**How will the world feed itself in 40 years' time?**

By 2050, the predicted world population will require the resources of two Earths to sustain it. How can we possibly meet these demands?

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A woman and her cow walk across a paddy field in north eastern Assam, which had a 75% rainfall deficit in 2009. Photograph: AFP/Getty Images

[The world is going to](http://www.oxfam.org.uk/policy/) [get hungrier](http://www.guardian.co.uk/lifeandstyle/2009/oct/11/www.oxfam.org.uk/policy/) this century, and on a scale that will make the famines of the 1980s look paltry. The maths are simple and devastating: in 40 years' time the global population will be 9.2 billion people – a third larger than it is now. But to feed us all, the UN [Food](http://www.guardian.co.uk/environment/food) and [Agriculture](http://www.guardian.co.uk/science/agriculture) Organization says, we will need to produce twice as much food.

That's because, despite the threats of this century, most developing countries will get richer. At present 350m households in the world live on £8,000 a year or more. That figure is projected to increase to 2.1bn by 2030. And the richer they are, the more wastefully people eat. Generally the poor eat vegetables, while the rich eat food that eats vegetables. Lots of it. To produce 1kg of beef takes 10kg of grass or soya-based feed. A farmed fish will have eaten three times its weight in wild fish. And the rate at which the richest consume these things is amazing: Americans consume 120kg of meat each per year; in the developing world they eat 28kg.

If the world develops as economists predict, it is hard to see how we can possibly meet these demands: environmentalists like to say that the 2050 population would require the resources of two earths to sustain it. No wonder the British government's chief scientific adviser John Beddington says: "Food security represents a greater threat to mankind than [climate change](http://www.guardian.co.uk/environment/climate-change) itself."

There lies the other big problem. While we look for ways to produce that extra food, the rapidly changing climate is going to make the earth a less efficient piece of farmland. Large swaths of the tropics and the equatorial regions will get hotter and drier, and while that won't leave them unable to grow things, what they can grow will change radically. The 2°C increase in average temperatures that is accepted as the likely minimum this century is enough to cause major shifts in the seasons and in what crops work where.

The great irony of this change is that, initially at least, most of us in the richer parts of the world will benefit. It's in the tropics, where most of the world's poor live, that climate change is damaging agriculture, and will continue to do so. Essentially, the belt round the centre of the earth will get hotter and drier, while those of us who live in the north of the northern hemisphere will see more warmth but also more rain. This will extend our growing seasons and increase the geographical area where it's possible to grow crops. Canada and Russia are among the countries expected to do well, as are northern China and northern Europe. But the Mediterranean countries, southern American states and California don't look comfortable at all. Spain, for one, is painted a nasty red on all the maps showing where water will be short come 2050.

And in Britain? "Winters are going to get warmer and wetter – summers much warmer and dryer," says Robert Watson, chief scientist at the Department for the Environment, Food and Rural Affairs. This will certainly mean that we can grow more, especially some of the food such as salad vegetables and fruit that currently we largely import. Already British farmers are experimenting with apricots, peaches, almonds and olives; in the future, staple crops such as durum wheat, soya and maize might become viable, too.

But we should not get too seduced by the vision of a new Britain with all the abundance of the Mediterranean nations: we are certain to be affected in our turn by the global shortages caused by the agricultural collapses in the tropics. Britain imports half its food, and we are predicted to see our population increase by 10 million. The failure of the monsoon in India this summer is already pushing up global food commodity prices such as those of wheat, sugar and rice. And we are likely to see other less pleasant effects in Britain: floods, storms and heatwaves will become more common. Defra predicts average summer temperatures in southern England will be up to 8°C higher than they are now.

This is why the British government has suddenly started making worried noises about British "food security". While it's hard to imagine Britain going hungry, we are certain to see food prices rise, and we may find that the cheap meat we've come to expect for so long reverts to being the sort of luxury it used to be. If Britain had to grow all its own food, it's said, we could do it – but at an immense price: it would mean an end to any wild or forested land in the parts of the country where [farming](http://www.guardian.co.uk/environment/farming) is possible.

But this is nothing compared with the changes that are happening or imminent in the tropical world. Rice production, the staple food of most of Asia, is already moving northwards, forcing millions of people to change ways of living that have sustained them for centuries. Along the coastal fringes of Asia, people's lives are changing radically, as a huge increase in storms coupled with a rise in sea levels (which is now predicted to be a metre this century) brings salt to their fields and makes growing rice impossible.

Half of the poorest billion people in the world live in South Asia, as do many of the 5 million children who die every year of diseases caused or exacerbated by malnutrition. According to a report by the Asian Development Bank, 1.6 billion south Asians will find their food security at risk because of climate change.

In Africa and parts of Latin America predictions are just as hair-raising. Maize is one of the world's four most important food crops and the staple of more than a quarter of a billion east Africans. It's a hugely important food for animals as well. Maize is vulnerable to water problems and to temperature changes. As Andy Jarvis, an award-winning crop scientist, puts it: "When you look at the graph, under even small average heat rises, the line for maize just goes straight down." It's estimated that maize production will drop in sub-Saharan Africa and much of India by 15% in the next 10 years alone. By 2080, according to government scientists in South Africa, the region can expect to see a 50% drop in crops of all the cereals.

**Among the luxuries of living in our comfy corner** of the world, is the fact that climate change still seems to be a problem of the future, something that we need to worry about less for ourselves than our grandchildren. But for many millions of people the devastation caused by changing seasonal patterns and unpredictable weather is already a clear and present danger. First-person accounts collected by Oxfam from agricultural workers around the world all say the same. Whether they're in the east African savannahs, the Peruvian altiplano or the fertile coastal wetlands of Indonesia, all complain that the seasons have become less certain, rainfall unpredictable and that their crops or their animals have suffered. There are new pests and diseases.

While it is still not possible to say with certainty that this is caused by human beings burning fossil fuels, it is undeniable that catastrophic changes are going on in the climate system. Filter the news with a climate change alert for a few months, and you watch a stream of worrying official statistics trickle in – all of them bad news. The southern Indian state of Karnataka reports a drop in rainfall of 6-8% since 1990. Tanzania and other east African countries report already an average warming of 1.5°C since 1990. Chinese meteorologists say that parts of their country have experienced the same. These figures may not seem enormous, but their effect is dramatic. According to the research of the IPCC, the Intergovernmental Panel on Climate Change, just half a degree of average temperature increase will reduce the yield of India's wheat crop by 20%. And India is the world's second largest producer of wheat.

Where's the good news? Well, there is still enough land to feed us all. Overall, less than 60% of the world's agricultural potential is exploited. If we act now to help countries adapt and prepare for the changes that are coming, it's possible that some of the most distressing effects – mass migration, conflict, starvation on a huge scale – could be diminished. There is a model. The world population quadrupled during the 20th century, and agriculture faced up to the challenge: global food production doubled between 1950 and 1980, in the so-called green revolution.

That increase happened primarily through the use of artificial fertiliser in countries such as India and China. And in technology lie many hopes. Even today African farmers use less than 1% of the fertiliser that we use in the rich world. A recent programme of government subsidy for new seeds and fertiliser in Malawi raised the maize yield in that [famine](http://www.guardian.co.uk/world/famine)-prone country from an average 1.2 tonnes a hectare to as much as 4 tonnes. (In Iowa in the US, the average rain-fed maize yield is 10 tonnes per hectare.) Genetically modified crops may provide some answers, and already there are efforts to produce new crop strains for the new world: maize that will tolerate less water and more heat, rice that can put up with a saltier soil.

But there may be more traction in less hi-tech solutions. Clearly, encouraging billions of poor world farmers to buy fossil-fuel-based fertiliser is no more sustainable than burning all the oil. There are many voices arguing that the only sensible way to increase food production is through organic and sustainable measures. While water is generally agreed to be one of the most potent sources of conflict in this coming century, we still use it very badly. Only 17% of all the world's agricultural land is irrigated.

In Africa, according to a World Bank study, rainwater-fed farms lose $27 (£17) with every 1°C rise in temperature – this could be equivalent to a month's profit for the average poor farmer; but irrigated farms gain $35. "Micro-harvesting" of rainwater and other low-tech irrigation ideas could make enormous differences, but these require education and investment. "We need to reinvent our agriculture," says Oxfam India's Shaik Anwar. "We must rebuild the forest areas, conserve water, make agriculture more organic and sustainable. At the moment we are losing our groundwater very quickly, destroying soil nutrients, and farmers are going into debt because they are dependent on fertiliser and other inputs."

Hi- or low-tech, these efforts will need funding by the rich world. It is estimated that we need to spend $50bn a year helping the poor world adapt to climate change – a sum that Oxfam and other international agencies will be asking the UN states to commit to at December's summit in Copenhagen. The need is urgent – climate-change-related disaster is already a reality across much of the tropics. "If there is 2°C of warming, I cannot imagine what will happen to us in southern India," says Shaik Anwar. "The impact will be huge on water, on people's ability to work, on nutrition, on animals. Four out of five families in rural Andhra Pradesh are already living on the threshold of disaster."

We have both a practical and a moral reason to help. The first is simple: if crops fail in India we will feel the effects very quickly – the enormous price rises in staple foods in Europe in early 2008 were born in the great cereal lands of Brazil and India and in the rice paddies of south and east Asia. A poor crop there, a panic in the commodities markets, and suddenly British shoppers found their weekly food bills were up 10-15%. Some of us even had to forsake Sainsbury's for Lidl. In poorer countries, it thrust people back into poverty. I've met farming families in Cambodia and India where the parents died – from hunger, or by their own hands because they were too ashamed to go on.

The moral reason? We burnt the fossil fuels in our own drive for development – and thus got the planet into its current mess. And we're still doing it. Though India is industrialising fast, in the rich world we still produce 10 times as much carbon per head as Indians do. Peter Balaram, project director of Apps, the NGO trying to help in Anantapur, says: "Climate change is everyone's responsibility, but especially that of the industrialised nations. My plea is for richer countries that are more responsible to come to the rescue of countries on the edge." **AR**

*Alex Renton's report for Oxfam International on the impacts of climate change on humans, Suffering the Science, can be downloaded at* [*www.oxfam.org.uk/policy/*](http://www.oxfam.org.uk/policy/)

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