

Why Britain faces a bleak future of food shortages

Britain faces a 'perfect storm' of water shortage and lack of food, says the government's chief scientist, and climate change and crop and animal diseases will add to future woes. Science is now striving to find solutions.

- Robin McKie
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The drought in Australia last year inflated food prices worldwide. Photograph: Mark Nolan/Getty Images

It was an ecological disaster that occurred on the other side of the planet. Yet the drought that devastated the Australian wheat harvest last year had consequences that shook the world. It sent **food** prices soaring in every nation. Wheat prices across the globe soared by 130%, while shopping bills in Britain leapt by 15%.

A year later and the cost of food today has still to fall to previous levels. More alarmingly, scientists are warning that far worse lies ahead. A "perfect storm" of food shortages and water scarcity now threatens to unleash public unrest and conflict in the next 20 years, the government's chief scientist, Professor John Beddington, has warned.

In Britain, a global food shortage would drive up import costs and make food more expensive, just as the nation's farmers start to feel the impact of disrupted rainfall and rising temperatures caused by **climate change**. "If we don't address this, we can expect major destabilisation, an increase in rioting and potentially significant problems with international migration, as people move to avoid food and water shortages," he told a conference earlier this year.

The reliable availability of food – once taken for granted – has become a major cause for alarm among politicians and scientists. Next month several of Britain's research councils, together with the Food Standards Agency, the Department for Environment, Food and Rural Affairs and the Department for International Development – will announce a taskforce that will channel the UK's efforts in feeding its own population and playing a full role in preventing starvation in other nations.

The problem is summed up by Professor Janet Allen, director of research at the Biotechnology and Biological Sciences Research Council (BBSRC). "We will have to grow more food on less land using less water and less fertiliser while producing fewer greenhouse gas emissions," she said.

No one said science was easy, of course. Nevertheless, the scale of the problem is striking. It is also unprecedented, says Professor Mike Bevan, acting director of the John Innes Centre in Norfolk. "We are going to have to produce as much food in the next 50 years as was produced over the past 5,000 years. Nothing less will do."

It is a staggering goal that highlights the depth of the food security crisis that Britain and the world face. Over the next 40 years Britain's population will rise from 60 to 75 million while the world's will leap from 6.8 to 9 billion. Feeding all these people will stretch human ingenuity to its limit. Crop yields will have to jump, a goal that will have to be achieved in the middle of global climatic disruption. At the same time, farmers

will find many aids – in particular, chemical fertilisers – that they have come to rely on will no longer be available .

"People do not quite realise the scale of the issue," added Bevan. "This is one of the most serious problems that science has ever faced." In Britain the lives of hundreds of thousands of people will be threatened by food shortages. Across the globe, tens of millions – if not hundreds of millions – will be affected.

Consider the problems that affect just one crop: wheat. This is the most widely grown cereal in Britain. British farmers excel at its cultivation. Today yields in Britain average between 8 and 10 tonnes a hectare, some of the highest in the world. Yet only 50 years ago UK yields were only 4 or 5 tonnes a hectare.

It took a green revolution in the 1960s that involved the development of new crop varieties, greater use of agro-chemicals and changes in farming practices to double production by the 1980s. Now a second revolution of equivalent magnitude is urgently required, say food scientists.

"We can certainly do it, although it won't be easy," said Bevan. For a start, farmers will have to increase yields using greatly reduced amounts of agro-fertilisers because their manufacture is energy-intensive. Some 3% of the world's energy is used in the manufacture of fertilisers and in a post-Copenhagen world, dominated by renewable energy, such carbon consumption is likely to be prohibited. "What we need are major research programmes to create new crop yields that, in effect, make their own fertiliser and will also be disease-resistant and more resistant to droughts and rising temperatures," added Bevan.

In this country, one such programme dedicated to improving wheat varieties is scheduled to be launched next year as part of Britain's food security initiative. This will exploit cutting-edge DNA technology to speed up wheat breeding projects to develop new drought-resistant, low-fertiliser strains, though the programme will stop short of the creation of genetically modified strains. "The wheat we use today is a hybrid, created by ancient farmers 10,000 years ago, from three different species of wild grass," said Bevan. "We are going back to these first types of grass and from varieties of these create fresh hybrids."

The importance of creating new crop varieties is also demonstrated by another threat to food production, the appearance of new crop diseases. For example, in 1999 a new variety of the wheat disease – black stem rust – appeared in Uganda. Since then, Ug99 has spread across Africa and Asia, destroying harvests and threatening the lives of millions. However, scientists have recently discovered a strain of wheat, known as Sharon grass, that is resistant to Ug99, raising hopes that the outbreak could be contained. "Creating ranges of new crop varieties is going to be vital in feeding the world," said Allen.

The farmers of tomorrow will not only have to improve yields using less fertiliser, they will also have to be increasingly wary of new agricultural pests and diseases as global temperatures have risen and more and more devastating varieties of viruses and fungi have spread around the globe. Britain will not be immune.

A classic example is provided by bluetongue disease, a virus that affects cattle, sheep, deer and goats and is spread by midges. Sheep are especially vulnerable and one in three can die if infected. The disease was unknown in north-west Europe until 2006, when an outbreak occurred in Holland and spread to nearby countries. Then, in 2007, it spread to Britain. Only swift action by agricultural authorities halted its advance. In future this will be harder to achieve.

"The problem is that the life cycles of diseases such as bluetongue speed up as temperatures go up," said Dr Chris Oura, of the Institute for Animal Health in Newbury. "The warmer it gets, the more infective they become." Bluetongue could soon return. More importantly, it is only one of many other exotic, potentially devastating livestock ailments that could be spread by insects.

"Bluetongue appeared out of the blue. And that could happen again. Other diseases like epizootic haemorrhagic disease (EHD) and African horse sickness are also spread by midges and threaten Europe and Britain," added Oura.

However, it is not just global warming that is increasing the risk of deadly new epidemics of livestock disease. Globalisation itself threatens to bring infestation in its wake. An important, and very worrying, example is provided by African swine fever virus, said Oura. "As its names suggests, it infects pigs. There is no cure and no vaccine and it kills every animal it infects. Recently the disease emerged from Mozambique and has spread along shipping routes around the coast of Africa and into central Asia. Should it appear in Britain, it would be devastating. And were it to strike in China, where there is a massive consumption of pork, it would be a disaster. Apart from the hardship there, pork prices around the world would soar." British pig farmers might do well, but the public would face a major jump in the price of a basic commodity.

The key to preventing such a scenario is science, said Oura. "We had the right vaccine to deal with the strain of bluetongue that hit Britain. We now need to develop vaccines that will halt diseases like EHD or African swine fever and contain them long before they ever hit our shores." This work is another key priority for researchers.

Changes are not confined to exotic foreign viruses. Many of the pests that have been part of the British agricultural scene for centuries are also likely to gain new leases of life as climate change takes a grip on the country. A perfect example is provided by the aphid. "Aphids are one of the country's main agricultural pests and they inflict about £100m of damage to cereal crops a year," said Richard Harrington, of the Rothamsted agricultural research centre. "But as the weather gets warmer and warmer, aphids are now arriving in fields far earlier than they used to do, and that is bad news. Crops in early spring are younger and more susceptible both to the damage inflicted by the aphid itself and also by the viruses they carry. It's a double whammy and it is leading to increases in crop loss – unless we find new ways to tackle aphid

infestation."

One answer is to use increased amounts of pesticides. However, this solution is limited by the spread of pesticide-resistance and by the EU's increased antipathy to their use because of potentially toxic side-effects. "It is quite clear that we need to take a more sustainable route to pest control," added Harrington.

One ingenious solution involves planting nettles around wheat fields. Parasitic wasps arrive to feed off the aphids that are found in nettles. Then, as the neighbouring wheat grows and aphid infestations arrive, there is a ready supply of wasp predators to deal with them.

"About 40% of crops in Britain are vulnerable to destruction by weeds, fungi and insects," added Dr Tom Hooper, another Rothamsted researcher. "We have got to find sustainable ways to prevent that from happening if we want to maintain and increase food production in future."

Of course, some answers to the threat of the forthcoming perfect storm and the threat to our food security involve political and economic solutions as well. The end of cheap supermarket deals, restraints on water use and the need to change farming practice have all been touted. In the case of farming practices, economists argue that small farms are too inefficient and should be incorporated into larger outfits, for example. Owners of small hill farms oppose the idea, however.

Economic or political changes will certainly be needed if Britain is to face the challenge ahead. However, it is now accepted that science will play the principal role in Britain's battle to ensure the nation can rely on food security in the future. Whether it has the funds to do so remains uncertain. A total of £600m was cut from the nation's science funding last week. Scarcely an auspicious start to our battle to survive the perfect storm.

BBSRC: www.foodsecurity.ac.uk