

How climate change is devastating food security

Climate change is already having a dramatic impact on all aspects of food security. Agriculture – on which the livelihoods of some 2.5 billion people in the developing world depend – is the sector most affected by climate change, due to its vulnerability to hazards such as floods, droughts and pest attacks.

Water is a critical constraint to agricultural production. This is particularly evident in Peru and Bolivia: between them, these countries accommodate more than 90 per cent of the world's tropical glaciers, which have been melting rapidly. Additionally, over-extraction of groundwater is a major problem in parts of south Asia that are intensively cultivated, and it could become

so in the arid and semi-arid zones of Africa if large-scale irrigated agriculture continues to expand.¹ Conflicts over rights to ground and surface water, as already witnessed in Peru and Bolivia, could intensify as climate change makes a further impact on water resources.

With global warming predicted to rise more than 3°C on the current pathway, there needs to be a clear acknowledgement of the implications of projected temperature rises on global food security and hunger (see Figure 1, below). This necessitates an **urgent push for greater emission reductions at both national and global levels, as well as critical adaptation of agriculture and food systems to the inevitable impacts of our changing climate.**

Figure 1.

Food and climate change – the killer facts

Why the food sector is important

- Annual global food retail sales are about US\$4tn.²
- 2.5 billion people rely on agricultural production systems for their livelihoods.³
- Eighty-five per cent of the world's farmers are smallholders who cultivate plots of land no bigger than two hectares. It is these small farms that produce the largest amounts of food globally (over 50 per cent) and cultivate around 60 per cent of the Earth's arable land.⁴

Nadia Saracini, senior policy and advocacy officer; **Alison Doig**, senior adviser – climate change and sustainable development.

POVERTY

**‘There are times when all it does is rain, and it carries away the fertile topsoil and you are left with poor soil where the crops do not grow well. There are also times of drought, and you end up having no harvest and no production.’
– Esther Gakobo, Kenya**

Figure 1 cont.

- More than 1 billion people are dependent on marine fish for their primary source of protein.
- Between 60-80 per cent of working adults in Africa depend on growing crops or grazing cattle for their living.⁵
- Agriculture is the principal source of livelihood for more than 58 per cent of India’s population.⁶

Current problems with the food sector

- Nearly 870 million people suffer from hunger (approximately 12.5 per cent of the world’s population).⁷
- Up to 2 billion people lack food intermittently, due to varying degrees of poverty.
- In the past century, 75 per cent of the genetic diversity of agricultural crops has been lost.⁸
- Humans now use some 171 million tons of nitrogen as fertiliser every year, polluting lakes, rivers, streams and the ocean.⁹
- A third of food is lost in developing countries because it cannot get to market on time; a third of food in rich countries is wasted because it is thrown away.¹⁰
- Eighty per cent of the world’s fish stocks are fully exploited, over exploited or depleted.¹¹

Predicted impacts of climate change¹²

- **Vulnerable climates:** even a small temperature change (1-2°C) could reduce crop productivity and increase risk of hunger. With a change of over 2°C, fish stocks will diminish due to acidification and decline in coral reefs.
- **Africa:** yield, length of growing season and the area suitable for agriculture will decrease in many parts of the continent. Projected reductions in yield could be as much as 50 per cent by 2020 in some countries. By 2020, 75-250 million people will be affected by water stress.
- **Asia:** 20 per cent increase of yield in east and south-east Asia, but a 30 per cent drop in yield in central and south Asia by 2050. Across the continent, fresh water in large river basins will decrease, affecting more than 1 billion people by 2050. India could lose 125 million tons of rain-fed cereal production (18 per cent of its total).
- **Latin America:** drier areas will have a significant drop in yields of crops and livestock; in temperate zones, soya bean yields will rise. Overall yields of wheat, rice, maize and soya bean are estimated to decrease by 2.5-5 per cent in the region by 2020.¹³ In the Andes region, studies predict a long-term dramatic decline in water availability in the dry season in areas fed by glaciers.
- The impacts of climate change will affect both levels of food production and food prices, with food prices yet again predicted to increase greatly as a result of recent droughts in Russia, the US and South America.

How food production contributes to climate change

Food systems contribute to climate change in a number of ways. Emissions directly from farming practice contribute 10-12 per cent of global greenhouse gas emissions,¹⁴ predominantly from methane from farm animals, energy inputs to the farm and nitrous oxide from nitrate fertilisers.¹⁵

However, there are also very significant emissions from the transport, storage and retail of food, which increase with the distance food travels to market. Another very significant source of emissions is land use change and deforestation to make way for cash crops and cattle ranching. With these emissions included, the global food system's greenhouse gas contribution moves closer to 40 per cent.¹⁶

Companies with interests in agricultural chemicals consistently argue that only genetically modified food¹⁷ and agrichemical inputs can feed the 9 billion-strong global population predicted for 2050. However, there is growing evidence that this is not the case – particularly if farming methods are very water- or energy-intensive, or deplete soil fertility leading to declining yields in the long term. Conventional or industrial approaches to agriculture, which involve high chemical inputs, are not the most appropriate for achieving these ends.

More wealthy countries should lead the way in reducing unsustainable food production practices, since these are largely driven by their consumption. For example, every kilo of beef produced for the European market emits the equivalent of 8-20kg CO₂,¹⁸ compared to less than 2kg of CO₂ equivalent for most grains and vegetables. Production of meat within the European Union relies on imported animal feed (soya) cultivated on some 20 million hectares of land outside Europe, amounting to 'virtual land and water grabbing' in Latin America.¹⁹

Small-scale farming and local supply

The application of ecological science to sustainable agriculture has contributed to promising new agro-ecological approaches. These are based on principles of environmental sustainability, diversity and minimising external inputs. They are often more relevant to poor small-scale farmers²⁰ and can also minimise the financial risks faced by poor farmers who cannot easily afford to purchase chemical inputs.

The best approaches are founded on farmers' existing knowledge and practices; utilise locally available materials and crops, as well as livestock suited to local conditions; and involve integrated approaches (such as mixed cropping, agro-forestry, and integrating crops with livestock or fish production) that have both nutritional and ecological benefits.²¹ In the face of climate change, the best outcomes will arise from combining farmer expertise with scientific research and advisory services that are tailored to meet farmer priorities, in line with ongoing and predicted changes to the local climate (see Figure 2, overleaf).

A growing body of evidence – supported by the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Environment Programme (UNEP) – shows that organic agro-ecological approaches to farming in developing countries are producing greater yields, proving to be more profitable and more resilient to stresses such as drought or hurricanes.²² One study showed that 'on average, in developed countries, organic systems produce 92 per cent of the yield produced by conventional agriculture. In developing countries, however, organic systems produce 80 per cent more than conventional farms'.²³

An FAO study on the use and impact of conservation agriculture in Kenya has shown labour yield growth for maize and wheat

'In the last few decades, there has been a drop in the amount farmers produce, which has led to poverty in families. We've noticed that the rains are less regular. We've had periods of drought and floods.' – Nizigama Sylvane, Burundi

of 100-150 per cent over conventional agriculture practice.²⁴ Another study shows that in Zimbabwe, conservation agriculture outperforms conventional farmer practice in terms of yield, profitability, production costs and productivity (returns to labour) under any rainfall conditions.²⁵

False climate solutions – biofuels and carbon markets

Some policies designed to respond to climate change are, in fact, contributing to competition for land and increased incidence of large-scale purchase of land in developing countries, often displacing small-scale food producers from their sources of food and income. Where this is not well-regulated, this can amount to illegal land grabbing.

The US and EU have set targets to replace 30 per cent and 10 per cent, respectively, of their transport fuel with biofuels. This has set off a chain reaction of land grabs in Africa:

- In Sierra Leone, a Swiss company leasing 40,000 hectares has been using chemical pesticides and fertilisers at a level that threatens groundwater and harvests beyond the plantation.²⁷
- In Ethiopia, the construction of a large dam on the Omo River and the irrigation of adjacent sugar plantations is predicted to increase salinity levels, have an adverse impact on fish stocks and invaluable grazing areas on the banks, and cause water levels at Kenya's Lake Turkana to fall by two metres.²⁸
- In Mali, Chinese and South African sugar companies are buying land and water rights that could drain the Inner Niger Delta.²⁹

These trends are similarly being incentivised by poorly constructed and regulated carbon trading mechanisms such as the Clean Development

'Before, we used to have water in abundance. Today we lack water. We used to plant our crops and the harvests were good, now the harvests are very small and leave us with just enough for our consumption.' – Teófilo Sulcacondor Candiote, Peru

Figure 2.

Agro-ecological farming in Cambodia²⁶

Although Cambodia is well known for its extensive annual river floods, a report published by Christian Aid has revealed that for many Cambodian farmers, drought is an increasingly serious risk and one to which they are least able to respond. They report that increasing unpredictability of rainfall is contributing to more frequent crop losses.

In response, Christian Aid partners have been working with communities to develop drought-resilient agricultural techniques that help to reduce climate risks, increase yields and diversify food production, and are accessible to poor farmers. These techniques are based on local knowledge, utilise locally available materials and Cambodian innovations, and minimise labour costs. They include:

- integrated farming, in which by-products of chicken- and fish-rearing provide organic fertilisers for vegetable production
- enhancement of aquatic food species (fish, crabs, snails) that naturally live in flooded rice fields
- drip irrigation, using cheap and locally produced materials, water harvested by traditional methods and innovations in mulching to retain moisture in the soil
- the System of Rice Intensification (SRI) and other innovations in rice production that minimise external inputs, reduce vulnerability to drought and enhance yields.

Mechanism.³⁰ Plans to use forests as carbon 'sinks' are affecting forest-dependent communities in Africa, who may further lose their rights to grazing land and forests. For example, a Norwegian company Green Resources has bought hundreds of thousands of hectares of Mozambique forest in order to obtain carbon credits – this threatens the food security and livelihoods of local populations by denying them access to their traditional lands and food sources.³¹

The same risk applies to efforts by the World Bank, among others, to include soil on agricultural land as a carbon 'sink', which could mean further takeover of land from small-scale farmers. There is great concern over the unreliability of soil for sequestering (absorbing) carbon and the lack of ability to measure the quantity of carbon sequestered in soil.

Making change happen

Christian Aid is calling for an immediate transition to agro-ecological methods – not only to increase agricultural productivity and resilience, but also to reduce climate change emissions from food systems. This requires a fundamental change in agricultural research and development to ensure that it is always guided by the priorities of small-scale farmers. There is also a need for much greater use of climate forecast information, and for that information to be made accessible to the small-scale farmers who are most at risk from climatic variability and hazards.

In global discussions on the successor to the Millennium Development Goals and the new Sustainable Development Goals, it will be essential that both global food security and the right to food for all are realised within the confines of finite natural resources and environmental limits, and particularly the changing climate. This means a new global development framework must address sustainability of food production, equitable access to land and water, and the political

commitment of governments to protect the right to food.

Financing must be generated – including through tax revenue, aid and climate finance – prioritising measures to help developing countries build resilience to environmental shocks and stresses. This should bolster the food production, purchasing power and social security of the poorest communities. It must include ensuring that small-scale farmers and pastoralists have full access to high-quality climate forecasts and early warning systems.

Attention and resources must enable small-scale food producers to adapt to climate change, prioritising agro-ecological agricultural practices in particular. Urgent national and global measures need to focus on people living in poverty within each country, who are particularly vulnerable to climate change and who spend up to 70 per cent of their income on food.

Christian Aid believes that in taking steps to mitigate greenhouse gas emissions, all governments should first meet their obligations to respect, protect and fulfil people's right to food and to protect subsistence agriculture. Smallholder farmers, pastoralists and forest-dependent communities should be involved and influential in any decisions regarding land use changes and support for their climate resilience and adaptation.

Industrialised countries should acknowledge the part their patterns of consumption and industrial food systems have played in contributing to greenhouse gas emissions. Moreover, they should take urgent steps to transform these patterns, rather than simply relying on carbon trading mechanisms that are difficult to monitor and that do not reduce their overall contribution to greenhouse gas emissions. This must include a massive reduction in food waste.

Christian Aid urgently calls for a suspension of the 10 per cent renewable energy

'We feel like pachamama [mother earth] is upset because we are destroying nature; the balance has been broken, and we have to fix things.' – Atencio, Peru

target for transport enshrined in the EU's Renewable Energy Directive, which in practice translates into a mandate for growth in biofuel production and trade.

If the above steps are taken, then tens of millions of the world's most vulnerable people could have more equitable access to land and water; secure and sustainable food production methods; the capacity to adapt

to a changing climate; a greater resilience to environmental shocks and stresses; and, crucially, enough food for the future.

For more details, contact Nadia Saracini: nsaracini@christian-aid.org or Alison Doig: adoig@christian-aid.org

Endnotes

- 1 See millenniumassessment.org
- 2 Economic Research Service and United States Department of Agriculture, 2009.
- 3 *FAO Statistical Yearbook 2012*, World Food and Agriculture, fao.org/docrep/015/i2490e/i2490e00.htm
- 4 *International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)*, 2008 global report.
- 5 Christian Aid, *Community Answers to Climate Chaos: Getting Climate Justice from the UNFCCC*, 2009, christianaid.org.uk/images/community-answers-to-climate-chaos.pdf
- 6 Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, *Annual Report 2010-2011*.
- 7 'Globally, almost 870 million chronically undernourished – new hunger report,' FAO, 9 October 2012, fao.org/news/story/en/item/161819/icode
- 8 *State of the World's Plant Genetic Resources for Food and Agriculture*, FAO, Rome.
- 9 A Hogg, A Cobham, D Black et al, *Hungry for Justice: Fighting Starvation in an Age of Plenty*, Christian Aid, May 2011, christianaid.org.uk/images/hungry-for-justice.pdf
- 10 See FAO research cited in 'One third of world's food is wasted, says UN study', BBC News, 11 May 2011, bbc.co.uk/news/world-europe-13364178
- 11 FAO, *The State of Agricultural Commodity Markets: High Food Prices and the Food Crisis – Experiences and Lessons Learnt*, 2009, fao.org/docrep/012/i0854e/i0854e00.htm
- 12 *Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007*.
- 13 FEU-US, *The Food Gap: The Impacts of Climate Change on Food Production: A 2020 Perspective*, 2011, feu-us.org/images/The_Food_Gap.pdf
- 14 See note 12.
- 15 This has been questioned by the fertiliser lobby – but recent isotope research has confirmed that 'the rise in atmospheric nitrous oxide levels is largely the result of an increased reliance on nitrogen-based fertilizers'. See Park et al, 'Trends and Seasonal Cycles in Nitrous Oxide since 1940', *Nature Geoscience* 5, 2012.
- 16 IAASTD states that agricultural activities and the subsequent processing, storage, transport and disposal of its products account for nearly 40 per cent of anthropogenic greenhouse gas emissions.
- 17 This statement does not criticise GM food itself but rather the input intensive and commercially controlled nature of food production, of which GM foods are currently a part.
- 18 See the CO2 food pyramid developed by Lars Krogsgaard Madsen and Phillip Geødesen Lund from the Danish Technical University.
- 19 *EU Imports of Soy for Animal Feed*, EU CAP Reform 2012 – CAP Lobby Brief 4, APRODEV, 2011.
- 20 The full range of benefits of sustainable agricultural practices are listed in Ben Hobbs and Sophie Powell, *Healthy Harvests: The Benefits of Sustainable Agriculture in Africa and Asia*, Christian Aid, 2011, christianaid.org.uk/images/Healthy-Harvests-Report.pdf
- 21 Ibid.
- 22 *Organic Agriculture and Food Security in Africa*, UNCTAD and UNEP, New York and Geneva, 2008, unctad.org/en/Docs/ditcted200715_en.pdf
- 23 Lim Li Ching, *Is Ecological Agriculture Productive?* Third World Network (TWN) Briefing Paper 52, Penang.
- 24 Kaumbutho Pascal and Kienzle Josef, eds, *Conservation Agriculture as Practised in Kenya: Two Case Studies*, African Conservation Tillage Network, Centre de Coopération Internationale de Recherche Agronomique pour le Développement, and FAO, 2007.
- 25 *Farming for the Future: A Guide to Conservation Agriculture in Zimbabwe*, Zimbabwe Conservation Agriculture Task Force, 2009.
- 26 *Public Perceptions of Climate Change in Cambodia*, DanChurchAid/Christian Aid Joint Cambodia Programme 2009; *Drought Resilient Agricultural Techniques*, Geres Cambodia and DanChurchAid/Christian Aid Joint Cambodia Programme 2011.
- 27 Elisa Da Vià, *The Politics of 'Win-Win' Narratives: Land Grabs as Development Opportunity?* Paper presented at the International Conference on Global Land Grabbing, 6-8 April 2011, iss.nl/fileadmin/ASSETS/iss/Documents/Conference_papers/LDPI/63-Elisa_Da_Via_2.pdf
- 28 See: media.oaklandinstitute.org/sites/oaklandinstitute.org/files/Land_Deal_Brief_Ethiopia_Omo_Valley.pdf
- 29 'Expansion of sugar production in Africa', *Afrique Avenir*, 15 March 2011.
- 30 The Clean Development Mechanism is a system whereby if a country or company cannot meet its carbon reduction targets at home, it can purchase carbon credits that pay for carbon reductions in developing countries.
- 31 *Understanding Land Investment Deals in Africa – Country Report: Mozambique*, The Oakland Institute, 2011, oaklandinstitute.org/sites/oaklandinstitute.org/files/OL_country_report_mozambique_0.pdf

Poverty is an outrage against humanity. It robs people of dignity, freedom and hope, of power over their own lives.

Christian Aid has a vision – an end to poverty – and we believe that vision can become a reality. We urge you to join us.

**Christian Aid, 35 Lower Marsh, London SE1 7RL
 t. 020 7620 4444 christianaid.org.uk**