



Environment, Food and Rural Affairs Committee

Oral evidence: [Food Security](#), HC 926

Wednesday 5 March 2014

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Written evidence from witnesses:

- [Soil Association](#)
 - [Friends of the Earth](#)
 - [CLA](#)
 - [Crop Protection Association](#)
 - [Research Councils UK](#)
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Members present: Miss Anne McIntosh (Chair); Richard Drax, Mrs Mary Glindon, Mrs Emma Lewell-Buck, Sheryll Murray, Neil Parish, Mr Mark Spencer, Roger Williams

Questions [185-256]

Witnesses: **Peter Melchett**, Policy Director, Soil Association, and **Vicki Hird**, Senior Campaigner, Friends of the Earth, gave evidence.

Chair: Good afternoon and welcome. Thank you very much indeed to you both for participating in our inquiry. Would you introduce yourselves for the record?

Vicki Hird: My name is Vicki Hird, and I am the senior campaigner running the Land Use, Food and Water Security programme at Friends of the Earth.

Peter Melchett: I am Peter Melchett, Policy Director at the Soil Association.

Q185 Chair: Thank you. At the outset, if there was one single thing that you think would improve and promote food security, what would you say it was?

Vicki Hird: From our perspective, if I had to pick one, it would be working towards a more sustainable diet within the UK and within Europe, setting up measures and policies and working with businesses to promote a more sustainable diet.

Peter Melchett: Picking one—not necessarily the most obvious—I would say dealing with insecurity caused by our reliance on imports of, for example, mineral mined phosphates, of nitrogen fertiliser and the energy that goes into it, and animal feed.

Q186 Chair: What do you think is the single biggest challenge to food security in the UK at the present time?

Peter Melchett: I think it is hard to rank. For example, between the two things Vicki and I have mentioned—the need to change diets and the fact that diets will change, which I think is a certainty, and the insecurity caused by our reliance on these inputs, on which certainly all non-organic agriculture crucially depends—we also have the challenge of meeting multiple objectives in agriculture. We will not have food security if we simply produce more but destroy soils, use up fresh water, destroy wildlife, and do things to farm animals that the public will not accept. All of those things are huge challenges, and are linked together with the overarching fact that climate change is now affecting farming and will affect it more in future.

Vicki Hird: Peter mentioned the one thing I would say is the biggest challenge, which is tackling the impact of climate change. The forthcoming IPCC report will be mentioning the fact that we are going to be losing capacity at 2% a year. That is obviously variable—it is slightly specific in terms of the impact of climate change—but it will have an impact here, and most importantly impact on the suppliers that we import from. As you heard from Professor Beddington, we are reaping the benefits now of climate change gases 25 years ago; in the next 25 years it is going to be really severe unless we tackle resource-use implications, including land, water, carbon and minerals, but also tackling diets. Climate change is number one.

Q187 Chair: I have to declare an interest, that I represent a very large meat-producing part of the country. How would you seek to change consumption habits if you are both dead set on thinking that people should eat less meat, which I necessarily do not agree with?

Peter Melchett: The Soil Association has been involved in programmes initially to change school meals, which led to the Jamie Oliver campaign and the introduction of standards for school meals and now Michael Gove's school meals review. We have a long history now, of nearly a decade, of working in schools and seeing what happens when you change first of all voluntarily in schools, and then the mandatory standards set by Government. We know that children will quite readily change what they eat to have more fresh, less processed, slightly less meat and dairy, and more fruit and vegetables. People think it is difficult; it is not.

What surprised us were two things about the programme. One is that over half the parents of children in these schools report changing in what they eat. So children's pester power works in the direction of getting the parents to eat more fruit and vegetables, and less oven chips, if that is what they get used to at school. The effects of these changes have been disproportionately beneficial in the poorest and most disadvantaged areas, and we are now building on that programme in universities, nurseries, hospitals, restaurants, sports venues all over the place—about 800,000 to 900,000 meals a day in the Food for Life catering mark.

Vicki Hird: We obviously support that, particularly the gold mark, which does specify working towards a lower and better meat menu delivered, but I think there are a lot

of ways. I think you might agree with us that we can waste less meat, and given that there is a huge tonnage of meat wasted, half of which could actually be eaten, which involves a huge waste of money for the consumer but also land, water and carbon.

I think there is overwhelming evidence that we need to do something about this, and so we have been looking at this for many years. We could do a lot with procurement. We could change subsidy systems to support producers that, for instance, are producing in ways that are lower impact, pasture-fed—we have done a lot of work on alternative feeds, which could feed the systems that we need to feed ourselves in the UK. We could do a lot of work to encourage consumers, through promoting, for instance, a set of principles and guidelines for supermarkets to use, so they can change their formulation so there is a bit less beef, a bit more lentils in the ready-stew, or whatever. What we need first is for this Government to actually agree a set of guidelines that include that, and include a lot of other things as well, such as wasting less. There are many things we could do, but it is not easy.

Q188 Chair: In your submission to the Committee, Friends of the Earth go on at some length about the use of water in fracking. Obviously that would not just be a problem in the south of England; it would be a problem in the north of England.

Vicki Hird: It is very site-specific, but there is a real issue there, not only in terms of extraction but potential pollution. I know you have talked about this with other people giving evidence, and we would not necessarily agree that there is not a risk of pollution. When you have got fracking wells and oil wells next to groundwater sources, then we think there is a risk, and with the flooding we have just seen how much we cannot control it. We think there is a risk north and south, and we should be really not investing in fracking as a solution to our energy problems. We have got many other solutions for energy problems in the UK.

Q189 Sheryll Murray: We are told that the world population will increase to 9 billion by 2050. How will it be possible to feed this many people without increasing the amount of land that is used for agriculture?

Vicki Hird: It is a very good question; it is a question that has been posed to us globally and at the UN over the past few years. I think we cannot do it unless we change diets; that is an absolute no-brainer. The recent UN report on land use alone showed, as a resource, we just cannot do it. So that is one thing we have got to do. We have got to really invest in agro-ecological farming systems, which protect the soil, use the resources—fertilisers, natural fertilisers—and use a diversity of cropping systems to provide what people need, not necessarily what is currently being demanded. That is absolutely crucial. If there is one thing that comes out of this report, I hope you are talking about what we need rather than necessarily demand.

Peter Melchett: Yes, it is a challenge, but it is not a challenge in the way in which it is posed, simply responding to increased population. We need to do that, first of all in this country—and we need to do it globally—by cutting greenhouse gas emissions by 80%. Now, we know from the work that was already done by the Committee on Climate Change in the UK that that is going to lead to a revolution in UK farming sometime between 2020 and 2050, when agriculture has to make those cuts. So that is a revolutionary change, just to meet the greenhouse gas targets, which are legally binding in the UK.

We can make huge changes: we could feed roughly 3 billion people more on the planet if feed that goes to animals—and which is capable of humans eating it, like grains and protein—went to humans. That would provide food for 3 billion more people. Not all of that is going to be diverted. We could cut waste, and provide food for about 3 billion more people.

However, we have got to go much beyond that; that is the beginning of the challenge. We have got to cut greenhouse emissions. We have got to learn to live in a world where mined phosphates, which are crucial to all crop yields in non-organic farming, start to decline and become much more expensive, and we have got huge water pressures that Vicki mentioned in other parts of the world. So just picking out the growth in population, as if that is a key challenge, is nonsense. There are a whole series of challenges, and they have got to meet in an integrated way.

Q190 Mrs Lewell-Buck: Earlier, you both expressed concerns about climate change, and its impact on food security overall. What do you feel the main implications are of climate change to UK food production, and how can you protect UK agriculture from the impact of climate change? That is to both of you.

Vicki Hird: There is a growing body of evidence—very strong indicators from the Met Office and beyond—that suggests that we are going to get a much more volatile climate and a more unstable climate, and particularly increased precipitation. That will have big impacts, both in terms of drought and in terms of flooding and unpredictable flooding. We need to prepare for that, and we need farmers to prepare for that, thinking about the kind of systems that will protect soil under those conditions, and still maintain production and incomes for those farmers. That means a good adaptation plan, and I think the Committee on Climate Change’s adaptation plan showed some holes in our current strategy that need to be filled. For farmers in particular, and also for other land owners and forestry, etc, we could be investing in natural flood defence systems which people have talked about in the last few weeks, which I think would be hugely beneficial.

But it will impact particularly also on our imports. 40% of our food is imported. There are things like the impact of climate change on bees in California, or the drought in California. We will not get any almonds. Most of our almonds come from California, and at the moment, they are importing their bees to pollinate the almond crops in California. That is not necessarily sustainable in the long term because they are bringing in diseases. So we have got to look at each crop that we rely on overseas, as well as what we are producing here. I know you are looking at that—I have seen your questions—but that is as important as what we are looking at here.

Q191 Mrs Lewell-Buck: I suppose what you are saying is that it cannot be looked at in isolation, can it? We cannot just look at the UK; we need to be looking globally all the time.

Peter Melchett: But if you do just focus on the UK, I would say the first challenge is one I mentioned already: how you are going to take 80% of greenhouse gas emissions out of UK farming in food—the target, which is the legal one for the industry, which other industries are having to meet rather faster than agriculture, actually.

The second thing I would say is climate change will bring more extremes. I farm in north-west Norfolk. In 2012 we had the longest, wettest, latest harvest since my dad bought the farm in the 1950s, but the year before we had the longest dry spell during the growing

season in the spring/early summer, three months with no rain. We are looking at climate extremes, and in answer to that you need resilience. You need soils that will be resilient, that will absorb water when it is wet, and that will hold water and release it when it is dry. You need farming systems that are not reliant on one or two or even three single outputs, but that have a diversity of crops and a diversity of programmes, so that if one element is hit you have got others to fall back on. It is the same in any natural ecosystem: diversity is resilience. So I hope that is something that you will consider: multiplicity of different threats that climate change—not just threats, but actual impacts—is already having on British farming.

Q192 Mrs Lewell-Buck: Pardon my ignorance, but how do we get soils that are more resilient? How do we go about doing that?

Peter Melchett: You get soils with higher levels of organic matter; that is the quick answer. More fibre in the soils, more green matter returned to the soils, crops with bigger root mass; modern crops, because the nutrients are put on from the surface, do not need to put their roots down very far, and those crops that are irrigated do not need to put their roots down for water. So you need crops with big, dense root masses, which go down enough that green material is returned to the soil.

You need composted farmyard manure, or compost that improves soil carbon and soil organic matter. This not only makes soils hold water more like a sponge, and release it more slowly so you do not get the flash floods on the surface of fields, which people have commented on in the aftermath of the latest floods, but you also get soils that are more resilient to drought, and incidentally soils that will store more carbon and help—which we think probably will be the biggest thing agriculture can do, if it changes practices—to take carbon from the air and store it securely in the soil, and thus combating climate change as well as responding to it.

Q193 Neil Parish: Good afternoon. To Ms Hird in particular, at Friends of the Earth you have said that the harm being caused to biodiversity is a greater threat than climate change to food security. Why do you think this?

Vicki Hird: Because it has such an impact on our ability to combat climate change; particularly I was thinking about the forests that we are destroying, partly to produce foods, in tropical areas, which are holding a huge amount of the world's biodiversity and a huge amount of the world's carbon stocks, but also providing a very large proportion of the circulation of climate and precipitation in that area, and maintaining water catchments. We are not just talking about the Amazon, but also the Cerrado and so on.

Q194 Neil Parish: So we have got 7 billion people in the world, and rising; we have got to feed these people, so I am sorry, but we cannot just wait around for the climate perhaps to change again. Surely we have actually got to feed people, and so therefore, if we are going to have, say, a shorter growing season because there is more rain, why do we not use biotechnology in order to get faster growing crops? Why do we not grow rice in the developing world that has got protein in it, and the like? That is where we have got to wake up and remember that we have got to feed people.

Vicki Hird: Absolutely, and we are completely on the same page; we have got to feed people, but it is how you do it. We can absolutely grow rice crops that can do it, but we do not necessarily need new technology. We are not against technology at all: I am actually a pest scientist myself; that was my background. I think there is an awful lot available now that we can do to increase and enhance yields in ways which are truly

resilient, as Peter was mentioning, and that goes for globally. There is an awful lot in agro-forestry that could be delivered, particularly in Africa, which will help protect the soil, the cropping systems, provide fodder for livestock, and protection for the crops.

We can do this if we waste less, if we use the crops we are producing more efficiently—not necessarily using them all for feeding animals. It is not us saying that; it is the scientists. There are a lot of papers saying we cannot continue to use crops to feed animals inefficiently like this, in the same way using them for biofuels.

Q195 Neil Parish: You are saying that biodiversity is a greater threat than climate change to food security—

Vicki Hird: Maybe that was a slight exaggeration; they are equally—

Neil Parish: I am a great believer in biosecurity, but all the plants out there and different types of species cannot necessarily be eaten, whether it is an animal or not. You are saying that we must feed more vegetables to humans rather than getting them to eat meat. Surely even with the vegetables, you have got to have one that is edible?

Vicki Hird: Absolutely.

Peter Melchett: I think the point is we both strongly agree it is going to be fatal if, in the face of this crisis and the need for radical change that everyone accepts, we latch onto a solution that maybe produces enough food to feed the 2 billion more people you say we are going to need to feed—we have enough food to feed everyone right now, of course—but, in the process, you make planetary climate change so much worse that it destroys most people, particularly in the South, the ability to feed themselves, or in the process you destroy parts of biodiversity and wildlife that either the climate depends on or we depend on as farmers. I grow seed crops of peas, vetch, grass seed; they all need insects to pollinate them. If you introduce a system of upping food production that destroys pollinators, you certainly do not achieve what you set out to do in the first place. You have got to think of these things in an integrated way.

Q196 Chair: I do not think we are seeing the connection between biodiversity and the fact that forcing people to eat less meat it is going to save the climate. I just do not see the connection there.

Peter Melchett: I think people will eat less meat, because the health messages will become as strong as the health messages were about tobacco. Now, they should not stop eating meat in my view, but—

Neil Parish: No, Mr Melchett, I will stop you there.

Peter Melchett: I would like to finish the point.

Q197 Neil Parish: I do not think that a health warning on a piece of meat is the same as a health warning on a packet of cigarettes, and on that I will disagree with you entirely. If that is the line that you intend to promote in this country—that meat is as dangerous to eat as smoking tobacco—then I am sorry; I do not take that as an argument.

Vicki Hird: He does produce meat; do you not realise this? He is a beef producer.

Peter Melchett: I am a beef producer.

Vicki Hind: And I am an eater of meat, so do not get us wrong.

Peter Melchett: What I am saying is that the public health pressure to change diets, to eat less meat and less dairy products and more fruit and vegetables, which is already official Government policy and guidance—

Chair: No, I do not think —

Peter Melchett: What I am saying, if I could just finish, to answer Neil Parish's point, I do not think the—

Q198 Chair: Let us just be clear what Government policy is and what Government policy is not. I think the Government policy is to eat five fruit and veg a day, and certainly we are committed to growing meat on the uplands, so I do not think we want to go down—

Peter Melchett: I am committed to that too, and I think we should be eating more grass-fed meat; home-produced beef and lamb, and less meat—particularly white meat—which is dependent on imported proteins, which has the negative effects on biodiversity that Vicki mentioned, so I am at one with Government policy.

Q199 Neil Parish: Mr Melchett, I quite agree with your final comments there, but you are rather contradicting what you were originally saying, and it is not only about people in this country, because if people in developing countries have more money, they have more meat.

Peter Melchett: I am only—

Chair: I do think we have on the record what you said.

Peter Melchett: I think I am only seeming to be contradictory because you would not let me finish my sentence.

Q200 Roger Williams: I am certainly not opposed to organic farming or agro-ecology or whatever it is called, or agro-forestry or all the different varieties of production; I think it is good we have diversity. But I think one of the things that people get hung up on, and where conventional farms find it difficult to engage with organic farmers, is this issue about absolute yield and the contention that some organic farmers have that actually if the whole of world production went organic, then there would be sufficient to feed the world.

Our experience would lead us to believe that that is not true, wouldn't it? Could you tell me what is the average yield for a staple food, like bread-making wheat, for instance, under an organic system and under a conventional system?

Peter Melchett: It depends in which country you make the comparison, but the UK—

Roger Williams: This country, for example.

Peter Melchett: In the UK, milling wheat yields in organic systems would be about 30% to 40% less than non-organic yields, but for some other staple crops—much of fruit and veg, and protein crops like peas and beans—yields would be the same, 100%. Lamb finished on grass may be even higher in organic systems. It varies a great deal. If you look at the output of milling wheat, to take your example, and you take into account the

inputs—the fertiliser, the fossil fuels, the phosphate that you have had to put in per hectare to get a ton of wheat out—I think it is arguable that organic wheat will be more efficient in terms of resource use per hectare.

So that is why, when you think about increasing food production, I think it is wise, and we hope the Committee will consider not just the absolute yield, but what you need to put in to get it, because what you need to put in to get it is what we are running out of.

Q201 Roger Williams: But you are telling us on one hand that we might have less land on which to produce food because of climate change, because of desertification in the Sahel, and perhaps increased rainfall in other areas, and then you are advocating a form of agriculture that I am sure is great on its own merits, but will produce less food than the conventional form of agriculture. The problem is, as we have already been told, that we are going to have more people, so I cannot really see how that will work. I am not against having organic farming taking place and it is great, and people should do actually what they most enjoy and what they feel best at, but to actually have a policy of a great increase in organic farming just does not produce the food that the people in this country that we are talking about, and the people in the world, need.

Peter Melchett: It does produce the food, if you do it in the context of having to cut greenhouse gas emissions by 80%. Now if you do not do that, you can carry on using fossil fuels to fuel industrial agriculture and it can produce more. But you have got to take into account that we are running out of mined phosphate, and without that, industrial agricultural yields—your milling wheat—would go back to the sort of yield levels we got in 1900, well below organic yields. You are not looking at a static picture. If you look at what we produce if all of England was organic, for example, there would be less wheat but you would have half of your wheat crop not being fed to indoor pigs and poultry, and available for human consumption, and people would eat less white meat. But they would eat more grass-fed beef and lamb, because you would have more grass, better flood resilience, and better climate change emissions.

Vicki Hird: From our perspective, we have got to look at this in terms of both production and consumption. That is the one message I can give: that we look at it from a production and consumption perspective, and we cannot go down the route of just thinking about one side and not the other. That has got to include an analysis of the resource use. One of those resources is the natural system. Maybe that is the hang-up with biodiversity that Neil is referring to: that the natural system on which we depends—when I talk about biodiversity, it is the natural system on which we depend—is not some tree somewhere that is not very important; it is absolutely crucial that that is taken account of.

Q202 Roger Williams: I think one of the great achievements of agriculture is how it is able to take new technology and use it, and yet sometimes—and you are probably going to tell me this is wrong—organic agriculture is painted as something that does not embrace new technology, does not take forward precision-type processes that would make it more efficient for the inputs that you have to put in as well. Can you tell us that organic farming really goes out there and grasps the new technology, and increases production?

Peter Melchett: Yes, I mean we are vitally dependent on good science, and we have been starved of scientific research in the organic sector. As a grower of seed crops, I find that most of the crops that I grow have been developed in other European countries where there has been much more support for organic farming than in the UK.

Laser-guided weeding and those sorts of precision, high-tech technologies were developed, many of them on the continent, for organic farming systems where sprays and chemicals are not used. The knowledge of nutrient cycling—what happens to the nitrogen, which we are still very ignorant about because we have been able to pour it down from a bag on top of the field—is a crucial area of science that we need more research in, and organic farming and organic farming researchers have done work in that area.

We have been strong supporters of marker-assisted selection breeding—using knowledge of the genome to speed up and make more precise conventional crop breeding, and that has delivered results for organic and other farmers all over the world, and there are lots of crops grown disease-resistant, saline-resistant, and drought-resistant—crops all over Africa and other parts of the world produced by MAS breeding. So we would embrace appropriate technology to our system, and deplore the fact there has been so little investment in it in the last 20, 30, or 40 years.

Vicki Hird: We endorse that very much: evidence-based and pro-technology genomics could, as Peter said, fast-track a lot of really useful stuff, but all the money has been pouring into other systems that have been—

Q203 Roger Williams: Not in this country, is it?

Vicki Hird: These are global companies doing the research, so they have been—

Roger Williams: That is the problem, isn't it? There has been very little research done in this country.

Peter Melchett: Very little close to the farm, we would say.

Vicki Hird: One piece of research that was several years ago on oilseed rape, looking at GM, made quite clear the problems there.

Q204 Mr Spencer: I do not want to focus too much on GM, but of course some of the problems you have been talking about—drought resistance and building more organic matter in the soil—those GM technologies can offer those solutions very rapidly and very quickly. I just wondered what your view on the traits that GM could bring forward, rather than the technology itself—those sort of traits and how they might assist.

Vicki Hird: They already have. I am not an expert on the current breeding and fast-track marker-assisted breeding—Peter probably knows more than I do—but for instance there is a blight-resistant potato that has been bred that could do an extremely useful job in helping farmers combat blight in particularly wet conditions. *[Interruption.]* No, it is non-GM. The Sarpo varieties are very effective.

Chair: Do not interrupt, Neil.

Vicki Hird: There is a whole range of Sarpo varieties that have been tested for. This is technology; these are breeding; it is very effective and there is a lot out there. But, as Peter said, it has been starved of funds to actually look at the kind of agronomics that will give us the diverse farming systems that will actually protect our food.

Q205 Mr Spencer: I will come to Peter in a moment, but just explain to me, if you can, in layman's terms, why a potato that is blight-resistant that is bred conventionally is

acceptable, but a potato that is resistant to blight that is bred using GM technology is not acceptable? If their DNA is so similar, what is the difference?

Peter Melchett: The answer is that the DNA would not be similar because the GM potato would have the genes from other organisms inserted to promote the blight-resistant gene and the marker gene. Those genes would have been inserted normally at random, sometimes not, into the potato DNA in places which had not been selected; they would be randomly chosen inserted, and that introduces a degree of instability and uncertainty into the DNA of that plant, which we have seen subsequently with Monsanto's Roundup Ready crops, which are approved: when scientists go back and look at the DNA five or 10 years later, it has changed significantly.

There is an inherent instability and an inherent risk in GM technology that does not apply to marker-assisted selection. For the crops that have been working, as I mentioned, in Africa using marker-assisted selection, when they have introduced more complex characteristics like drought resistance, that has involved moving a whole group of genes. These are characteristics that are not controlled by single genes, and are therefore not at all at present susceptible to genetic engineering or genetic modification. You need to move a group of genes with their associated proteins, which are what cause the genes' expression. It is a much more complicated characteristic; it is why none of the GM crops currently on the market exhibit drought-resistant saline tolerance, or increased yield as a characteristic that has been transferred. Those are all characteristics Rothamsted recently, using a wild relative of wheat—to come back to the wheat—increased using marker-assisted selection; they increased the yield potentially by 30%, which is a staggering achievement.

Roger Williams: I think they say that is the potential.

Peter Melchett: No, they have actually trialled it in the field at Rothamsted. It has not had anything like the publicity, which is a tragedy, because it is not GM. The media and everyone else thinks the only developments in farming that are sexy and interesting are GM, but this is a staggering scientific achievement by Rothamsted if it is carried through into commercial trials. That is marker-assisted selection working in practice right now; the GM crops you are talking about are the ones where companies say, "We think this will happen, maybe in 10, 20, 30 years' time."

Q206 Mr Spencer: Some of the evidence we have heard, you will not be surprised to hear, differed from that point of view. It said natural selection and cross-breeding was much more random, whereas GM technology allowed you to only take the specific gene you required and you did not risk the mutation that you might do through conventional methods.

Peter Melchett: If you just look at it from the practical point of view as a farmer, what crops are actually being grown? What are farmer colleagues in this country and around the world actually using? We are an industry; we grow things that we want to sell to people, and we want to have products that we can use. There is not a single GM crop being grown commercially in this country, after 20 or 25 years of research and millions of pounds of public money. In developing countries, there are some GM crops being grown, but in Africa, where we would need to increase the yields and change farming practices most drastically, a lot of these new crops are from marker-assisted selection. They do not have the patenting problems that GM crops have; they do not have the cost problem to poor farmers that GM crops can have. I think from a practical point of view, forget the propaganda, and look what is actually working and what farmers are actually using.

Q207 Mr Spencer: If we look at America and South America and all those countries where they are growing, is there any evidence where there has been any effect to consumers anywhere in the world through consuming a GM crop?

Peter Melchett: If you include farmers amongst consumers, yes, there is lots of evidence of increased pesticide use, and now a desire to get out of GM from farmers in the American Mid-West, and increased sales of non-GM seed being forecast. If you think about people who eat GM, it is true that in America there has been a dramatic increase in diet-related ill health in the period since GM crops were introduced, but nobody has done any research to look at whether that is to do with GM food or not. There is no evidence, and one of the simplest scientific errors that people can make is to equate the fact that no research has been done with the idea that nothing is happening. You do not know until you look.

Vicki Hird: Nobody has researched it. The baseline from which to—

Q208 Mr Spencer: But this is in America; this is the most litigious country in the world. There are lawyers all over America, and no one has even attempted to take a lawsuit forward.

Vicki Hind: But nobody is looking; nobody has really looked from the beginning.

Peter Melchett: But if you look at what is happening in the American market—which again, as a farmer, thinking about selling things to ordinary people, is what would interest me—there has been a dramatic increase in non-GMO labelled products. They are increasing by more than 100% a year. In the US there is a project that has been going for about seven or eight years now that has thousands and thousands of lines, and thousands of retailers and manufacturers have now signed up to it. There are 20 states in American looking at passing GM labelling laws, and two that already have. There are talks about federal law on labelling that would be the same as we have in the EU.

Q209 Sheryll Murray: Just one last question: you seemed to have contradicted yourself; I may have misheard. You said there has been no research, and before that you made a claim that with the increase in consumption of GM foods, there was a link between that and the health risks.

Peter Melchett: No, I said there was no evidence of that link. I said the background is an increase in diet-related ill health in America; there is no evidence that that is linked to GM consumption. In addition, there is no evidence that GM consumption has not led to dietary-related ill health. If you do not research something, you cannot make claims about it in either direction, so I am not making any claim, but nor should scientists who come before you and say, “America has been eating this stuff for years; there is no problem.” In scientific terms, that is bunk; that is nonsense; you have got to do the research.

Sheryll Murray: To make that claim that there could be a connection is also—

Peter Melchett: Yes I agree, which is why I said it was nonsense.

Q210 Chair: Can I just quickly put something to you that you said in your evidence—that GM is the product of a narrow, top-down approach driven not by the needs of farmers, consumers or the environment, but of seed and chemical companies. Why do you reach that conclusion?

Peter Melchett: If you look at the history of GM, the original crops, as we know, were designed to overcome problems that the pesticide industry had, either of resistance to herbicides, or they wanted to be able to use Roundup, a blanket herbicide, and make the crops resistant to that, or insect resistance—the corn borer was proving difficult to get rid of in maize, in corn in America. They were not problems brought by farmers, still less consumers, to scientists saying, “Look, we want to do X or Y.” That is illustrated by the fact of how little use they have been to farmers in most countries apart from the US, with a limited number of crops in Argentina and so on. We think it is more interesting and more useful for agricultural research to start by talking to farmers and talking to consumers, and saying, “Right, what are your priorities? What are the real needs of the farming industry? What do consumers want to see happen with their food?”, and base research on those priorities. That is starting to happen; I think the Agri-Tech Strategy shows signs of that. I think it is moving, but very slowly.

Chair: Thank you both very much indeed. That has been extremely helpful, so Ms Hird, Lord Melchett, thank you very much for being with us this afternoon.

Examination of Witnesses

Witnesses: **Henry Robinson**, President, CLA, and **Nick von Westenholz**, Chief Executive, Crop Protection Association, gave evidence.

Chair: Good afternoon and welcome. Thank you very much for participating in our inquiry. If you could just introduce yourselves please for the record.

Henry Robinson: Thank you very much indeed. Henry Robinson, President of the CLA.

Nick von Westenholz: Nick von Westenholz; Chief Executive of the Crop Protection Association.

Chair: I just have a housekeeping matter.

Roger Williams: Just to place on the record, I am a member of the CLA.

Mr Spencer: So am I, Chair, apologies.

Henry Robinson: How nice to be amongst friends.

Q211 Chair: You are both very welcome. It is your first appearance before us, so I hope it is a pleasant one. First of all, each of you, what do you think is the one issue that you would like to see to promote better food security?

Henry Robinson: If you have to pin me down to one thing, I would probably say that sustainable production is not the preserve of any one single method of production. I think there is room for all sorts, and I think we see it as a broad church.

Nick von Westenholz: I would say we have heard about diets and about waste, and I certainly agree that those are issues that need to be focused on, but we have not heard today so far very much about production and attempting to increase yields. I think a big issue in the UK is breaking out of the current yield plateaus that we have been experiencing for some time.

Q212 Chair: I would just like to turn to the recent floods and the ongoing effect of either flooding or drought, in other years. I was at the NFU conference, not being a member, but I did attend part of the NFU conference last week, where we heard the percentage of agricultural land that is at risk of flooding on a year-on-year basis—what assessment has the CLA made of the threat to food security and production caused by the recent flooding of the UK?

Henry Robinson: Recent flooding in the UK, certainly for those involved is an agricultural disaster for them personally; it is also, I would say, an environmental disaster as well. The two are completely linked. Will it affect food security within the UK? No, I am afraid it will not. It is simply not a large enough area. We are in a world market, and a world market will fill any shortfall we have in this country with imports.

Q213 Chair: If you just look in my own area, there are going to be multiple licence applications for fracking. We do not yet have an extraction policy. Does the water use that might be required either for farming or for fracking worry you?

Henry Robinson: I think the amount of water required for fracking is clearly an issue, and you will know as well as I do that—the Water Bill is in front of the House at the moment. Clearly the distribution of water and the availability to important and indeed strategic industries is something that we have to get right.

Q214 Neil Parish: Good afternoon. Are you concerned about the UK's reliance on the global market for products we do not produce here, especially perhaps on seasonality and the like? Is there any way we can change any of that?

Henry Robinson: Products we do not produce here.

Neil Parish: Yes, that is right.

Chair: Out-of-season products.

Henry Robinson: I see. So you are not thinking of bananas. We clearly have to import a large amount of food.

Q215 Neil Parish: Yes, global warming has not got quite that warm yet, but to be serious, no, it is about the products that we are importing, and I think not just the products that we cannot produce here, but also the products that we are importing when seasonally we could grow them here, but not perhaps strawberries in January, or whatever.

Henry Robinson: I think the point there is about the variety of supply from a multitude of different destinations including, of course, home-grown crops where we can, but food security depends on, and is enhanced by, being able to import, and not being just dependent on supply from one area. Saying we could produce it all from our own resources, if it were true, would leave us liable to a disease or a pest outbreak in this country that would put food security at risk.

Q216 Neil Parish: If you look at the moment at the situation in the Ukraine, for instance, Black Sea grain produces a huge percentage of wheat, even in the world market, so there could be a problem, even with something like wheat. So is there a need for us to look at growing more wheat in this country?

Henry Robinson: I do not go down the route of saying that we need to have quotas or be growing more; the market will decide, and if there is a shortage of wheat coming from the Ukraine in the near future, like they had two years ago when they stopped exports

when they had a bad harvest, then the price will go up and more wheat will be grown over here.

Neil Parish: Therefore, yes, add to security.

Chair: Mr von Westenholz?

Nick von Westenholz: I would agree with that. I think it is about 60% or so total self-sufficiency for UK production at the moment, which feels quite low, but I would absolutely agree that you want a diversity of supply, and you would not want to put all your eggs in one basket, to use that phrase. But wheat is a very sophisticated, highly developed marketplace, and you have seen milling wheat prices and wheat prices generally go up in the last week because of the Ukraine crisis. That may well stimulate some sort of supply increase in future, but I think a diversification of supply, both domestic and abroad, is important for food security in the UK.

Q217 Neil Parish: Perhaps taking it a bit wider to world security, what impact do you think increased demand for food from China will have on our food security?

Henry Robinson: It is clearly going to be one of the major issues as to food security throughout the world. They are saying that the Asian middle class will rise from 500 million to 3 billion in the next 15 years; that is an absolutely colossal increase, and given what we know to be the case about changing diets, that will have a very considerable effect on the availability of meat and dairy products in particular.

Q218 Neil Parish: You are expecting that middle class in the Far East to eat more meat, are you?

Henry Robinson: I think I would, yes.

Q219 Neil Parish: Even despite all sorts of propaganda being put about, they may still carry on eating more meat.

Henry Robinson: I think that as long as food remains a free market, they will choose to do that, yes.

Nick von Westenholz: I think it is worth saying as well that you cannot really pull apart domestic food security issues from global food security issues. The fact that there is going to be increased demand across the globe will have an impact on what we are required to do in the UK and Europe in terms of production, and I think the really crucial point about increased population, whether it is China or elsewhere in the globe, is that Europe is going to have to be part of the response to meeting that increased demand.

Q220 Neil Parish: Not only is it a matter of food security; it is also going to be a matter of price, is it not, because actually if there is a greater demand, the price will go up?

Henry Robinson: It is a market.

Q221 Richard Drax: My next question moves on quite nicely from that one. The world's population is increasing; demand for food will increase. The EU, bless its socks, is continuing to look at imposing regulations on the farming industry, not least of course on its control of chemicals and pesticides. What are your concerns about this increased use of EU regulations that are targeting this, and of course the impact no doubt on yields and food production? Mr von Westenholz, I will start with you.

Nick von Westenholz: As I said at the beginning, we have a concern about yield plateaus and the fact that there was an extended period of time post-war where cereal and other crop yields increased exponentially, and that has not happened in the last decade or so. The European regulatory and policy environments do not appear to encourage any way of breaking out of that stalling. The real concern is that as climate change hits over the next 30 to 50 years, and as population globally continues to increase, Europe is going to become comparatively better as a place to produce food because there will be parts of the globe where it becomes very difficult to produce food. Despite that, it appears to me that Europe is actually nobbling its own productive capacity, therefore actually requiring other areas of the world to provide—

Richard Drax: Because of the regulations of what you can put on the crops.

Nick von Westenholz: Yes. So that is a key area. GM is obviously another issue.

Q222 Richard Drax: I am assuming an awful lot of research is going on to try to reduce what we put on our crops.

Nick von Westenholz: Precision farming would allow you to target better what you use in terms of inputs on your crops. Most farmers would be absolutely delighted if they were given the tools that allowed them to be much more targeted and therefore reduce their overheads in terms of inputs. So absolutely, if you look at investment in Europe in terms of crop protection products—so insecticides, herbicides, fungicides—it has dropped since the mid-1990s from about 33% of global expenditures being focused on Europe to now about 7%. So there is a desertion of investment in these technologies.

Q223 Richard Drax: Are yields dramatically down in that period?

Nick von Westenholz: Yields have plateaued. From post-war until the 1970s or 1980s, you got 2% to 3% yield increases decade on decade. Since the 1990s, wheat yields have essentially been the same in the last 15 to 20 years.

Henry Robinson: Can I just pick up on that? I think the real need for reform is in this process of how long and how costly it is to bring forward new products. It is an incredibly long period—something like 10 years—and it costs something like £200 million to bring a new product to the market. Two-thirds of that £200 million is in the authorisation process, and what is happening is multinational firms are choosing, frankly, to go elsewhere rather than do it in Europe because it is too expensive, too long, and too complicated.

Q224 Richard Drax: Which member states generally support the EU approach and which do not? Do you know?

Nick von Westenholz: It slightly depends on the issues. There is obviously always going to be—

Richard Drax: Generally on herbicides and pesticides, which are you —

Nick von Westenholz: I would say that we would support the UK's approach over recent times in the way that they have approached these issues, which has been very much pro-innovation, pro-science, and based on evidence. Elsewhere in Europe, there have been other countries that have not followed that, many of them. It depends on what particular issues—

Q225 Richard Drax: Sorry, the EU approach, now—the regulatory system—which of the EU countries are backing it, and which are not? Over half? Are we on our own?

Nick von Westenholz: As I say, it is on a case-by-case basis, but take, for instance, an example that some people here will be familiar with: the recent neonicotinoid debate around bee health and pollinators, where the EU actually did not come to a majority decision about banning those, but a number of countries— for example, France—certainly voted to ban those products, whereas the UK did not. I can provide a breakdown of how the voting went.

Q226 Richard Drax: I am just looking for a general picture on agriculture and growing agricultural crops; where are we? Are EU members for or against the regulatory system generally?

Nick von Westenholz: Generally for it.

Q227 Richard Drax: They are for it, despite the fact that years of—

Nick von Westenholz: Much of it is based obviously in the Commission, so it is not necessarily a member-state-by-member-state issue. The Commission itself has obviously backed up the regulatory system. The Commission seems to be very comfortable with that, and actually moved the last review five or six years ago to a hazard-based system, where it looks at regulating products simply on the basis that it poses a hazard, rather than actually the specific risk that it may in real life provide.

Q228 Richard Drax: So that is the Commission, unelected commissioners. What are the countries saying? Can you expand on what you think the EU countries are feeling about all this regulation?

Henry Robinson: I am not in a position to give you, I am afraid, what is happening in Europe. I could just give you two examples as to where we are on the wrong end of chemicals being restricted in this country, and one is the well-known example of Asulam, which we only get as an annual licence now, and it is essentially for controlling the bracken in upland areas for sheep production, and the other of course is the well-known example of Warfarin, which is costing far too much to re-license, and which we lose, as of 1 April this year, for control of that invasive species, the grey squirrel.

Q229 Sheryll Murray: Could I turn to organic production please? Is it possible to reconcile the identified need for greater output produced sustainably with reliance on more organic and extensive agricultural production?

Henry Robinson: If you are asking me, I find it very difficult to; I really do. If I take you back 200 years, when Thomas Malthus was writing that he did not think it was possible to feed the world when there was 1 billion people in it; we are now feeding 7 billion, wasting a remarkable amount of food as it is at the moment, and food has never been cheaper as a percentage of average income, in this country at least. So technologically, we have done it, and I think the technological route is the solution to this problem. We need to get better ways, and better methods, and more science and better science, in order to find our way through to food security.

Nick von Westenholz: When we talk about sustainable intensification, it is a buzz-phrase often used around these discussions. We are talking about increasing output on the same, or even less resources—using less resource, so less land being an obvious one. I do find it hard to see, and it was discussed in the last session, how we would achieve that through entirely organic approaches. Having said that, I do think it is not just about

being able to use more inputs or more pesticides or even fertilisers; it is about taking quite an integrated approach. So it is about taking new approaches in terms of cultivation, rotations, precision technology, but also using, in a targeted manner, technology through things like pesticides and fertilisers.

Q230 Sheryll Murray: Can I ask you both please, whether there is any evidence to suggest that organic farming encourages greater biodiversity, rather than conventional agricultural systems, which might have the environmental policy requirements?

Nick von Westenholz: The key to biodiversity is about management; it is about the approach to farming you take. There was some research done recently by the University of Southampton, and it showed that some of the best results in terms of biodiversity—this used farmland birds as its indicator—was through either environmental stewardship approaches or conservation grade-specific wildlife-management approaches to farming, and not organic approaches. However, if you had an organic farming approach that actually followed those same criteria, that would then have equally positive effects. It is not about organic farming or the use of pesticides or not; it is about the specific approach you take to creating a habitat alongside your farming and food production that encourages biodiversity.

Henry Robinson: I would echo that; it is exactly what we do as part of an HLS farm at home. Environmental management requires active management and setting aside land for doing good things with the environment. The issue, of course, is how you then pay for that, because it is land that is then not producing food.

Q231 Roger Williams: This is perhaps a question for the CLA. Do EU and UK farmers have poorer access to new technology than farmers in the USA and South America would have?

Henry Robinson: There are two potential answers to your question. One is that, if by technology you mean things like precision farming, GPS satellites and robotic tractors, the answer is no. It is certainly available over here, and larger farms are certainly using those. However, of course, with any new technology you need it to be profitable in order to be able to pay for it.

The second answer to that is, if by technology you mean GM new technology, clearly the answer is no. We do not have the same access to that, and that, on balance, is a shame.

Q232 Roger Williams: Would you say the necessary advice is available to farmers in order to change their production method?

Henry Robinson: We have lost a great deal of the advisory system. Certainly, there is an enormous role for the levy boards, for the Farming Advice Service and for a lot of close-to-the-market advice there. The area where there is an obvious and distinct shortage is in scientific research and development, and, of course, extending that knowledge into the marketplace after that.

Q233 Roger Williams: Perhaps I could ask the representative of the Crop Protection Association what farmers and landowners should be doing to access the technology needed to improve their yields.

Nick von Westenholz: It is a good question, because it is something that has occupied the minds of successive Governments recently—the whole issue of knowledge transfer, about how we try and connect up the R and D work that is being done to go beyond the farm

gate. The agri-tech strategy recently launched by this Government very much focused on doing that, but, of course, the proof will be in the pudding. There is a lot of positive intent there in terms of knowledge transfer, but it remains to be seen—it is early days yet—whether that actually gets borne out.

Henry has already spoken about some of those mechanisms or vehicles, such as the levy boards and the Farming Advice Service, which can actually link up. It is important that those are used, as well as more informal routes such as advisors, agronomists and crop advisers and so on, whom farmers listen to and take advice from.

Q234 Roger Williams: Going back to the issue of EU regulation, I am sometimes told that research is cramped because there may be a regulation on the appearance of particular chemicals in groundwater at such low concentrations that, in fact, the only criteria that is used is, “Can it be measured?” If it can be measured, it stops the research going ahead. So many potentially new chemicals are ruled out because of these particular regulations. Is that a fair suggestion?

Nick von Westenholz: It is broadly recognised that the regulations around drinking water are basically arbitrary and that the very low-level thresholds for chemicals in drinking water pose no risk whatsoever to health. However, that is where we are. It is an EU Directive and it is posing problems. For example, Metaldehyde slug pellets, which are widely used, are very much under the spotlight at the moment, because they do occasionally crop up at levels above that threshold, even though nobody is suggesting they pose any risk to public health above those levels. However, the industry is working very hard—this is a voluntary approach to stewardship—to try to keep those levels well below the threshold.

Q235 Mr Spencer: Mr Robinson, I wanted to talk about small farmers. Perhaps you could also tell us what defines a small farmer in your answer, but should the Government be doing anything to support small farmers or should we leave it to the market?

Henry Robinson: The UK has a larger average farm size than most of the rest of Europe, but that does not mean to say the holdings are any bigger. In my terms, a small farmer would probably be in two figures rather than three figures of acreage, but it is very hard to be specific, because if you are on an intensive system on 50 acres you can be producing a great deal of food.

In essence, small farmers are very good at finding niche markets and producing local produce for local areas. Of course, that is it. However, it is and has to remain part of the market. There is help being pushed towards them as part of the Common Agricultural Policy reforms, but it is pretty small and pretty limited.

Q236 Neil Parish: Along the same lines, Mr Robinson, how important are new entrants to the farming industry for our future food security?

Henry Robinson: Behind your question, I suspect, is the knowledge that the average age of farmers is about 58 or 59, which I used to think was rather old. It has grown a lot, however.

Neil Parish: As someone fast approaching that age, I am inclined to agree with you.

Henry Robinson: We always say we need new entrants; actually, what we need is good farmers. Farmers have to work hard and be technologically good, which is what will happen if the market makes them do that. It is a market-based system.

Neil Parish: As a CLA representative, perhaps share farming initiatives could assist.

Nick von Westenholz: We pioneered share farming in the 1980s. Coming out on 2 July this year will be our updated share farming system. We are as innovative and forward-thinking about this as anyone. Contract farming has taken a lot of the ground on that, but, for livestock systems, share farming is extremely useful.

Q237 Chair: I have a particular interest in tenant farmers and whether there is a problem in having new entrants into tenant farms. I do not know whether it is a problem of succession, but is there more we could be doing to encourage new entrants into tenancies?

Henry Robinson: It is clearly about education coming out of the agricultural colleges and making land available. That is certainly happening with regard to new enterprises and people doing—

Chair: I will give you a little story. I heard about it on the radio, even though it is a local boy. A local lad wanted to become a farmer, but had no access to land; he had no family connections with farming. Castle Howard gave him a field so that he could start his rare breeds. This is just about how to explore what the vehicle should be.

Henry Robinson: Was that not almost exactly what would have been covered by the CLA share farming agreement? There you are: you have somebody putting the land in and the other man putting in his expertise and perhaps a percentage of the stock. That system is available already. We get very hung up on the difference or the similarity of owning land and farming land. The two are separate occupations.

Q238 Chair: As far as you are concerned, share farming works very well.

Henry Robinson: Share farming is a good system. I was speaking to a farmer the other day who had eight different share farming arrangements. The real point is this: he has had them all for 30 years. They have just been carrying on.

Chair: Okay, thank you very much indeed. I am going to wind up now, because we have another Panel as well, but you have been incredibly patient and generous with your time. Thank you.

Examination of Witnesses

Witnesses: **Professor Melanie Welham**, Executive Director of Science, BBSRC, **Dr Paul Burrows**, Executive Director of Corporate Policy and Strategy, BBSRC, and **Professor Sue Hartley**, Director, York Environmental Sustainability Institute, University of York, gave evidence.

Chair: Good afternoon, and welcome. You have been very patient. Could each of you introduce yourselves for the record?

Professor Hartley: I am Professor Sue Hartley. I am Professor of Ecology at the University of York, where my research focuses on novel, sustainable pest-control methods and improving crop resilience to climate change. I am also the Director of the York

Environmental Sustainability Institute, which is a cross-disciplinary institute between natural, social and physical sciences, designed to provide the evidence base for sustainable solutions to global challenges.

Professor Welham: I am Professor Melanie Welham. I am currently on secondment from the University of Bath. I am Executive Director of Science at the Biotechnology and Biological Sciences Research Council. I am here with my colleague to represent both our research council and also the strategic partnership of the seven research councils in the UK, RCUK.

Dr Burrows: I am Paul Burrows; I am Executive Director of Corporate Policy and Strategy at BBSRC, but part of my brief is also to look across our food security strategy more generally.

Q239 Chair: Obviously, where you agree, you do not have to speak, but where you disagree, it would be helpful to know. If there was one thing you would like to see to promote food security, what would it be? Professor Hartley?

Professor Hartley: One thing that would be extremely helpful would be to have a rather longer-term and larger-scale perspective on research to underpin food security. It is a grand challenge; research can support it both directly and indirectly, but a lot of the issues will require rather longer-term and larger-scale experimentation than we are currently very well equipped for. For example, if we wanted to understand the most efficient use of break crops in a crop rotation and how they could foster improved soil health and productivity, you cannot do that in a three-year research grant.

We need rather longer-term programmes and we also could do with some facilities on which to base those programmes. That is probably two things, which is cheating. The number of agriculture departments in universities and university farms has declined quite steeply recently, but there is considerable interest now in on-farm technology platforms, where we can trial some of the new approaches to improving food security.

Professor Welham: I would build on that theme, really. It is a complex area and there are many interdependencies. The one thing we really need is to get people working across disciplines, in a multi-disciplinary fashion, to address some of these interdependencies between food, environment and energy, and to consider not just the food aspect, but the wider social, economic and environmental context as well.

Q240 Chair: From where you sit, what do you believe the main driver for research is? If you look at the farming community, for example, the CLA highlights the need for more research to be transferred commercially to bring the product closer to the market and greater public-sector funding into food and farming research. The Government has a new £160 million fund for agricultural technologies, we were hearing earlier. Where do you think the main driver for research is at the moment? Is it in the right place, Dr Burrows?

Dr Burrows: From RCUK's perspective generally, one of the issues is trying to enable sustainable intensification, which is a concept I am sure you are very familiar with. The challenges ahead for food security are familiar to us all: rising global populations needing to produce more from the same area of land, broadly, with fewer inputs and so on. These really are enormous challenges.

As Sue says, that is going to take long-term strategic investment in research. The basic research, the sort of research we are talking about, will probably not pay dividends for 10 or 15 years. However, at the same time, that needs to be translated into solutions and practical applications on-farm. Getting the balance between those two is the really crucial issue.

When you did your original inquiry back in 2009, if you had asked me that I would have said, “We have got the balance completely wrong,” because there was clearly, in my view, not enough translation of the fantastic science that the research councils have funded into practical application. We have seen that beginning to change over the last few years quite positively. The TSB has come into the mix and has started to make a difference there.

However, more recently, the agri-tech strategy—in particular, the agri-tech catalyst fund—provides a new funding stream to help academics and business, working together, to take the great ideas coming out of the research base a little bit further towards application and commercialisation. I believe that is really to be welcomed.

Chair: Would you agree with that, Professor Hartley?

Professor Hartley: Yes, certainly. There is a lot to be learned about the new agri-tech innovation strategy. It is great to see that level of investment from the heart of Government. It can deliver on a number of fronts. The obvious one, as Paul said, is it can help academics and end users interact more effectively. The agri-tech catalyst programme has been a great stimulus. The first round of that programme was six-fold oversubscribed. There is a lot of interest from industry in those kinds of interactions. They do help deliver the solutions that the farming industry is looking for.

If I have a concern, it is that we are building up from quite a low baseline in terms of academic researchers interacting with industry in this area. A lot of the key industry players are global companies, whose food production lies outside the UK. The issue for the leadership council will be to ensure the message gets out to the big players in the UK—such as they are these days; a lot of companies have left the UK—that this is for them and to persuade them to come up with the level of investment the Government is looking for.

Q241 Chair: I have one more question in two parts. Is the present funding for research into food security adequate? Is the focus specifically on securing food supplies or is it on improving food security as a secondary objective?

Professor Welham: I can speak to that, if you like. Following the 2009 inquiry, BBSRC were leading in establishing the Global Food Security programme, which brings in a lot of the research councils and Government Departments. Collectively, those Departments spend £350 million annually on food security-related research across a whole range of areas. That is not just in production, but also around resilience, sustainable productivity and supply, nutrition, health and wellbeing, and reducing waste in the food supply chain as well.

By bringing that collective together and identifying where some of the key challenges are where people can work together, we have identified a lot of those key questions and are continuing to do so. GFS is very proactive in looking at whether we are addressing the

right questions and whether there are other questions we should be looking at. They have active programmes ongoing in this area.

Professor Hartley: I would agree there has been a very positive start from the research councils. It is particularly nice to see them working together so closely in initiatives like GFS. As I mentioned before, for some of the larger-scale and longer-term work, there might need to be some reinvestment. As we have already said, looking at food security as a whole, I would emphasise that it does require an interdisciplinary approach. Certainly, the focus has probably been on improved crop production, but that is only one small part of food security.

At YESI, what we try to do is look across the whole food supply chain, from studying soil health, crop production and crop protection right through to studying on-farm waste and how make the best use of it, and, critically, the socioeconomics of the farming system, the uncertainty in global food supply chains and the volatility produced by climate change and other drivers. That kind of integrated approach, right across the piece, is what is required.

Q242 Richard Drax: Can we move onto precision agriculture now? We have heard that China has apparently invested quite heavily in this. Here in Europe and the UK, certainly, companies are not doing so, or they are investing less. What is your view of precision agricultural techniques? Dr Burrows, let us start with you.

Dr Burrows: They hold a lot of promise. If we take one of the challenges of food security as resource use efficiency and getting more from less, that kind of technological approach is low-hanging fruit—no pun intended—in a way, because they are fantastic ways that we can use agricultural machinery in real time, going across fields, to map yields, nutrient content and so on, and be very sparing with the amount of pesticides or fertilisers we are putting on.

The TSB has recently had a call for—I am paraphrasing—engineering for agriculture, which TSB and the BBSRC have defined, with others—about moving some of the existing technologies closer to market. The Global Food Security programme, and BBSRC within that, recognises the need to inspire more basic research, which can lead through eventually into those kinds of practical applications. Under the auspices of GFS, we had a workshop in recent months that identified things like robotics, sensors and imaging—particularly satellite imaging—as key areas of technology, which we might try to invest in and develop. This is very early stage, basic research, but it would come through to practical application down the line.

To answer your question, it holds a lot of promise.

Richard Drax: Everyone is nodding their heads. Do you want to add anything to what Dr Burrows has said?

Professor Welham: No. The only thing I would add is that, actually, the use of precision agriculture can help with the environment, because there can potentially be less damage to the soil, less compaction and fewer issues around that, as well. That is the only thing I would add.

Professor Hartley: We are doing a lot of interesting research in this area in the UK. I was talking to a colleague of mine at the University of Manchester, who directs the

Syngenta Sensors Centre, and they have some really innovative projects using sensors, either in the soil or on tractors and other robotics, not only to reduce inputs of pesticides and nutrients by spatial precision, but also doing things like early-warning systems for fungal pathogens in cereal crops. These sensors are now starting to deliver on a lot of different fronts and it is really exciting.

Q243 Richard Drax: Just briefly, are there any quick wins we can adopt now that are not being adopted or are not available and need further exploration immediately?

Professor Welham: There are none that come immediately to mind.

Q244 Richard Drax: Satellite imagery is already being used; I know that we do it ourselves, with satellite equipment on combine harvesters and so on. That is all coming in, but are there any other quick wins?

Professor Hartley: I would just make one comment. Our spatial precision is probably better than our temporal precision.

Richard Drax: Forgive me; I am very stupid. In English, that means what?

Professor Hartley: That means we are very good at putting sensors on our tractors and saying, “You need to dollop a bit of fertiliser on this particular patch in this spatial area.” We are probably less good at saying exactly when you should dollop that little bit of fertiliser on, in terms of the use of things like slow-release fertilisers and fertilisers that do not get washed away the minute it rains. It is that sort of area. We could do more on temporal precision, on the timing.

Q245 Richard Drax: So more tying in with weather forecasters and those sorts of things so the application goes on at the right time.

Professor Hartley: Exactly, yes. The other quick win would be to improve our interaction between ground-truthing and remote sensing.

Richard Drax: Sorry; in English again.

Professor Hartley: It means measuring things on the ground with a real person and linking that to what your satellite or aircraft is telling you from the air. We could improve the quality of our predictions from remote sensing by understanding the link between what is actually happening on the ground and what the sensors tell us.

Richard Drax: It is about having a real person on the ground to do the ground-truthing.

Professor Hartley: Yes.

Dr Burrows: To finish your question, if we could invest in just one thing, my bet would be sensors, because I am told so many times, “If we can measure it, we can do something about it.”

Q246 Richard Drax: Finally, will the new agri-tech catalyst fund encourage the commercialisation of precision agriculture in the UK?

Dr Burrows: It should do, because it is precisely there to encourage the translation and application of good ideas that are in the academic community or in business already. It provides a source of funding to do that, which has not been there previously.

Professor Hartley: Very quickly, all of the projects I have spoken to Bruce Grieve about in the Syngenta Sensors Centre are funded by TSB under the agri-tech catalyst programme.

Richard Drax: That sounds like an advert, does it not?

Professor Hartley: It is definitely working.

Q247 Roger Williams: From all three panels, we have heard about the importance of soil, and soil fertility, compaction, composition and structure. It seems that soil science is regaining some of its status in the scientific world. You have already answered quite a lot of this, but could you tell us how the publicly funded research is addressing these issues? We have had some comments in written evidence saying that there is a fundamental lack of knowledge in this area.

Professor Welham: The research councils have recognised collectively—this is partly due to coming together under the GFS programme—that we really need to consider the soil, because soils actually provide a whole lot of services to us that we would not perhaps think about. They are the medium for growth; they are a location where microorganisms and other organisms live; and, obviously, they are key to food, fodder and fuel production.

The Natural Environment Research Council, NERC, has been leading on developing a soil-security programme, which BBSRC, Defra and the Scottish Government are also involved in, which is really trying to build up a series of approaches to understand much better how our soils function, what determines their function and how those functions change when either the climate, land use or nearby land use change. It is not just at a small-plot scale. You need to look at multiple scales: plot, field, landscape and earth systems. Again, it requires this multidisciplinary approach, which is why we are working together to address some of those problems.

It is an area that is very much recognised. We are seeing increasing activity from the public funders in wanting to encourage and support research in that area, recognising that we need to look at it in a very holistic way, because it is multifaceted and we need to take into account all of those things.

You mentioned that other witnesses have suggested that there are gaps in knowledge; there certainly are gaps in knowledge. That is why we need to invest in the fundamental understanding, so we can develop that knowledge and so we can inform policy and land-management decisions, not just at the level of the farmer, but actually more broadly as well. Those gaps are recognised and we are trying to encourage research to address those challenges.

Professor Welham: It is a very complex area, however.

Dr Burrows: It is very complex and could largely absorb our whole budget.

Professor Hartley: It is a critical time for soils. They are certainly at risk globally from a great number of threats. In some areas of the world, we are losing soil 100 times faster than it is being formed. The time to act is now, but we have one very positive thing and one slightly tricky thing.

The very positive thing is that we now have techniques that help us see into the soil. It is a kind of black box full of organisms that we cannot see and we do not know how they work, but now we can tell because we have new genomic and DNA technologies, which means we can understand a lot more about the biological functions of soil. That is a positive development in terms of technology helping us understand how soil organisms underpin soil function, whether that is carbon storage or crop production.

However, because these techniques are very new, what we do not understand is how to link that biological function with the information we have about soils from soil surveys. They have almost been collected with Victorian-type parameters, such as soil pH and texture. It is about linking those physical and chemical parameters with the biological ones that is quite hard, because we cannot look back. It is linking that knowledge together that is really important, but it could be very fruitful, and now is the time to do it.

The slightly difficult thing is that, despite a lot of new investment in soils, both from NERC and BBSRC, both of those programmes are relatively small. The soil security programme is only £8 million. It sounds like a lot, but that funds six or seven projects. The issue is that the soil surveys we are using to try to understand the long-term changes in soils are carried out by different organisations. CEH carry out some; BGS carry out some; Cranfield University carry out some. The information is fragmented. That is an issue.

The other issue is it is not clear now whose responsibility it is to do the next soil survey. There are no plans at the moment to do a soil survey of England. Wales and Scotland are taken care of.

Roger Williams: Could you write to us about this?

Professor Hartley: Yes. That means, of course, that we do not knit those things together. There is one more very positive point that I must just say in defence of the research council. NERC have started a soil observatory. They are going to distil all the soil information into one place and launch that in April. That will be a huge benefit, but we do need to look at this issue for the future.

Q248 Roger Williams: To get all of that work done, you need soil scientists and hydrologists. When I was on this Committee about six years ago, we found that there were very few hydrologists being trained in this country. How are you going to get these young people enthused and excited about this work?

Professor Welham: The research councils are continually looking at where we need to have skills, where skills need to be developed and where we can work with others to enable those skills to be developed, either through directly funding studentships or other types of partnerships. We have funded advanced training partnerships, where people working in the agri-food sector can actually undergo professional postgraduate training courses towards qualifications. Those are ways of changing people's skills.

However, as people more generally understand how critical the issue around food security is, it will increase people's perception, and people's interests will naturally follow that. It is incumbent on all of us to continue to emphasise how important it is.

Professor Hartley: One very small additional point is that a lot of soil science departments, rather like the agriculture departments, have fallen by the wayside in universities. A last issue to consider is that a lot of our hydrologists and soil scientists are currently in the Centre for Ecology and Hydrology. The ownership of that organisation is currently under debate, which is another thing to consider for the future.

Q249 Neil Parish: What research has been carried out on reducing greenhouse gas emissions from livestock? A recent FAO report indicates that the livestock sector contributes some 14.5% of all human-induced emissions.

Professor Welham: We are funding a number of research programmes. I will give you the example of IBERS, our strategically funded institute at the University of Aberystwyth, where they have actually bred high-sugar grasses. When cattle are fed on these, it has been shown that they have 24% higher meat and milk production and a 20% decrease in greenhouse gas emissions. You are getting greater outputs of products that you would want to use—milk and meat—and less greenhouse gas emissions.

Q250 Neil Parish: Is this partly because the animals finish quicker?

Professor Welham: It is in terms of the way the high-sugar grasses are actually digested and treated within the cattle rumen. I am aware that both Asda and Sainsbury are encouraging the use of those high-sugar grasses on their farms as a way of mitigating or reducing greenhouse gas emissions. Another programme that we are also funding at IBERS is trying to model the cattle and sheep rumen to understand how it functions and how we can optimise its function, both from the point of view of production, so that there is maximum nutrient production, but also from the point of view of reducing greenhouse gas emissions.

Another point I would like to make is that it is well recognised that healthy animals produce far less greenhouse gas than unhealthy animals. Animals suffering from endemic diseases in the UK contribute more extensively to greenhouse gas. We have very large investments, with the Roslin Institute and the Pirbright Institute, in maintaining animal health and managing disease to mitigate against that as well. That is an important point.

Dr Burrows: May I add to that? The other side of this is the management system of the animals themselves. If we look at pasture, for example, depending on how it is managed, pasture emits a lot of greenhouse gases. It is fertilised; ammonia comes off the pasture. We really need the infrastructure to be able to understand, measure and experiment with these farm-scale effects of agricultural management. At the moment, we effectively have one farm-scale research platform, which is North Wyke in Devon, which is lowland sheep and beef. I believe some of the Members of the Committee might be visiting there shortly.

This really is a national infrastructure. We need more of them. We need more of those experimental-type and highly instrumented farms, where various parameters of the water runoff and greenhouse gas emissions can be measured under different agricultural regimes in different parts of the country, and not just livestock, too. There are different forms of arable and different geographic regions. That ties in with what Sue was saying right at the beginning about the big picture, the big programme and the big project that would really help the sustainability of agriculture.

Q251 Neil Parish: This final part is a slightly different angle to the question I asked Mr Melchett. Given the contribution livestock makes to our emissions, are the changes in the

grass system—producing new grasses and the like—sufficient or will we have to begin to eat less meat?

Professor Welham: You can ask from a scientific point of view or from a philosophical point of view, I suspect.

Professor Hartley: I am a vegetarian.

Professor Welham: Clearly, if the high-sugar grasses are used more widely, we will see significant reductions in greenhouse gas emission, which will help us as a country meet the targets we have for 2050. However, if there is a rebalancing in our nutritional diets and the nutrition that we require, you could see a case where we have higher-quality and higher-welfare livestock production, which could mitigate against that. However, there has been research conducted by the ESRC, who are one of our research councils, which has shown that it is very, very difficult to change human consumption behaviour. It does not move very much.

Neil Parish: That is really the correct answer.

Q252 Chair: Just before I lose everyone, could I ask a couple of questions on biofuels? There is a big argument about biofuels. This is specifically directed at the University of York, who mentioned it in their submission. Are biofuels a threat to food security? What are the benefits of second and third-generation biofuels?

Professor Hartley: The second and third-generation of biofuels are an important development, because, clearly, if we have to produce more food, if we are growing fuel we are not growing food by definition. However, the new generation of biofuels are removing that kind of issue, because they are focusing on generating fuel from the non-food part of crop products, such as the straw components and the non-grain components, which are often not used for anything useful at the moment. Using them for biofuels is really helpful.

Q253 Chair: We have spent years investigating how to stop diesel from freezing in the winter. Now that we have 10% biofuels in a diesel tank, it is now thickening and freezing in the winter, because that does not have any additive in it. Will there be some research done into that?

Professor Hartley: My understanding is the third-generation biofuels will be much more similar to existing fuels and will be alkane-based, and so they will not suffer from these disadvantages.

Professor Welham: They are not there yet, however.

Professor Hartley: That should save your tank.

Q254 Chair: Professor Hartley, how are you getting on with the Initiative in Agri-food Resilience that you started last year? It was a joint initiative between FERA—you will be pleased to hear we went to visit them at Sand Hutton—and the University of York. When is the study likely to conclude?

Professor Hartley: That is an ongoing collaboration between the University of York and FERA. We are pooling our expertise to try to understand the resilience of the entire food chain right across it, from improving soil health right through to making better use of waste and securing food supply chains, looking at the socioeconomics of this. A big part of it is also food integrity, which is around understanding more about food safety and how to ensure that food supply chains remain safe and unadulterated. That is about less horse meat, basically.

Q255 Neil Parish: There are not enough agriculture graduates. What is being done to encourage more and address this?

Professor Welham: I can start. The research councils do not fund undergraduate degrees, but obviously we are interested in working with the university sector around the skills that are needed. We do fund postgraduate students; 27% of the postgraduate students we do fund are in the area relating to food security. At that level, we are taking students and they are developing the skills that are going to be needed for this area. I cannot speak for the university sector in its agricultural capacity; perhaps Sue can.

Professor Hartley: As I have already mentioned, the number of university agriculture departments is now vanishingly small.

Chair: There are very good agricultural colleges, however, which have university status.

Professor Hartley: There are, yes. That is the way forward, because a lot of agriculture departments have closed, but what is happening now is that some of the skills are within other departments in universities. The good thing would be to facilitate interactions between research-intensive universities doing, say, crop science and practitioners training the next generation of farmers.

At York, that is very much in our minds. We have had long conversations with Askham Bryan College and Bishop Burton College, because, of course, they are training the next generation of farmers on-farm. That is a good way forward to bring together the fundamental research into plant and animal science at universities and these agricultural colleges. That is a great way forward.

Q256 Neil Parish: Could I just follow up? Are you finding, within the education institutions, that, because food, food security and agriculture are starting to become more important across the world again, partly because of food prices and everything else, there are more students within higher education interested in agriculture again?

Chair: Also, how are you transferring the knowledge from your institutions and universities to the agricultural sector?

Professor Hartley: There are a number of options. I can only speak for York, and we do not recruit to an agriculture degree per se; we have biology degrees. Recruitment to biology is robust, but the students often veer towards the biomedical side, to be honest. Encouraging them to pursue the more agricultural and ecological modules can be actually quite hard. I do not know whether that is a feature of the kind of debts they graduate with and whether they are more focused on careers they perceive as delivering debt reduction a bit quicker than being a farmer.

That is one challenge, but the other challenge is to try to inspire them with something of the nature of the grand challenge that we face. It is incumbent upon us, as university teachers, to get the message across to the next generation of biologists: these problems and issues need addressing now. They are the guys who will have to fix it, because they are living with it. If we can inspire them that the solutions are out there and if they can train up and help deliver improved food security, it is a huge thing to do.

Chair: That is a very inspirational note on which to close, if I may. There may be things that we write to you about to expand on, which we have not had time for, particularly on that point in relation to Mr Williams' question; it would be very helpful. Thank you all very much for being with us.